Power-Linked Evaluation of State Forest Organizations
A New Model and International Empirical Evidence

Dissertation

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Declaration of originality and certificate of authorship

I, Ameni Hasnaoui, hereby declare that I am the sole author of this dissertation entitled: "*Power-Linked Evaluation of State Forest Organizations: A New Model and International Empirical Evidence."* All references and data used in this dissertation have been appropriately acknowledged.

I furthermore declare that this work has not been submitted elsewhere in any form as part of another dissertation procedure.

Göttingen, April 2021

Ameni Hasnaoui

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Summary

Globally, state forest organizations have a wide scope of tasks. They play a central role in managing state-owned forestlands. In addition, they are responsible for implementing forest law on both private and state-owned forestlands. This task's complexity causes a huge challenge for evaluating state forest organizations. The active role that state forest organizations play in policy processes increases these difficulties because of power, which is considered a crucial factor for achieving forest outcomes. The constitutive publications of this thesis identify a link between state forest organizations' power and forest outcomes in the case of Tunisia. Following the revolution of 2011, the state forest organizations lost power and faced new challenges to achieve sustainability goals. The main objectives of this thesis are (i) to scrutinize the role of power in driving the performance of state forest organizations to achieve specific forest outcomes and (ii) to look for a larger empirical basis to check the relevance of power as a driver of the state forest organizations in different contexts.

Theoretically, this thesis develops a new power-linked three-layer model (3L model) based on political evaluation and power theories. The 3L model was selected due to its comprehensive coverage of a broad range of ecosystem services, including timber production, biodiversity, and carbon sequestration. The actor-centered power approach was selected because it links power to a specific actor and makes the elements of power well measurable. Within the developed model, actor-centered power is integrated on the theory level and linked with the state forest organization's outcomes in forestry as a driving factor. The link between power and outcomes' achievements by state forest organizations was first explored in the case studies of Tunisia. In addition, a systematic literature review was conducted to extend the empirical basis for the power-linked 3L model.

The results show that achieving high outcomes requires both high interest and the strong power of state forest organizations. Furthermore, state forest organizations combine the different power elements of coercion, (dis-)incentives, and dominant information flexibly to implement forest policies effectively. Despite empirical evidence of 49 case studies from the global north and south, this empirical basis remains too limited and selective to check the power-linked 3L model comprehensively. As a practical solution to improve the evaluation of state forest organizations in the future, a new platform is designed to collect consistent data globally. The power-linked 3L model provides a guide for creating the platform's content and specifies the data input enabling a theory-based comparison between different countries. Finally, some policy and management requirements for establishing such a platform are discussed. To conclude, the new power-linked 3L model can significantly improve the evaluation of state forest organizations and support effective reforms in practice.

Zusammenfassung

Weltweit haben staatliche Forstorganisationen ein breites Aufgabenspektrum. Sie spielen eine zentrale Rolle bei der Bewirtschaftung von Waldflächen im staatlichen Eigentum. Darüber hinaus sind sie für die Umsetzung des Forstrechts sowohl im privaten als auch im öffentlichen Wald verantwortlich. Diese komplexe Aufgabe ist eine große Herausforderung für die Evaluierung staatlicher Forstorganisationen. Die aktive Rolle, die staatliche Forstorganisationen in der Politik spielen, erhöht die Schwierigkeiten der Evaluation noch zusätzlich, weil Macht ein entscheidender Faktor ist, um bestimmte Wirkungen (Engl. outcomes) im Wald zu erreichen. Die vier konstitutiven Veröffentlichungen dieser Promotionsschrift identifizieren eine Verbindung zwischen Macht und den Ergebnissen der staatlichen Forstorganisation in Tunesien. In der Revolution 2011 verlor die staatliche Forstorganisation wesentlich an Macht und hatte mit großen Problemen zu kämpfen, um Nachhaltigkeit im Wald zu sichern. Ziele dieser Arbeit sind, (i) die Bedeutung von Macht als wichtiger Faktor für die Forstorganisation zur Erreichung bestimmter Ergebnisse (Engl. outcomes) im Wald zu klären und (ii) die empirische Basis für die Überprüfung dieser Frage im weltweiten Kontext zu erweitern. Die Promotionsschrift entwirft ein neues machtbasiertes drei Ebenen Modell (Engl. 3L Model) für die Evaluierung staatlicher Forstorganisationen. Es integriert das bestehende „3L Model“ mit akteursbezogenen Machttheorien. Das „3L Model“ wurde wegen der großen Vielfalt an Ökosystem-Services ausgewählt, die es umfasst und die von Holzproduktion bis Biodiversität und CO_2-Bindung reichen. Ein akteursbezogener Machtansatz wurde ausgewählt, weil dadurch die direkte Verbindung zu einem Akteur – hier die staatliche Forstorganisation – gegeben ist und die Elemente der Macht einfach gemessen werden können. Das neue Modell integriert die Macht auf der Ebene der Theorie und verbindet diese direkt mit der Ebene der Ergebnisse im Wald (Engl. outcomes), die die staatliche Forstorganisation bewirkt. Wirkungen der staatlichen Forstorganisation und Machtprozesse wurden zuerst in vier Fallstudien in Tunesien erforscht. Zusätzlich werden in einer auf das machtbasierte „3L Model“ gestützten sytematischen Literaturauswertung die empirische Basis um 49 Fälle aus dem globalen Norden und Süden erweitert. Die Ergebnisse zeigen, dass hohe Ökosystemleistungen im Wald nur bei großem Interesse und großer Macht der staatlichen Forstorganisation erreicht werden können. Darüber hinaus kombinieren staatliche Forstorganisationen die unterschiedlichen Machtelemente: Zwang, Anreiz und dominate Information flexibel, um größere Wirkungen in Wald und Forstwirtschaft zu erreichen. Obwohl 49 Fälle aus unterschiedlichen Ländern literaturgestützt untersucht werden konnten, ist die empirische Datenlage zu begrenzt und selektiv, um das neue Modell umfassend zu überprüfen. Als Lösung, um die Evaluation staatlicher Forstorganisation zukünftig zu verbessern, wird eine Plattform

entworfen, die die Erhebung konsistenter Daten weltweit ermöglichen kann. Das neue machtbasierte „3L Model“ liefert eine Vorgabe für den Inhalt der Plattform, die theoriebasiert die Daten spezifiziert und einen weltweiten Vergleich ermöglicht. Zusätzlich werden Erfordernisse des Managements und der Politik diskutiert, um eine solche Plattform zu etablieren. Insgesamt wird gezeigt, dass das neue machtbasierte „3L Model“ die Evaluierung von staatlichen Forstorganisationen wesentlich verbessern kann, um einen Beitrag zu zukünftigen effektiven Reformen zu leisten.

List of constitutive publications and author's contributions

Article 1. **Hasnaoui, Ameni**; Krott, Max (2018): Political drivers of forest management in Mediterranean countries: a comparative study of Tunisia, Italy, Portugal, and Turkey. In *Journal of New Sciences* 14, pp. 3366–3378.

As the first author of this publication, Ameni Hasnaoui applied the theory and methodology developed by Krott in Tunisia's case study. She also formulated the hypotheses and produced the findings, which provide an overview of different interests and power sources of different actors' categories in the Tunisian forest sector.

This article aims to analyze the overall power and interests of public and private actors in the forest sector that shape the management of the forest ecosystem services in Tunisia. The analysis is based on the actor-centered power approach. The Tunisian case study results are then compared to other Mediterranean countries, namely Turkey, Italy, and Portugal, where the same analysis was conducted. Overall, the shift from government to governance did not happen in different case studies. Despite the weakened state organizations after the revolution of 2011, Tunisian state organizations remain the first responsible for controlling the access and use of forestlands in Tunisia. Nevertheless, through incentives and dominant information, international organizations' influence on forest policy orientations is increasingly significant.

Article 2. **Hasnaoui, Ameni**; Krott, Max (2019): Optimizing State Forest Organizations for Forest People: A Case Study on Social Sustainability from Tunisia. In *Sustainability* 11 (7), p. 1954. DOI: 10.3390/su11071954.

Ameni Hasnaoui is the first author of this publication. She applied theory and methodology and produced the results evaluating Tunisian state forest organizations' performance regarding forest inhabitants. Ameni Hasnaoui has contributed to the methodology by developing new performance measurement indicators specific to social sustainability. Krott has initially developed the evaluation model. The first author formulated hypotheses.

This article aims to evaluate the performance of the state forest organizations regarding forest people. More than 90% of forestlands in Tunisia are state-owned and managed by state forest organizations. Nearly 750,000 people live within this forest area, which increases the social responsibility of state forest organizations to consider and support these people's livelihoods while managing the forestlands. This evaluation based on a comprehensive set of criteria and indicators of the 3L model represents an

option to help formulate sustainable strategies supporting forest people. The results mainly show that the outcomes of the state forest organizations' activities for forest people differ from those for the forest sector in general. For example, to support forest people, state forest organizations should not seek the achievement of high technical efficiency. Technologies that are adapted to the traditional know-how of forest people are required. Furthermore, a sustainable development strategy for forest people would require strengthening Tunisian state forest intuitions against foreign donors' influence.

Article 3. **Hasnaoui, Ameni**; Krott, Max (2019): Forest Governance and the Arab Spring: A case study of state forests in Tunisia. In *Forest Policy and Economics* 105, pp. 99–111. DOI: 10.1016/j.forpol.2019.04.016.

Ameni Hasnaoui is the first author of this publication, applying theory and methodology and bringing a contribution to the methodology of measuring state forest organizations' performance within the revolution's context. She produced results that discuss the claimed impact of post-revolutionary forest policy programs on state forest organizations' performance and identified some potential driving factors of implementation failures. Krott developed the general theory and analytical framework. The first author formulated hypotheses.

This article evaluates the performance of state forest organizations in the pre and post-revolutionary contexts. Following the evaluation of state forest intuitions' overall performance in the pre-revolution period, the reform discourses of the post-revolutionary forest policy programs claiming to improve this performance were analyzed. These programs were funded by foreign donors with a limited role of the weakened state forest organizations. The performance evaluation is based on the criteria and the indicators of the 3L model. The results show that post-revolutionary forest policy programs fail to foster an efficient implementation of their objectives. The two main reasons behind this failure are: (i) the lack of comprehensiveness and coherence of objectives and (ii) the gap between the objectives and the time needed for the implementation.

Article 4. **Hasnaoui, Ameni**; Ongolo, Symphorien; Hasnaoui, Foued; Aloui, Kamel; Mouelhi, Fida, Krott, Max (2020): Contesting State Authority in Forestland Use: A Power-Based Case Study Within Arab Spring Transformations in Tunisia. In *Journal of rural studies (submitted for publication).*

Ameni Hasnaoui is the first author of this publication, applying theory and methodology and producing findings regarding power dynamics related to different land uses between state and non-state actors in pre-and post-revolution contexts. Ameni Hasnaoui contributed to the theory of actor-centered power

regarding the definition and use of power elements. Symphorien Ongolo contributed to the reflection on the theoretical framework, hypotheses development, and results' interpretation. Foued Hasnaoui and Fida Mouelhi contributed by providing complementary data. Kamel Aloui produced maps illustrating the evolution of different land uses between 2000 and 2019. Max Krott developed the general theory and methodology and contributed to the development of hypotheses.

This article Scrutinizes the dynamics of power between state bureaucracies and non-state actors, including local populations in the access processes and control of forestlands in northwest Tunisia. The analysis covers pre-and post-revolutionary periods from 2000 to 2019 and is based on the actor-centered power approach. The results show that the revolution of 2011 resulted in the collapse of state authority in the governance of forestland resources. The use of coercion before the revolution without combining it with other power elements such as incentives has become inefficient after the revolution. Furthermore, the use of coercion in a post-crisis context can only be effective if the 'potentate' or powerful actor is able to deal with the ability of the 'subordinate' or weak actor to resist the potentate. This resistance of the subordinate can be achieved through a set of 'dominant information' such as the informality and the capacity to conceal illegal logging and forestland conversion to agriculture.

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1 Introduction: Challenges of state forest organizations

State forest organizations[1] are one of the main actors of the forest policy processes. More than 70% of forestlands are state-owned globally, and the management tasks of these lands are generally transferred to these state forest organizations (Stevanov 2014; White and Martin 2002). Furthermore, these organizations play a central role in managing state-owned forestlands to provide different goods and services for the public interest and satisfy the market demand in terms of timber and non-timber products. The state forest organizations' main challenge is to achieve simultaneously high economic, environmental, and social standards. Beyond the tasks related to sustainable forest management, state forest organizations are in charge of implementing forest law and providing extension services to private forest owners.

These rising complexity and scope of state forest organizations' tasks and, at the same time, the reduction of the resources allocated to these organizations (Stevanov 2014; Möhring et al. 2017) are increasing the need for reforms. These reforms are also required within a context of globalization and governance trends that are putting pressures and constraints on national policy processes and choices made by domestic actors. Governance aims to involve various actors with different interests and power sources in policy formulation and implementation (Hay 2006; Hans Klijn 2012; Hufti 2011). Consequently, for at least three decades, policymakers in many countries have pushed reforms such as adopting the 'New Public Management' option to optimize public organizations' performance (Stevanov 2014). Together with the concept of 'good governance,' New Public Management was developed to increase public organizations' effectiveness and efficiency (McDonald and Lane 2004; Hibou 2019; Hufti 2011).

For such reforms, collecting information about these organizations' performance is considered a prerequisite (Stevanov 2014). In this vein, several international processes have focused on formulating different sets of criteria and indicators to evaluate forest management's sustainability. The criteria are based on the different goals of multiple-use and protection of forests and targeting the measurement of the goals' achievement. Many of the relevant existing evaluations focus on specific aspects such as the economic ones (e.g. (Möhring and Rüping 2008; Chiabai et al. 2011).

In order to broaden the scope of these evaluations and complete them, the three-layer model (3L model) has been developed. This model is one of these evaluation frameworks that aim to measure state forest organizations' performance regarding the wide range of responsibilities allocated to them (Krott and

[1] State forest organizations[1] can be defined as "public organizations making decisions regarding particular problems based on legal standards and implementing specific measures to solve these problems" (Krott 2005). In this thesis public/state forest administration are used as synonyms for the state forest organizations

Stevanov 2008; Stevanov and Krott 2013). The benchmark set of criteria in this model are considered as (i) relevant to countries' policy goals, (ii) simple to use due to the link established between these goals and suitable theories, and (iii) empirically applicable.

Additionally, the model aims to identify the factors that drive state forest organizations' performance and lead to specific outcomes. However, some of these driving factors might not be explicit in this evaluation. One of these crucial political factors is the actors' power, driven by their interests.

Several studies showed that actors' power influences a certain outcome, like timber harvesting for market or keeping the sustainability of forest stands, by hindering or enhancing it. From the Tunisian case studies of the constitutive publications, it was possible to identify the importance of state forest organizations' power in shaping particular forest outcomes. For example, the observed increase of illegal logging and wildfire after the revolution of 2011 was linked to the weakened state coercive capacities to control these illegal activities (Hasnaoui and Krott 2019a; Hasnaoui et al. 2020). One of the frameworks that empirically measure power applied in the constitutive papers is the actor-centered power approach (Krott et al. 2014).

This thesis's main objectives are (i) to explore the role of state forest organizations' power as a driver of their performance to achieve forest outcomes, which is evaluated by the 3L model, and (ii) to look for larger empirical evidence from literature review to check the relevance of this power in different contexts.

Overall, the current thesis aims to answer the following questions:

- Is power a relevant driver of the state forest organizations' performance?
- How can the description and the measurement of power be improved?
- Can the integration of power measurement expand the evaluation of state forest organizations, and will this improve the explanation of state forest organizations' specific performance?

Answering the questions above would require a larger empirical basis to support developing a framework that integrates power in evaluating state forest organizations' performance.

In order to broaden the empirical basis compared with the constitutive cases, a systematic literature review was applied. This literature review aims to scrutinize all existing publications using the 3L model and those applying the actor-centered power framework in order to identify in both categories of publications the mention of any link between the use of power by state forest organizations and specific outcomes in the forestland. The choice of these two frameworks is justified by two main reasons: (i) to keep coherent with the Tunisian case studies which apply these two frameworks (ii) to avoid fuzzy results by combining other methods of performance and power measurements.

Following the systematic literature review, an improved power-linked 3L model that brings together both frameworks is established. Through this model, the evaluation of state forest organizations can be expanded and can contribute to analyzing better the achievement of certain performance and outcomes in the forestlands.

2 Theoretical framework of the 3L model and power

This thesis's theoretical frameworks are mainly based on (i) the forest political evaluation approaches using criteria and indicators and (ii) actors' power theories. Both frameworks are discussed in the following two subsections with the aim to establish a link between them and integrate actors' power as an explicit driving factor of the state forest organizations´ performance.

2.1 The 3L model for a comprehensive evaluation of state forest organizations

The 3L model was first developed by Krott and Stevanov (2008) to comprehensively evaluate the state forest organizations in different contexts from the global north and south based on benchmarking criteria. In general, several governments adopted evaluation criteria within the New Public Management that pushed states to review expenses, calculating performance indicators, and comparing them to concurrent (Hibou 2019). In other words, it is practicing benchmarking by evaluating these administrations regarding established benchmarks (Hibou 2019). Benchmarking can be broadly defined as the comparison, which is based on a wide range of criteria generated from practice (Grundmann 2001; Krott and Stevanov 2008).

The 3L model aims to tackle several challenges and bridge the gaps identified in the different sets of criteria and indicators developed within international processes.

Compared to the existing sets of criteria and indicators such as the pan-European criteria[2], the 3L model aims to better fulfill the requirements for applicable benchmark criteria. Policymakers consider that a useful evaluation should be based on criteria that fulfill the following three requirements (i) first is the political relevance. Evaluation should be based on criteria that reflect the priorities of national policies in a precise way. Despite their relevance, existing international criteria are considered vague in providing a clear orientation of balancing ecological and socio-economic goals and translating them into specific national forest policies. (ii) The second is the possibility of identifying driving factors. While providing information about the specific status of the forests and which targets are met, international criteria leave the issue of identifying the causes and the ways to improve the situation unsolved. (iii) Finally, simplicity is a fundamental requirement to apply benchmarking. The definition and the use of indicators for the international criteria remain a complex resource and time-consuming task (Krott and Stevanov 2008).

All these requirements are considered the advantage of applying the 3L model (Krott and Stevanov 2008; Stevanov and Krott 2006; Stevanov 2014).

[2] https://foresteurope.org/sfm-criteria-indicators2/

The 3L model focuses on evaluating state forest organizations' performance using eight benchmarking criteria covering different aspects of sustainability. These criteria represent different outcomes in the forestlands covering the provision of market and non-market goods and services, economic outcomes (profit-making, technical efficiency, and exploring new markets), conflict and interest mediation, and sustainability of forest stands (see figure 1). These forest outcomes represent the achievements that are observable in the forestlands, like maintaining or increasing the forest size. The forest *outcomes* are different from the forest administrations' *outputs*, like producing plans for planting and maintaining new forest stands to increase the forest size and produce wood sustainably. Unlike outcomes, the administrations' outputs do not include the changes in the forestland and forest sector. Outputs are restricted to the activities of the administrations made in order to achieve an outcome. The following table (table 1) summarizes the eight criteria of the model and the theories in which they are anchored. The first criterion concerns the state forest organizations' orientation toward the *market demand* by focusing on forest goods and services that may be exchanged on the market, such as wood. The *orientation toward non-market demand* is the second criterion dealing with state forest organizations' focus on providing forest goods and services that are not exchangeable on the market (public goods) or those securing public welfare (merit goods). The third criterion is the *sustainability of forest stands* focusing on maintaining forest size and continuously producing wood. *Technical efficiency* is the fourth evaluation criterion that assesses the efficiency that allows approaching the maximum of production. The fifth criterion, the *profit from forests*, deals with evaluating the revenue generated from forests benefiting the state forest organizations and/or allowing other actors to make profit. The *orientation toward new market goods* is the sixth evaluation criterion focusing on organizations' orientation toward creating new revenue sources from forests supporting economic performance. The seventh and eighth criteria aim to assess the state forest organizations' role in *advocacy for forestry* or *mediation between different interests*. The advocacy's role deals with the organization's focus on particular forestry-related interests and ignoring other different actors' interests. The mediator role concerns the forest organization's ability to allow stakeholders to take part in policy processes.

Table 1. The criteria of the 3L model (Hasnaoui and Krott 2019b)

Criteria (C)	Explanation of the criteria
C1: Orientation toward market demand	Concerns forest goods and services that can be exchanged on the market (e.g., wood) and the market limits. This criterion is anchored in economic, market theories.
C2: Orientation toward non-market demand	Relates to forest goods and services that cannot be exchanged on the market (public goods) or those which are considered as necessary to secure public welfare (merit goods). For example, conservation activities, poverty alleviation. These orientations are also financed by public means and can be anchored in public economics theories.
C3: Sustainability of forest stands	Refers to the goal of maintaining forest size and the capability to continually produce wood using forest management theories that are part of natural sciences.
C4: Technical efficiency	Refers to the efficiency that allows production to approach the maximum, which can be anchored in business management theories.
C5: Profit from forests	Concerns the evaluation of the importance of revenue generated from forests. It may concern state forest organizations' own revenue and/or opening the possibility for other actors to generate revenue from forests. This criterion can also be anchored in business management theories.
C6: Orientation toward new forest goods	Focuses on organizations' orientation toward developing new revenue sources from forests, supporting the market's orientation and economic performance. Similar to criteria 4 and 5, this criterion is linked to business management theories
C7: Advocacy for forestry	Relates to the role, within political processes, of forest organizations in managing the use and protection of forests. The advocacy's role shows the organization's focus on specific interests in forests without considering all different actors' interests. This criterion, as well as criterion 8, are anchored in political theories
C8: Mediation between all interests in the forest	Deals with the capability of the organization to apply forest governance. It is an opportunity for stakeholders to take part in policy processes.

The 3L model comprises three levels (layers) that allowed the extraction of the evaluation criteria and indicators. The first layer is 'political relevance.' This layer includes all related forest policy goals. These goals are formulated mainly in forest laws and programs and are in general considered as complex. The second layer contains theoretical frameworks such as economic, natural, and political theories. The third layer is the empirical evidence layer that allows measuring the state forest organizations' performance empirically using a set of indicators for each criterion.

In the following, the process of the emergence of the eight criteria and their particularities are explained. First, the benchmarking criteria selection process started with identifying different goals and common priorities developed in forest laws and programs that were considered the standards for this selection. This focus allows the criteria to be better integrated into the processes of reforms as perceived from a policy perspective (Stevanov and Krott 2006, 2013). In the case study of Tunisia, the benchmarking criteria were found to be capturing different goals of recent policy programs formulated in the forest strategy (2014) and the program of forest investment (2016), which are targeting the sustainable multiple-use of forestlands.

Priority objectives included in the general goal of sustainable forest management are highly relevant on the political level. Nevertheless, they remain difficult to operationalize. The vague terms used in political discourses can be interpreted in different ways. To specify these goals, suitable theories were applied to anchor the goals into more accurate scientific terms. Theories provide the possibilities to identify different processes and their driving factors. For example, the economic theory contains a description of different market mechanisms that influence forest use. Identifying the aspects of sustainable forest management influenced by the market can help better understand the process and plan optimization actions. (Krott and Stevanov 2008). Furthermore, ecological theory can be used to identify different aspects defining the forest's capacity to produce timber continually.

The link to theories also allows identifying causative factors that may explain a certain performance of state forest organizations. For example, such criteria can help to explain if a weak performance regarding a specific goal, such as sustainability, is caused by economic, ecological, or political factors. Identifying the driving factors can help to optimize the performance of these organizations by adjusting their activities.

The combination of the political relevance with the theories resulted in the emergence of the eight evaluation criteria that were selected based on policy programs' priorities and scientific significance.

Furthermore, this combination with theories grants a better operationalization of the selected criteria and then the possibility of empirical performance measurement. Measurement indicators (layer 3) can be easier to define when the criteria are based on a specific theory. For example, the criterion which is

related to sustainability (criterion 3) is based on forest management theories. This anchoring allowed to easily find related indicators that include annual increment, growing stock, and forest area development, indicating whether the requirement for sustainability is achieved over time. In the same vein, the link to theories grants the possibility to compare several state forest organizations in different countries since theories allow to extract standard scientific terms that can be, in general, understood in the same way in different contexts. In Tunisia's case studies, it was possible to use the definition of annual increment similarly to other case studies in Europe since this definition and how to calculate its value were found in the Tunisian forest inventory.

Overall, the eight criteria emerged from linking the layer of complex policy programs-layer 1- (represented by clouds in figure 1) to clear and well-defined theories -layer 2- (geometric shapes in figure 1). Linking the political goals to specific theories allows specifying these vague goals and then allowing their measurement by developing a set of indicators for each criterion (Layer 3).

Based on the above-developed explanation, the criteria of the 3L model are considered as relevant to different policy goals (layer 1), well based on theories that allow an easier application for comparisons between state forest organizations (layer 2) and empirically measurable (layer 3).

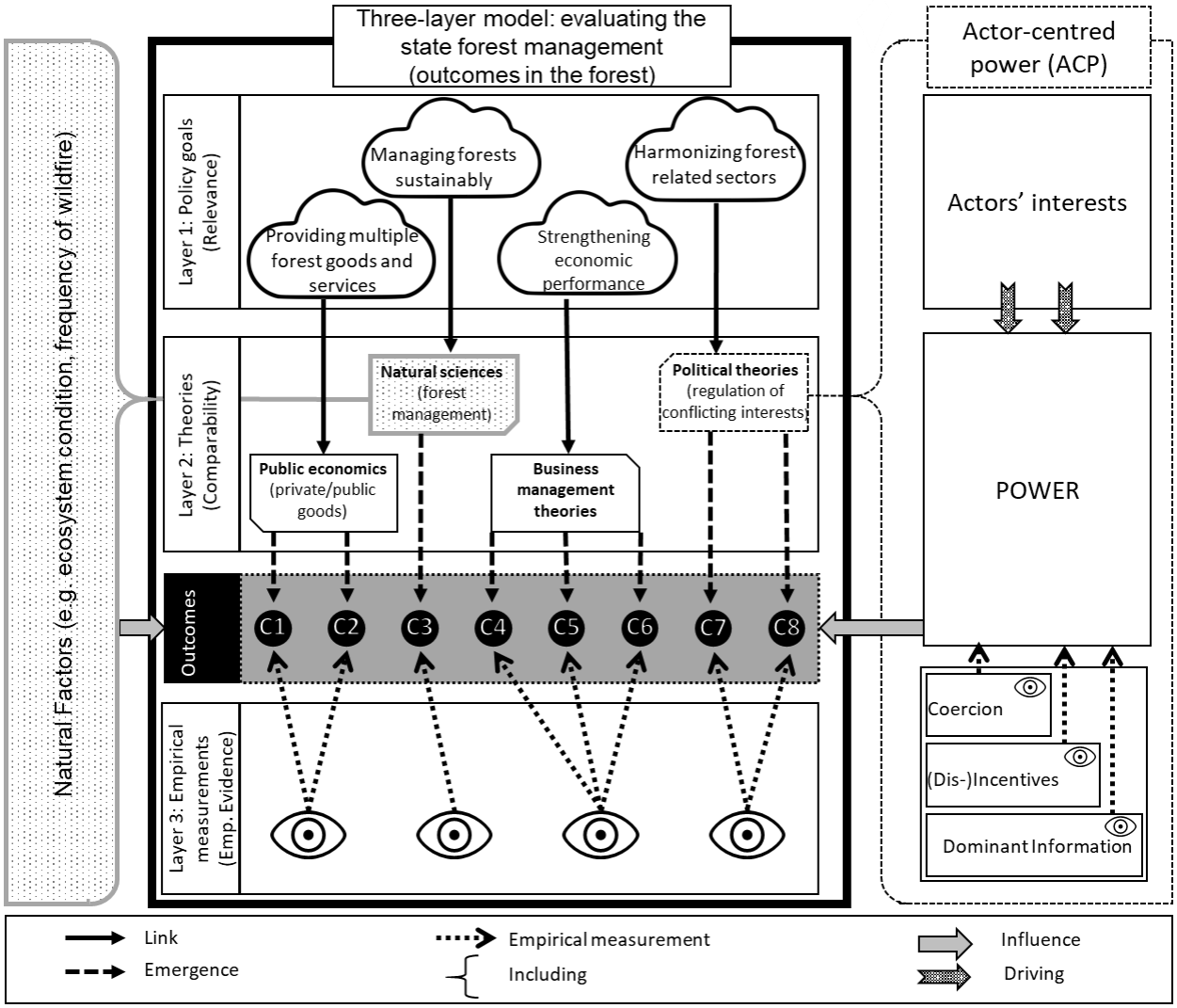


Figure 1. Power as a driving factor of forest outcomes: linking the actor-centered power approach to the 3L model

2.2 Expanding the 3L model evaluation by integrating power as a driving factor

Despite covering a wide range of forest administrations' tasks, the 3L model does not explicitly show all the driving factors influencing the forest sector's outcomes produced by state forest organizations. Two important drivers can be the natural factors and actors' power (figure 1). A natural wildfire or the ecosystem conditions are examples of natural factors that may hinder the outcomes in terms of sustainability (criterion 3) even in the presence of a strong performance of state forest organizations in terms of management. These natural factors are included in natural sciences theories (figure 1), but their influence on the outcomes is not considered an explicit driving factor.

Another relevant driving factor is the actors' power, driven by their interests in the forest sector. Power is mainly covered by the political theory, which is already integrated into the theory layer of the 3L

model (figure1). It was considered implicitly in developing some criteria of the model (criteria 7 and 8). However, it was not directly included in the evaluation as a driving factor. Considering the power as a driving factor in this thesis is due to its central position in political theory.

The following description of the power concept is mainly developed within the theoretical framework of one of this dissertation's constitutive papers[3].

The concept of power has been extensively analyzed in academic literature. However, there is no unanimous definition of this concept despite the high number of related works. The definitions and interpretations of power's notion in literature depend on the disciplines and the social contexts in question. These definitions encompass those from a political science perspective (Dahl 1957; Allison and Zelikow 1971; Wight 2002), sociology (Crozier and Friedberg 1980; Scott 2010), and political philosophy (Foucault 1991). In some definitions, power is considered a 'possession,' meaning that it cannot be shared and should be related to a specific function and place. This perception of power was particularly promoted by developing sovereignty and legitimate authority theories (Holeindre 2014). In contemporary societies, power is perceived as a 'social relation' between different actors (Revault d'Allonnes 2014). Foucault considers that within a relation or practice of power, an actor's behavior can be altered by another actor without any obvious use of coercion (Foucault 1991). According to Weber, power is not bound to having the capacity but to executing this capacity. He defines power as the possibility to impose one's will within a social relation despite resistance and regardless of the means on which this possibility is relying (Weber 1978[1922]). In the same vein, Weber perceives the state as the entity with the exclusive legitimacy to use force and coercion for law enforcement while imposing a 'general interest' over self-interest (Weber 1978[1922]).

From a more empirical perspective, Krott et al. (Krott et al. 2014) further developed the definition of power and its central elements in the frame of an 'actor-centered power' approach. Empirically, the authors define power as "a social relationship in which actor A alters actor B's behavior without recognizing B's will." In this relationship, the relation between A and B can be summarized as follows: Actor A, who acts as a 'potentate' (who is altering the other actor's behavior), forces actor B to react as a 'subordinate'. The 'will' of an actor is a fundamental part of the power definition in the actor-centered power theory. It indicates the importance of considering actors' interests as the main driver of power (figure 1). Further, actors' interests are considered as the driving force of forest policy (Krott 2005).

[3] The paper is entitled: "Contesting State Authority in Forestland Use: A Power-Based Case Study Within Arab Spring Transformations in Tunisia" submitted to the journal of rural studies on 19.11. 2020

That is to say, forest policy goals formulation and implementation depend greatly on the interests of involved actors.

The three fundamental power elements defined by the actor-centered power are coercion, (dis)incentives, and dominant information. These three power elements of the actor-centered power form the main advantage of this approach in terms of empirical measurement of power (figure 1), which is initially considered invisible (Krott et al., 2014). According to actor-centered power, the use of power (i.e., the three power elements) is driven by the interests of the actors (figure 1).

(a) Coercion

The aim of the use of coercion is "altering the behavior of a subordinate by force." This force can be related to declared or anticipated physical actions. For example, forbidding the physical access to forestland resources above ground (wood, wildlife, arable land) and below ground (mining, oil) and restricting the access to a certain area through the deployment of armed forest rangers or fencing. In this case, the subordinate can try to resist by damaging or traversing the fencing or accessing the forestland by avoiding forest rangers' periods of presence in the field. Resisting the potentate's coercion can also be by using violence (e.g., armed rebellion, wildlife poaching, illegal logging). The threat of force is considered as the main sort of power in this form of social relationship. Forest administration can often use this threat to implement political steering and to oblige people to respect the regulations. The scope of the threat's influence depends on the subordinate's belief concerning the potentate's power capacities. The main factor influencing this belief is the degree of visibility of the potentate's force. The potentate can use the subordinate's belief to threaten even though the truly existing power sources are weaker than what is expected by subordinates.

Furthermore, threats can be observed within public or closed discourses in the political processes. For example, forest law encompasses several sanctions that include physical force, such as incarceration. Forest administrations can use these sanctions as a threat to alter the behavior of subordinates.

(b) Incentives and disincentives

Using (dis)incentives aims to "altering the subordinate's behavior through disadvantages or advantages." For example, State bureaucracies can use penalties as disadvantages through forest police to control illegal logging or offer wood certification facilities within the public market. In this case, the potentate has different aims than those of the subordinate. The subordinate is pushed to change his/her behavior and obey the potentates' rules to avoid penalties or profit from particular advantages. The use of disadvantages to influence the subordinate's behavior is closely linked to the potentate's coercion. As an example, being forced to pay the penalty is considered coercion. However, the amount of the penalty to be paid is a disincentive.

(Dis)incentives can be material or immaterial. Material incentives may be applied by providing money, materials (e.g., machines, devices), or essential resources (e.g., water, food). Immaterial incentives consist of offering advantages, such as those related to education, health care, or moral demands. These sources can be used simultaneously as disincentives like reducing the provision of some subsidies or admitting a certain action as threatening some social conventions.

(c) Dominant information

Dominant information was defined by Krott et al. (Krott et al. 2014) as being the social influence where a powerful actor (the potentate) is "altering the behavior of subordinate using unverified information." Actor-centered power distinguishes between 'shared information,' which acknowledges a certain level of information for both actors (potentate and subordinate), and 'dominant information,' which restricts the subordinate's capacity to verify this information. In the latter case, the potentate can omit particular facts while providing information. Based on this incomplete information, the subordinate can make inappropriate decisions leading to a behavior that does not correspond to his initial will. Not being able to verify given information can be (i) inescapable if the subordinate lacks the means to verify it and consequently is obliged to accept the information as it stands. For example, forest-dependent people are hardly apt to check the accuracy and comprehensiveness of forest management related information. Nevertheless, it can also be (ii) voluntary when the subordinate trusts the potentate's 'goodwill' and the ideologies that he/she defends.

Several power theories look at the actors' behavior and the outcomes as both parts of power's essence. Actor-centered power considers that actors' behavior in a power relationship is not the only factor determining a specific outcome's achievement. The potentate targets a certain outcome and struggles to impose a position within a specific social relationship by forcing the other actor(s) to change their activities. Nevertheless, additional ecological, economic, and social factors also the outcomes which are beyond the power relations of the potentate. In some cases, the potentate can have a wrong understanding of some factors and impose a behavior leading to an outcome opposite to expected. Overall, based on actor-centered power, power is considered as a crucial social factor but not the only one shaping outcomes.

Figure 1 illustrates the integration of actor-centered power as an explicit factor driving the state forest organizations' outcomes in forestlands. Power is included in the political theories (figure 1). Nonetheless, it is not explicitly integrated into the performance measurement made by the 3L model. Establishing the link between the actor-centered power approach and the 3L model allows exploring the relevance of power in influencing state forest organizations' performance and, consequently, shaping particular outcomes.

Based on this theoretical framework, the following hypotheses were formulated:

H1. In addition to natural and technical factors, state forest organizations need both high interest and strong power in order to produce high forest outcomes.

H2. State forest organizations use a combination of different power elements to produce aspired outcomes in the forestlands.

3 Methodological approach

This thesis aims to scrutinize the role of power as a driving factor of state forest organizations and to extend the empirical evidence beyond the Tunisian case studies presented in the constitutive papers. These constitutive papers were based on data that was collected between May 2016 and February 2020. A substantial part of the data collection process was mainly relying on documents related to the forest sector in Tunisia (e.g., national strategies, annual reports, forest law, development projects and unpublished workshops reports, and statistics from the General Directorate of Forests). Key experts' interviews were conducted via phone, email, and face to face with experienced actors from forest organizations, research institutions, and ministries officials at national and local levels as well as local forest people (Hasnaoui and Krott 2018, 2019a, 2019b; Hasnaoui et al. 2020). Besides, my field observations (in 2013 and 2014) allowed me to check the provided information further. In the fourth publication, a mapping was realized to analyze the evolution of different forestland land uses from 2000 to 2019 in a case study from the Northwest of Tunisia (Hasnaoui et al. 2020). Additionally, regular meetings with the research group allowed avoiding personal bias. Besides, the triangulation of all these data sources increased the results' accuracy further (Hasnaoui and Krott 2019a, 2019b).

In addition to this collected data for the Tunisian case studies, a systematic literature review was conducted to extend the empirical basis of this thesis. This type of literature review aims to identify, assess, and produce a synthesis of all relevant studies in order to answer specific questions (Petticrew and Roberts 2006). It is a scientific tool rather than a discussion of literature. A systematic review can be used to summarize, evaluate, and share the results of research (Petticrew and Roberts 2006). The systematic literature review process starts with a review planning phase, which includes defining the research questions and developing a review protocol. The second phase is the review conducting by identifying and selecting relevant research, assessing the studies' quality, extracting the required data, and synthesizing it. The last phase is the document review through writing a review report and validating it (Brereton et al. 2007).

In this thesis, the identification of relevant studies was based on Google scholar citations. Among different scholarly databases such as Web of Science and Scopus, google scholar is considered to be able to find most of the citations in social sciences publications[4]. Out of 217 citations of Krott et al. (2014) on google scholar[5], 39 studies are based on the actor-centered power approach (applying it as a theoretical framework and/or for result analysis) and dealing with state forest organizations. All these

[4] https://blogs.lse.ac.uk/impactofsocialsciences/2019/12/03/google-scholar-web-of-science-and-scopus-which-is-best-for-me/

[5] Until August 2020

publications were reviewed in order to identify the possible link between power use by state forest organizations and a certain forest outcome. First, these publications were regrouped into seven categories according to the main issues they address: (i) Decentralization and participatory approaches; (ii) Community forestry/social and small scale forestry; (iii) Political changes/transitions; (iv) Climate policy/REDD implementation; (v) Sustainable Forest Management, ecosystem services, and certification; (vi) Land use conversion and; (vii) Biodiversity and conservation policy. This categorization allows for easier identification of the forest outcomes that these studies deal with and understanding the power dynamics regarding a specific issue in different contexts. When identified, the outcomes are linked to the suitable criteria of the 3L model. For example, if the state forest administration possesses limited power sources, that results in more forestland conversion into agriculture. In that case, a link will be established to criterion 3 of the 3L model "sustainability of forest stands." The results show that the state's weak power has hindered the achievement of high outcomes regarding sustainability. This influence of power on outcomes should have been directly or indirectly highlighted by the author(s) of the study in question.

Similarly, the ten existing studies that apply the 3L model as an analytical framework to evaluate the state forest organizations' performance were reviewed. Their identification was based on the internal literature system of the Chair Group of Forest and Nature Conservation Policy and crosschecked with google scholar. The objective is to investigate the possible link between a certain outcome (final evaluation of a criterion) and the use of power elements by the state forest organizations. These research studies are not explicitly mentioning the power elements of the actor-centered power approach. Thus, based on the definition of these power elements, the description of state forest organizations' specific behaviors and tools were associated with power elements. For example, if the authors mention that the state supports sustainability due to forest law's strict application, this would be identified as a clear use of coercion to push the stands' sustainability (criterion 3).

The case studies considered in the analysis are presented in table 2. The four constitutive publications on the Tunisian case study (two applying the 3L model and two based on the actor-centered power approach) are counted in the total number of retained case studies.

Table 2. The selected studies for the literature review

Analytical frameworks	**Countries**	**Number of studies**	**Authors**
Studies based on the Actor-centered power approach	Nepal	3	(Basnyat et al. 2020; Basnyat et al. 2018; Harrer 2016)
	Bangladesh	9	(Islam et al. 2014; Islam et al. 2015; Islam and Sato 2018; P.K. Sarker et al. 2017; Rahman and Giessen 2017; Rahman et al. 2016; Rahman et al. 2018; Sadath et al.; Giessen et al. 2016)
	Indonesia	12	(Ekawati et al. 2019; Fatem et al. 2018; Maryudi et al. 2016; Mulyani and Jepson 2017; Prabowo et al. 2017; Purnomo et al. 2018; Sahide et al. 2020; Sahide et al. 2018; Sahide et al. 2016; Wibowo and Giessen 2015, 2018; Yusran et al. 2017)
	Cameroon	1	(Awung and Marchant 2016)
	Vietnam	1	(Bach 2018)
	Germany	1	(Schusser et al. 2013)
	Sweden	1	(Guillén et al. 2015)
	China	1	(Ba et al. 2020)
	Armenia	1	(Burns et al. 2017)
	Portugal	1	(Marques et al. 2020)
	Pakistan	1	(Zeb et al. 2019)
	Tunisia	1	(Hasnaoui and Krott 2018; Hasnaoui et al. 2020)
	International studies	6[6]	(Dobšinská et al. 2020; Hasnaoui and Krott 2018; Juerges et al. 2018; Kirchner et al. 2019; Schusser et al. 2015; Stanzel et al. 2020)
Studies based on the 3L model	Tunisia	2	(Hasnaoui and Krott 2019a, 2019b)
	Laos	1	(Phommachanh 2019)
	Philippines	1	(Daisog 2020)
	Brazil	1	(da Motta Bustamante et al. 2018)
	Poland	1	(Chudy et al. 2016)
	Romania	1	(Hapa 2019)
	Comparative studies	3	(Stevanov et al. 2018; Stevanov and Krott 2019, 2013)

[6] The international studies include one case study from Tunisia (constitutive paper) which is a comparative study

4 Results: Power as a driving factor of state forest organizations' performance

Based on the review of existing literature, the main findings presented in this section focus on identifying the influence of state forest organizations' power on achieving different outcomes in the forestlands[7]. Furthermore, state forest organizations' use of strong or weak power sources was linked to outcomes. They can either enhance or hinder the achievement of high outcomes. Powerful or weak public forest organizations can use, strongly or weakly, only one or a combination of power elements. The analysis of the specific power was made by the authors of the reviewed publications. The results' presentation is divided into two main sections: (i) analysis of studies that are applying the actor-centered power approach, (ii) analysis of studies using the 3L model. Each section contains information about the outcomes considered influenced by states' power and the different (combinations of) power elements used by state forest organizations. Furthermore, the sections include a deeper analysis using the examples of the Tunisian cases presented in the constitutive publications.

4.1 State forest organizations' power in the studies based on the actor-centered power approach

Overall, the results show that the studies based on the actor-centered power theory establish a link between state forest organizations' performance and particular outcomes in the forestlands. State's power has influenced mainly the provision of market and non-market demand (criteria 1 and 2, Table 1), sustainability (criterion 3), economic performance (criteria 4, 5, and 6), and the management of interests and conflicts between different actors in the forest sector (criteria 7 and 8). The results also show the use of different power combinations by state forest organizations to produce forest outcomes. The following subsections summarize the results based on tables. These tables include the cases where a specific outcome is hindered or enhanced for each category of outcomes due to the state forest organizations' (weak or strong) power. Different power combinations used by state forest organizations are also outlined.

4.1.1 Provision of market and non-market goods and services

The analysis focuses on research studies dealing with state forest organizations' power regarding the market and non-market orientations (criteria 1 and 2). The results are summarized in Table 3. Overall, state forest organizations' use of power to push market orientation was found in four analyzed studies. However, no publications were dealing with hindering this outcome due to the organizations' power. Regarding the orientation toward non-market demand (i.e., public goods and services), 14 cases mention that the state forest organizations' power influenced this outcome. In 12 cases, the outcome was hindered, while enhanced only in two cases (table 3).

[7] As mentioned earlier, these outcomes are represented by the eight criteria of the 3L model

In several case studies, public forest organizations' power is mentioned with the market and non-market orientations as one of the driving factors leading to strengthening or hindering these orientations. The orientation toward market demand is pushed in general by a powerful state. Only one case was associated with a weak state forest organization. This case was a study from Armenia showing that the forest administration was very weak and dependent on donors. This dependency allowed the World Bank to influence the national policy and promote market development while restricting local inhabitants' forest use (Burns et al. 2017).

Regarding the non-market orientation, the results show that the outcomes were impeded in most cases despite the presence of strong state forest organizations. The causes for such a result are varying depending on the context as well as the analyzed issue. For example, in Portugal, despite considering the state as a powerful actor, it is still challenging to control wildfire and pests. This performance is explained by the inefficient management strategies of fire and pest control (Marques et al. 2020). These kinds of activities of protection are defined within the 3L model as non-market orientation. In another international study, strong states hinder biodiversity conservation, which is also a non-market orientation (see Table 1), while prioritizing other forest sector interests (Stanzel et al. 2020).

Table 3. State forest organizations' power influencing market and non-market orientations

Identified Criteria (representing the outcomes in the forest)	Identified influence direction on the outcomes (criteria)	Number of cases where the state* is considered strong	Number of cases where the state is considered weak	Total number of cases**
C1: orientation toward market demand	Outcomes enhanced	3	1	4
	Outcomes hindered	0	0	0
C2: Orientation toward non-market demand	Outcomes enhanced	2	0	2
	Outcomes hindered	9	3	12

*The state refers to the state forest organizations.

** only the cases where a power's influence on outcomes was identified are considered in this table

4.1.2 Achievement of sustainability goals

The reviewed studies show that achieving sustainability goals remains a challenge in several countries. There are 10 cases where the sustainability-related outcomes are considered to be hindered while it is enhanced in one case only. In all these studies, the power of state forest organizations influences these outcomes. Six out of ten cases show a link between the hindered sustainability outcome and the existence of weak state forest organizations. However, there are still four case studies where the state is considered as powerful. Depending on the case study in question, the origins of such a contradiction are varying. Rigid laws in the forest sector can block the power of the state. In the case of Bangladesh, the forest department has incentives and dominant information power. However, the ban-related regulations block their ability to use this power to achieve sustainable forest management (Giessen et al. 2016). In Pakistan, the state implemented a logging ban efficiently to limit forest loss. Nevertheless, this ban, despite the coercion, has not achieved the intended goals. Instead, a higher loss of forests was observed due to a shift to illegal selective logging with the same significance (Zeb et al. 2019). Besides, some cases show that a certain change, such as decentralization, can lead to new actors' involvement in land-use conflicts, which reduces the state's capacity to protect forest stands and timber interests. In Indonesia, despite possessing coercive power, the central state could not control land conversion. Within a decentralization context, the palm oil industry gained more power and got supported by local governments and communities, which has affected the sustainability of forest stands (Prabowo et al. 2017).

Table 4. State forest organizations' power influencing sustainability

Identified Criteria (representing the outcomes in the forest)	Identified influence direction on the outcomes (criteria)	Number of cases where the state* is considered strong	Number of cases where the state is considered weak	Total number of cases**
C3: Sustainability of forest stands	Outcomes enhanced	1	0	1
	Outcomes hindered	4	6	10

*The state refers to the state forest organizations.
** only the cases where a power's influence on outcomes was identified are considered in this table

4.1.3 Economic efficiency in the forest sector

A limited number of reviewed studies that use the actor-centered power approach focus on the economic outcomes in the forest sector (criteria 5 and 6). None of these studies is mentioning that these performances are hindered due to the state's power. Only four cases deal with the profit from forests and mention that the state's power is intended to push this outcome (Table 5).

Regarding the orientation toward creating new forest products to explore new markets and increase economic performance, merely two cases mention a link between a powerful state and enhancing such an outcome. It is even possible that the state forest organizations, based on their interest, create exceptions for specific forest goods. In Indonesia, the state has broken a deadlock created by a "deep root bureaucratic politics" of biodiversity conservation to implement a geothermal project. In contrast, this deadlock was maintained for community and traditional use (Sahide et al. 2018).

Technical efficiency was not in the focus of any study, neither as hindered nor as pushed.

Table 5. State forest organizations' power shaping economic outcomes

Identified Criteria (representing the outcomes in the forest)	Identified influence direction on the outcomes (criteria)	Number of cases where the state* is considered strong	Number of cases where the state is considered weak	Total number of cases**
C5: Profit from forests	Outcomes enhanced	3	1	4
	Outcomes hindered	0	0	0
C6: Orientation toward new forest goods	Outcomes enhanced	2	0	2
	Outcomes hindered	0	0	0

*The state refers to the state forest organizations.
** only the cases where a power's influence on outcomes was identified are considered in this table

4.1.4 State forest organizations' power to advocate and mediate different actors' interests

A large number of the analyzed publications is dealing with the power of the state to keep control over forests and to remain the leading representative of the sector (table 6), in other words, to push its role of advocacy of forestry (criterion 7). In these studies, Criterion 7 and Criterion 8 are most of the time opposed to each other. For example, when the state pushes centralization processes or does not support community forestry and participatory approaches, it enhances its advocacy role and, at the same time, reduces its role in the mediation of other actors' interests in the forest sector (criterion 8).

In 20 cases, state forest organizations' advocacy role was enhanced by powerful organizations. Consequently, in 19 out of these 20 publications, the mediation of other interests was hindered. As above-mentioned, the main issues treated concerning this outcome are re-centralization processes and community forestry, for example, in Indonesia (e.g., (Sahide et al. 2016), Bangladesh (e.g., (Islam et al. 2015); Vietnam ((Bach 2018); China (Ba et al. 2020), and Nepal (Basnyat et al. 2020; Basnyat et al. 2018). Another publication in European countries in transition shows that the state is still powerful despite a successful restitution process and trying to keep the hand over private forests' use (Dobšinská et al. 2020).

Only one case is showing that a powerful state is pushing the mediation role. In Sweden, the forestry department is trusted by small scale foresters because of the expertise (dominant information) provided to fulfill their interests through a "client-based approach." (Guillén et al. 2015)

The advocacy role can also be hindered in the presence of a strong state. Despite the coercive power in Indonesia, the central state could not keep the hand over forests because of the local government's resistance, which built coalitions with other actors to resist this power (Fatem et al. 2018).

Table 6. State forest organizations' power and their role in solving the forest conflicts of interest

Identified Criteria (representing the outcomes in the forest)	Identified influence direction on the outcomes (criteria)	Number of cases where the state* is considered strong	Number of cases where the state is considered weak	Total number of cases**
C7: Advocacy of forestry	Outcomes enhanced	20	0	20
	Outcomes hindered	1	1	2
C8: Mediation of different interests	Outcomes enhanced	1	0	1
	Outcomes hindered	19	0	19

*The state refers to the state forest organizations.
** only the cases where a power's influence on outcomes was identified are considered in this table

4.1.5 Power elements (combinations) influencing outcomes

After analyzing the state's overall power to influence forest outcomes, different power elements used by state forest organizations were scrutinized. The aim is to identify the power sources that the state forest organizations use to produce a particular outcome. The systematic literature review did not go beyond identifying the state's power sources due to the diversity of power evaluation and interpretation methods applied by the authors. Depending on case studies, the same combination of power can be associated with a strong or weak state. Furthermore, in several case studies, there is a lack of precision regarding the importance of using different power elements compared to each other. There are cases where the state uses strong coercion, dominant information, and (dis)incentives simultaneously. In contrast, this same combination is used in other cases but relies mainly on coercion and using the other elements in a less significant way. Moreover, the methodology of how to come up with a specific evaluation of the strong or weak use of a power element is not clarified in all publications.

Figure 2 shows that state forests rely on a combination of power elements in more than 50% of the cases (22 out of 37 studies where power elements were mentioned to be used by state forest organizations to influence forest outcomes). Five cases mention that public forest organizations are mainly relying on coercion, while only two use dominant information. The remaining cases are using different combinations of two of the power elements. None of the studies shows that a state forest organization relies, for the most part, on (dis)incentives.

The dominance of different power combinations indicates the expansion of state forest organizations' role, which is not limited to the police role. Within these social relationships, state organizations aim to keep stable power by diversifying and associating different power sources (e.g., extension services,

incentives, and regulation). The importance of such combinations for stable power relations is further detailed in the following case study of Tunisia.

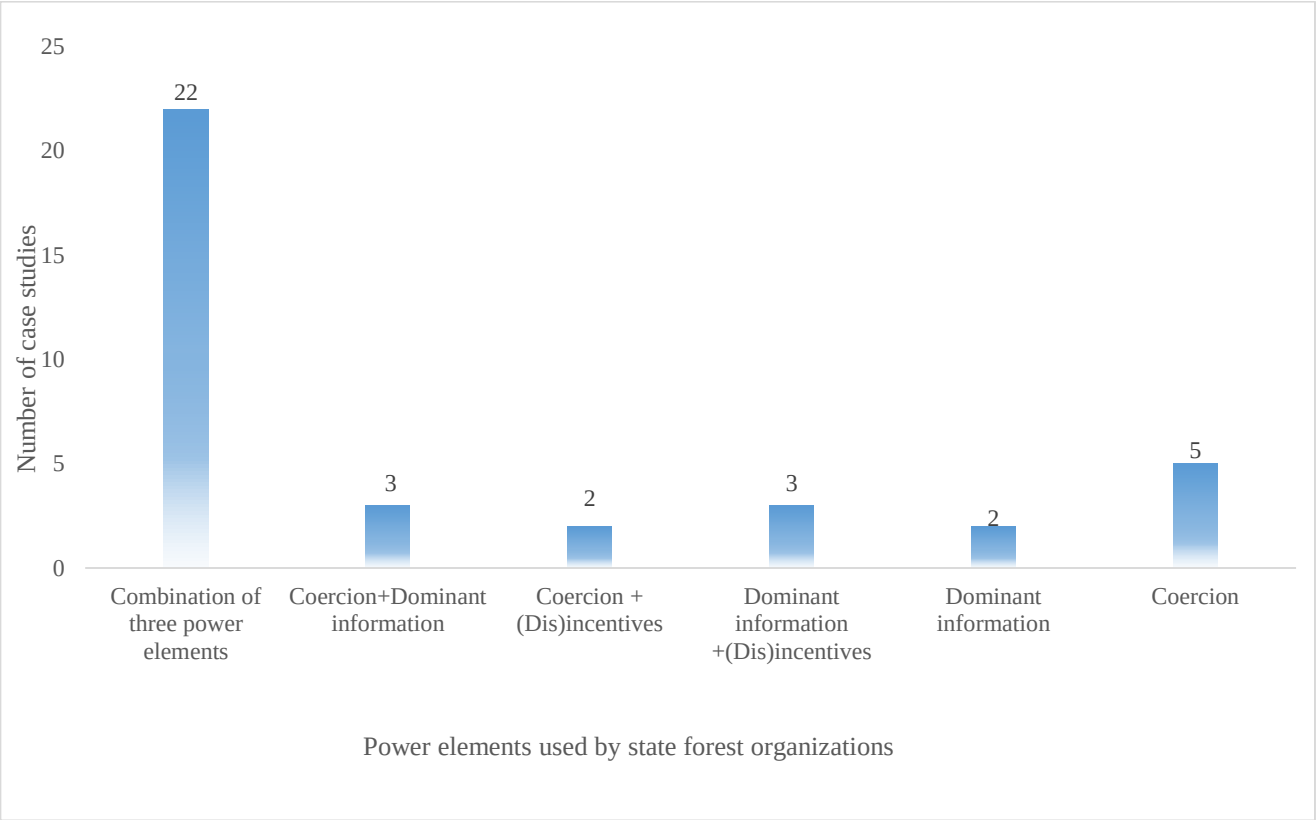


Figure 2. Different power combinations used by state forest organizations to shape forest outcomes based on the 3L model publications

4.1.6 Tunisian state forest organizations: power dynamics and influence on outcomes

Building on two constitutive papers of this dissertation ((Hasnaoui and Krott 2018; Hasnaoui et al. 2020), insights into the Tunisian case study are presented. These studies allow a better understanding of power's role in shaping the relationship between state forest organizations and other categories of forest users and generating forest outcomes within a particular context of political change. The main results are dealing with the weakening of the central state's power after the revolution of 2011 (decrease of the advocacy role, Criterion 7) and the hindering of sustainability outcomes (criterion 3). However, the state's power and influence on outcomes that followed the revolution cannot be generalized to the whole country. It depends on the power elements used to regulate specific land use within forestlands. Furthermore, the Tunisian case shows the importance of combining specific power elements to control forestlands and avoid social contestations resulting from a political change and affecting sustainability.

A wide range of tasks is allocated to public forest administrations in Tunisia. The share of state ownership of forestlands exceeds 90%, making the management of these lands quite challenging. Tunisian forestlands have mainly social and protective public goals. The livelihood of nearly 750,000 inhabitants depends on the access to these forestlands, among other things, for grazing, firewood, and non-wood products. In this regard, public forest administration needs to balance different interests and solve the conflicts that may arise in relation to these different interests. This major challenge around regulating access to forestlands has been exacerbated since the revolution of 2011, marking the start of a series of contestations in the Arab world known as the 'Arab Spring.' After this event, the state's authority was contested by the population. It has become defying for the public authorities to enforce the regulations related to access to natural resources, including forestlands. The main effects observed are the acceleration of forest loss, mainly through illegal logging and wildfire, which considerably affected the stands' sustainability (figure 3).

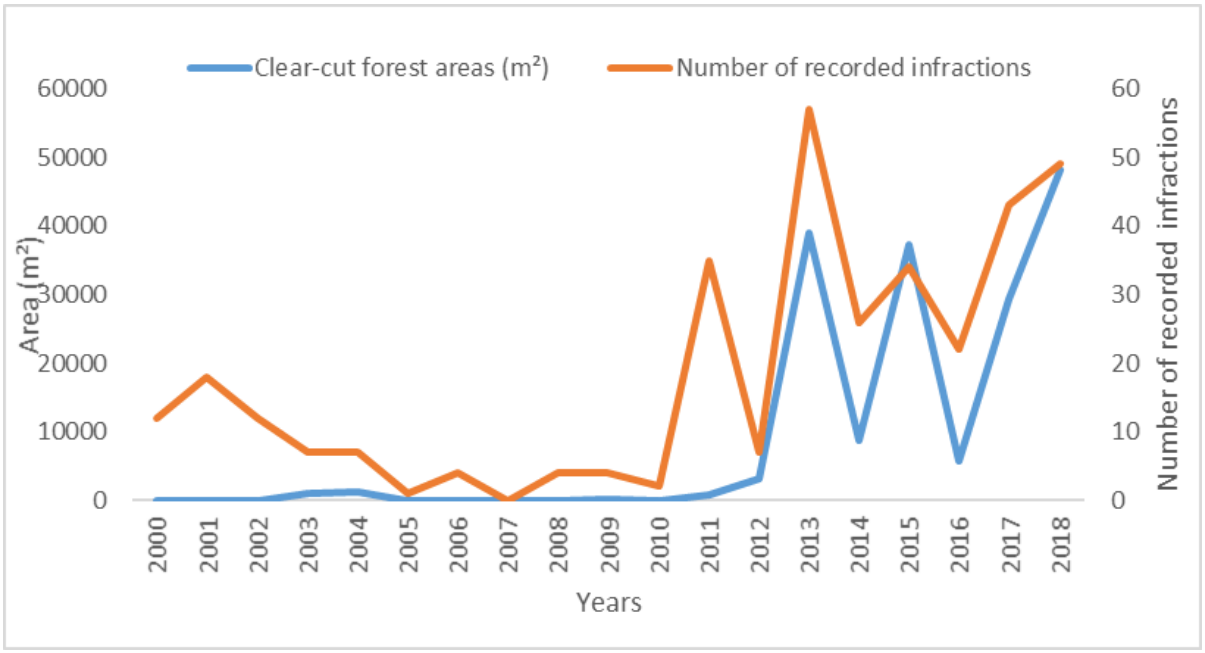


Figure 3. Evolution of recorded infractions in the forests and the clear-cut areas between 2000 and 2018 in the forest of Mekna -Northwest Tunisia (Hasnaoui et al. 2020)

In general, since the revolution, there has been no complete shift of power from government to other actors' categories, such as market and forest inhabitants. The state is still resisting the other actors and trying to gain control over forestlands again and use different power sources. However, depending on the land use and the regions, the state's power and other actors' resistance capacity vary. A particular case study from the forest of Mekna in the northwest region revealed several ruptures and continuities in terms of power sources used by state forest organizations regarding selected types of land use between

the periods of pre-and post-revolution. This case study shows that the state's use of specific combinations of power elements can influence its relation with other actors differently. A weakened state due to an unusual political event such as the revolution can still keep the hand over some land uses and avoid contestations if a set of power elements was used before the occurrence of this event. Based on this case study, different power dynamics resulting from combining power elements (Coercion, dominant information, and (Dis)incentives) by the state are discussed:

(a) The association of coercion with incentives to keep stable power balances

Since Tunisia's independence, forest and agricultural land ownership have been one of the main advantages of reinforcing its coercion capacities. Despite inefficient management of agricultural lands caused mainly by the limited resources[8], land ownership remains a good option for the state to use as incentives to solve conflicts related to different land uses, including access to forestlands.

In general, public bureaucracies have the tradition to use force (coercion) coupled with financial sanctions (disincentives) to control natural resources access. However, the use of such a combination of power has shown its limits after the revolution of 2011. Since this political change, a shift in power balance has been observed. As subordinates, forest users gained more power to resist and avoid destabilized state coercion and sanctions' capacities. Consequently, forest authorities could not control illegal logging properly (criterion 3 decreased).

Simultaneously, another example of power sets used by the public authorities showed that a stable power could be kept even after the revolution. Tunisian Ministry in charge of forests and Agriculture planned in 2003 to relocate inhabitants from a forest area to install a water dam. Legally, the state can decide and enforce, through coercion, projects of public interest on state-owned lands such as constructing a water dam. However, the concerned authorities have the responsibility and obligation to provide compensation for people living on these lands. Before starting the water dam construction, the state has planned to provide incentives for these forest people. Land compensations with much better access to different facilities were provided instead of forcing people to move or allocate poor quality lands. The use of incentives under a clear legal framework allowed state authorities to implement this planned project without facing any resistance from forest people. Furthermore, after the revolution, the situation has not changed and the inhabitants have not tried to challenge the forest administration. Therefore, implementing the law while providing incentives proved to bring more stability into the power relation.

[8]http://www.onagri.tn/uploads/lettre/lettre28-12-2016-5.pdf

(b) The use of coercion in association with shared information and dominant information

The case study from northwest Tunisia brings a contribution to the actor-centered power approach to better understand the use of coercion by the state forest organizations. As defined in this theory (Krott et al. 2014), coercion builds on the use of force as a source of power. This definition supports Max Weber's understanding of the state as the actor who dominates the use of political force through its different administrative entities. The state's coercion capacity is supported by a legal framework giving the rights to apply control sanctions. The case study results from northwest Tunisia show that shared information among actors (potentates and subordinates) is an essential requirement to properly use coercive power. As long as different actors have an equal level of knowledge about "(i) the existing resources, (ii) how much of this can be used, when and where (iii) the possible sanctions that the non-state actors risk when they commit infractions such as illegal logging." It is called shared information, which does not set power on any individual or group of actors. This shared information stops to exist when non-state actors gain the power of dominant information. In this case, the state loses the coercive capacities despite the existence of a legal framework supporting the use of coercion. These interactions between shared information, dominant information, and coercion are explained through the example of hidden illegal logging, which can be considered as a form of dominant information power.

The state has the potential to use coercion against illegal logging. Nevertheless, subordinates' ability to hide illegal logging inhibits forest authorities' coercive capacities to cease it physically.

The Tunisian case study reveals that hiding illegal logging includes the use of dominant information additionally. For example, the collaboration between the private forest users and forest people who have considerable knowledge about the available resources increases the likelihood of more access to resources and hiding information from the state. Furthermore, the state's access to information about harvested quantities decreases mainly due to the administration's lack of personnel to control different field activities. This limited access to information forces the authorities to accept the information provided since they cannot verify it. Additionally, during the night or in areas that are difficult to reach, forest administration gets no information and cannot react against illegal logging due to the limited capacities of control. This example provides empirical evidence of the importance of shared information as a prerequisite to use coercion.

Overall, using coercion to regulate logging and other forest-related activities needs to be associated with shared information among all actors or to monopolize the use of dominant information. When non-state actors acquire the capacity to hide information about illegal logging or other forest activities, the equal sharing of information is suppressed and leaves room for dominant information used as a power source. In this case, the state capacity for regulation is lost. Overall, the case study of Tunisia shows that the

impact of the revolution on sustainability (decrease of criterion 3) and state's authority (decrease of criterion 7) could have been (partly) avoided by using specific sets of power elements that allow to mitigate and control the contestations of the administration's authority.

4.2 State forest organizations' power in the studies based on the 3L model

Despite the limited number of publications based on the 3L model, the analysis reveals a link between some performance evaluations and the state forest organization's power. The identified influence of power on outcomes in these studies concerns (i) the orientation toward non-market demand (criterion 2); (ii) Sustainability of forest stands (Criterion3); (iii) Economic performance of state forests organizations (criteria 4 and 5) and; (iv) the role of these organizations in managing different interests and conflicts in the forest sector (Criteria 7 and 8).

Unlike the studies based on the actor-centered power, a powerful state is associated with strong outcomes in almost all cases, while a weak state drives weak evaluation results.

4.2.1 Orientation toward non-market demand and sustainability

Overall, two cases are dealing with the orientation toward non-market demand. One case shows that a powerful state enhances this outcome, while the other case reveals a hindered outcome in the presence of a weak state forest organization. The lack of personnel and financial resources in Serbia and Croatia slows down implementing different programs, such as those related to non-market orientation (Stevanov and Krott 2013). Community development plans produced in Tunisia are targeting poverty alleviation by providing incentives. Poverty alleviation activities are considered as non-market orientation and are enhanced in this particular case.

Regarding forest stands' sustainability, the outcome is hindered and driven by weak state forest organizations in all identified cases. Either in Romania, Serbia, Croatia, or in Tunisia and Laos, the weak control and law enforcement capacities and the lack of resources are driving the low sustainability of forest stands and the continuance of illegal logging (Hapa 2019; Stevanov and Krott 2013; Hasnaoui and Krott 2019a; Phommachanh 2019).

Table 7. Market and non-market orientations outcomes driven by state forest organizations' power

Identified Criteria (representing the outcomes in the forest)	Identified influence direction on the outcomes (criteria)	Number of cases where the state* is considered strong	Number of cases where the state is considered weak	Total number of cases**
C2: orientation toward non-market demand	Outcomes enhanced	1	0	1
	Outcomes hindered	0	1	1
C3: Sustainability of forest stands	Outcomes enhanced	0	0	0
	Outcomes hindered	0	4	4

*The state refers to the state forest organizations.
** only the cases where a power's influence on outcomes was identified are considered in this table

4.2.2 Economic performance of state forest organizations

Regarding economic performance, the influence of power was identified regarding criteria 4 and 5 (Table 8). Overall, weak state forest organizations are hindering the technical efficiency in the forest sector. In Brazil, a study shows that the state provides weak incentives to support concessions, which affects the technical efficiency within these concessions (da Motta Bustamante et al. 2018).

There is only one exception in an international UNECE[9] study showing that powerful states can drive weak performance in some countries. The rigidity of bureaucratic rules using disincentives hinders the establishment of reliable accounting systems used in the 3L model as an indicator to measure technical efficiency (Stevanov and Krott 2019).

In only one case, profit from the forest is being enhanced by a powerful state forest organization. The case study from Tunisia, where an organization focuses on poverty alleviation and creating income sources for forest people, pushes the profit from forests through implementing development projects. The state uses mainly dominant information by producing specific plans for these activities and providing incentives for these people (Hasnaoui and Krott 2019b).

[9] United Nations Economic Commission for Europe

Table 8. Forest economic outcomes driven by state forest organizations' power

Identified Criteria (representing the outcomes in the forest)	Identified influence direction on the outcomes (criteria)	Number of cases where the state* is considered strong	Number of cases where the state is considered weak	Total number of cases**
C4: Technical efficiency	Outcomes enhanced	0	0	0
	Outcomes hindered	1	3	4
C5: Profit from forests	Outcomes enhanced	1	0	1
	Outcomes hindered	0	0	0

*The state refers to the state forest organizations.
** only the cases where a power's influence on outcomes was identified are considered in this table

4.2.3 Solving conflicts of interest in the forest sector

In the analyzed publications, three cases highlight the link between the state forest organizations' power and their role as forestry advocators (Table 9). In comparison, four cases show the link to their position as mediators between different interests.

The advocacy of forestry is slowed down in the presence of weak organizations only, while it is pushed in one case by strong forest administration. The use of strong coercion in the Philippines is reflected in the strong control of forests and bureaucratic rules' rigidity. This rigidity increases the advocacy role since the state does not consider the community forestry's interests properly (Daisog 2020). This strong advocacy position consequently leads to weakening the mediator role.

The mediation role is hindered in all three identified cases (Table 9). Two cases are linked to weak state forest organizations. For example, Poland experienced a lack of expertise and trustful cooperation with different actors (dominant information), limiting state forest organizations' role as a mediator of different interests (Chudy et al. 2016).

A study from Balkan countries shows that state forest organizations have weak influence in private forests and were not recognized as advocators or mediators by other actors, resulting in a weak performance for both criteria (Stevanov et al. 2018).

Table 9. The role of state forest organizations in solving the forest conflicts of interest driven by their power sources.

Identified Criteria (representing the outcomes in the forest)	Identified influence direction on the outcomes (criteria)	Number of cases where the state* is considered strong	Number of cases where the state is considered weak	Total number of cases**
C7: Advocacy of forestry	Outcomes enhanced	1	0	1
	Outcomes hindered	0	2	2
C8: Mediation of different interests	Outcomes enhanced	0	0	0
	Outcomes hindered	1	2	3

*The state refers to the state forest organizations.
** only the cases where a power's influence on outcomes was identified are considered in this table

4.2.4 Power elements influencing outcomes

Despite the limited number of studies, the key information to extract from identifying the use of power elements is that the state forest organizations, based on the issue and the context in question, can use different combinations of power elements to influence a certain outcome (Figure 4). It does not mean that the identified power combinations are the unique ones used. Further, it does not represent the overall power of state forest organizations. It is limited to the outcome to which the link to power is established. This aspect is developed further in the case study of Tunisia.

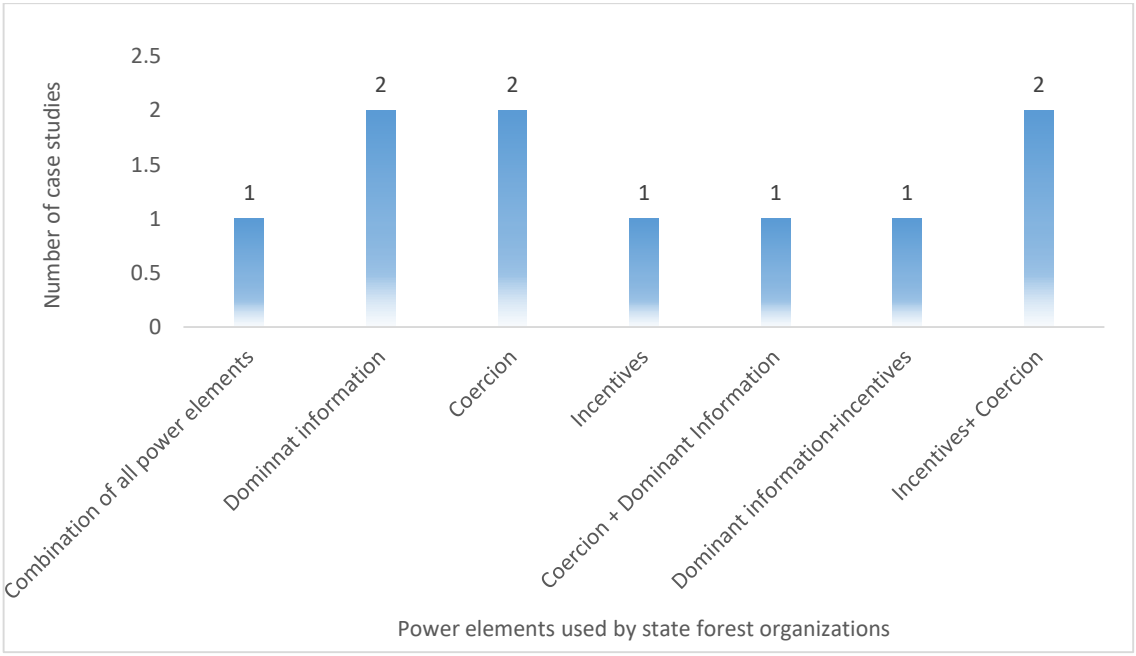


Figure 4. Different power combinations used by state forest organizations to shape forest outcomes based on the 3L model publications

Overall, the literature review shows the existence of power influence on the forest outcomes evaluated by the 3L model. However, the limited number of studies is insufficient to conclude about a specific influence of a particular combination of power elements and a specific outcome in the forestlands.

4.2.5 Evaluation of state forest organization in Tunisia

Two constitutive papers from this dissertation assess state forest organizations' performance in Tunisia (Hasnaoui and Krott 2019a, 2019b). The first one is more specific to social sustainability by focusing on the performance that impacts forest people (Hasnaoui and Krott 2019b). The second one evaluates the performance within the context of the revolution of 2011 (Hasnaoui and Krott 2019a).

4.2.5.1. The state forest organizations' priorities (interests) shaping the outcomes

Evaluations of state forest organizations based on the 3L model have the advantage of being relevant to national policy goals and reflect the national priorities. These priorities can be different from what is expected at the international level or international organizations' interests.

For example, to achieve strong economic outcomes, state forest organizations are expected to have strong technical efficiency performance (criterion 4). In Tunisia, state forest organizations have weak performance in terms of technical efficiency, which can be perceived as negatively impacting economic outcomes in general. However, public forest organizations prioritize poverty alleviation goals. Forest people in Tunisia have very limited technical skills in performing forest activities. Nevertheless, state forest organizations are strategically employing these people by providing short contracts in order to generate some source of income, allowing people to survive on the one hand, and the administration to

avoid social contestations and more illegal logging, on the other hand. If state organizations were targeting higher technical efficiency, these people would be excluded from realizing these activities and replaced by machines or contracts with professional enterprises.

Consequently, their income from forests would decrease. This case shows that state forest organizations' interests and priorities, which drive their power use, can shape the forest outcomes. Priorities of forest organizations can widely vary depending on political and socio-economic contexts, influencing the final outcomes (e.g., being more market-driven or focusing on non-market orientation).

4.2.5.2. The role of state forest organizations' power in producing forest outcomes

In all studies using the 3L model, state forest organizations' power was considered as a factor influencing different outcomes. The situation was particularly complex in Tunisia due to a political change. Following the revolution of 2011, the state's coercive capacities were considerably hindered. However, there was no significant shift from government to governance. Other national actors such as those from the market and civil society have not gained the possibility to contribute directly to decision-making and policy formulation processes. Nevertheless, a central role was played by foreign donors such as the World Bank and the GIZ[10] in shaping the new political orientations in the presence of weakened state organizations. Under this influence of international organizations, mainly through incentives and dominant information, policy programs have been formulated after the revolution claiming the improvement of different forest sector outcomes.

However, many hindering factors were identified, which can slow down the implementation and, consequently, hindering the achievement of the targeted outcomes.

[10] German Corporation for International Cooperation

(a) Weak state forest organizations under the influence of foreign donors, shaping post-revolutionary policy goals

The new forest policies that have been formulated since 2014 have prioritized the production of management plans and forest inventories to contribute to achieving higher sustainability outcomes.

Forestland planning is an important factor contributing to reducing illegal logging and forestlands conversion into agricultural lands. However, such information systems can also benefit other actors fulfilling their interests in different land uses, leading to less sustainability in forest stands. Forest inventories define some notions like tree height. Based on these definitions, some areas might be excluded from the forestlands, allowing other sectors to identify the possibility of converting these lands into other uses such as agriculture (Burns and Giessen 2016). In Tunisia, The Forest investment plan includes an entire project dedicated to developing agricultural lands facing erosion threats. Developing this project within a forest policy program indicates that this sector is getting more important, which might lead to future policy changes benefiting the agricultural sector, especially in the presence of weakened forest administration.

In terms of budget, new forest policies in Tunisia allocate negligible amounts to capacity building despite the important role of these organizations to realize different tasks in forests and rangelands. Between 0.1% and 3% of the total budget amount of these formulated programs are allocated to individual and institutional capacity building. By considering the decrease of the personnel's number since the year 2000, mainly because of the non-replacement of retired employees, ignoring capacity building might slow down implementing these policy programs. The lack of personnel in the field was one of the main factors causing an increase in illegal logging and wildfires. Inventories and management plans can be more useful when more attention is allocated to the individual and institutional capacity building

(b)Weak state forest organizations failing to plan a coherent implementation process for the post-revolutionary forest policies

The forest production processes and the economic sector's activities require different implementation time (Krott 2005). Thus, considering the time dimension in planning forest policies' implementation is an important requirement to maintain or improve sustainability.

40% of the total budget of the Tunisian forest strategy (2014-2025) was allocated to forest resources development, including producing management plans. The main claimed goal of this investment is to improve sustainability. Additionally, achieving sustainability outcomes is assumed to be enhanced by adopting a co-management approach between forest administration and forest people. In co-management plans, forest people can use specific forest products to make a profit. In return, they have

an obligation to develop and protect new plantations and forest resources from different dangers such as wildfires and illegal logging. However, considering the time factor, these sustainability goals can be more difficult to achieve than expected. The formulation and the implementation of co-management plans are long processes (from law approval to tests, then to generalization on the whole forest area). Besides, this process should consider the time needed to convince forest people to adhere to these agreements and provide capacity building programs. Overall, such a long-term goal can take several decades to be effectively implemented in practice. In the meanwhile, new plantations and management plans can be produced within a much shorter time. Due to this gap and imbalanced time planning, there will be no qualified people to fulfill such management plans' requirements. This imbalance would engender considerable natural and financial loss.

Overall, in the presence of weakened state organizations, other actors can intervene in shaping new forest policies through their power of incentives and dominant information. However, the resulting post-revolution policies, claiming to push different outcomes and support more participation of different stakeholders, present several incoherencies, and do not fit the Tunisian context. These issues can particularly influence the achievement of sustainability goals.

4.3 Main findings: the power-linked 3L model

The major contribution of this thesis is the establishment of a power-linked 3L model (figure 1). Initially, power was not explicitly considered as a driving factor in the 3L model. This model provided a framework for evaluating state forest organizations' performance regarding different sustainability aspects based on eight benchmarking criteria. These criteria represent different forest outcomes and are relevant to policy goals, simple to use, and empirically applicable. The analysis of 49 case studies, including the Tunisian cases, shows that the criteria are relevant to policy goals in many global north and south countries.

Furthermore, the evaluation provides a better explanation of the factors driving the state forest organizations' performance. Nevertheless, the link between achieving a particular outcome and state forest organizations' power was not explicit in this model. In the four constitutive papers, it was possible to identify this link in Tunisia's case study. In these papers, two kinds of evaluations were made separately. The 3L model was used in two papers to evaluate the state forest organizations' performance, while the actors-centered power approach was applied in the other two papers to identify the power dynamics concerning forestland uses and outcomes. After exploring the link between power and the achievement of outcomes in the Tunisian case study, a systematic literature review was applied in the current thesis in order to support this link with more empirical evidence and check its soundness in other contexts. The literature review focuses on publications using the 3L model and those using the actor-centered power approach summed up in 49 publications.

The literature review revealed the existence of power influence on different forest sector outcomes as initially identified in the Tunisian case studies. In other words, successful forest policy-making and implementation are influenced by state forest organizations' power since they can be (partly) reflected by achieving certain outcomes. Furthermore, the results showed the importance of considering the interests of state forest organizations. The existence of hindered outcomes despite state forest organizations' power, mentioned 35 times, shows that powerful state forest organizations do not always aspire to achieve high outcomes in all relevant policy goals.

Besides, the literature review and the Tunisian case studies show the common use of different power elements by state forest organizations to keep stable power relations rather than relying on the exclusive use of coercion. Supported by the Tunisian case studies, the results allowed confirming the formulated hypotheses that (i) "*In addition to natural and technical factors, state forest organizations need both high interest and strong power in order to produce high forest outcomes*." and (ii) "*State forest organizations use a combination of different power elements to produce aspired outcomes in the forestlands*."

The systematic literature review gives empirical evidence for comparing multiple cases, but this empirical basis is still insufficient for testing specific hypotheses regarding power influence. The weaknesses are caused mainly by (i) the focus of the reviewed studies, which are varying based on the issues and the different contexts and scales; (ii) the description of power impact on outcomes made by authors, which is very selective and depending on their perception of how to assess and use the different power elements.

These results are significant at this stage. However, they do not allow to measure in a deeper way (i) the significance of power's influence on outcomes compared to other factors such as the natural ones. (ii) the possible interactions between certain outcomes and specific combinations of power elements. Tackling these issues would require a higher number of relevant case studies that are based on a predefined methodology for deeper data collection and analysis.

5 Designing a new platform-based concept for a power-linked 3L model

This section is dedicated to presenting a new platform concept to apply the power-linked 3L model on a larger scale and create a comprehensive database. This database aims to centralize information regarding state forest organizations and their power sources by following a consistent data collection process to overcome the mentioned limitations of the current thesis.

To achieve this goal, several questions should be answered in advance, including (i) how to proceed in order to create and manage such a platform, (ii) how to operationalize the concept of a power-linked 3L model within this platform concept?

In recent years, several mechanisms have been developed to increase knowledge and to support science-policy interfaces. For example, the knowledge and learning mechanism for biodiversity and ecosystem services (EKLIPSE) was developed to support decision-making on environmental issues based on the best available knowledge[11]. This mechanism may have some common aspects with the planned platform. The main similarity is producing high-quality knowledge and making it available for large scale use. However, this mechanism is acting mainly based on requests from policymakers and societal actors seeking more information regarding several issues related to biodiversity within Europe.

The power-linked concept will actively work on different case studies and contexts to increase and share knowledge about one defined topic: the state forest organizations' power and performance evaluations. The challenge is to make the digital platform simple and comprehensible for data providers and users. Nonetheless, this platform's users can express their interest in obtaining data about their countries and request a collaboration for a study based on the power-linked 3L model. Furthermore, if needed, data users can request further details or clarifications on realized studies via the digital portal. The involved scientists and experts can answer these requests and contribute to improving the final evaluation results. A selection of some first ideas that can be relevant to creating and running this platform is presented in the following. These ideas are inspired by the European EKLIPSE mechanism and KNEU project results.[12] Nevertheless, additional studies will be necessary to develop and operationalize a new platform for the power-linked 3L model.

5.1 Creation of a network of knowledge

The first step to establish this new concept would be to create a science-based network of knowledge. To start with, a search of existing networks of relevant organizations, researchers, current projects, NGOs, platforms of forest-related statistics should be made. This search aims to identify the networks that are already working on evaluating forest outcomes and actors' power in interdisciplinary contexts.

[11] https://www.eklipse-mechanism.eu/how_did_we_get_there

[12] http://www.vliz.be/projects/biodiversityknowledge/progress-and-results/the-white-paper.html

The network can further include organizations with knowledge about state forest organizations that are not necessarily available for the public. After the selection, these different networks will be contacted in order to ask them for a commitment to join this project. The process will start by contacting the already established network who can mobilize their own networks.

This 'network of networks' will allow scrutinizing available knowledge and the research gaps to bridge. There will be no restrictions regarding countries of case studies. The collaboration can concern the existing networks regardless of their locations. The first criteria are to target interdisciplinary networks with closely linked activities to the topic of the concept.

This Network of knowledge will be designed based on the platform-oriented model. This model is different from the informal network, which is based on the commitment of individuals. The platform model aims to officially engage organizations in order to reduce as much as possible external funding dependency (KNEU project 2014). Different tasks and roles will be distributed among these organizations. This platform model is based on membership. Each institution that becomes a member of this network would have rights and obligations to contribute. The number of engaged organizations and their size should be as limited as possible but still able to produce high-quality results. They also should be distant from political interests. Furthermore, different processes should be run transparently according to scientific standards and predefined rules and structures.

5.1.1 Motivation for knowledge holders to contribute

Engaging different knowledge holders to actively join the network and to contribute is considered a challenging task. Despite the importance of such networks, knowledge providers can lack time or motivation (KNEU project 2014).

To increase the chances of active commitments, it is important to enhance the credibility and legitimacy of the network of knowledge by approaching well-known contributors and integrating different knowledge types from the beginning. Nevertheless, the process will also include less experienced contributors to support the learning process and capacity building.

Additional benefits of this kind of networks can be a good motivation to be actively involved:

- Having personal contacts and dialogue with peers within an interdisciplinary environment.
- Giving them opportunities to develop new projects and to keep updated.
- Developing careers (e.g., through scientific publications, agreements with peer-review journals).
- Allowing the improvement of knowledge regarding methodologies to use in this kind of study.
- Providing opportunities for gatherings and covering some related expenses.

5.1.2 Knowledge collection and synthesis methods

Specific data that is targeted by this power-linked 3L model does not explicitly exist comprehensively. Furthermore, available data differs based on the context. After presenting the concept to the network members, a collaborative process for developing a clear data collection guideline should occur. The starting point would be the existing 3L model manual developed by Stevanov and Krott (2013). This manual can be updated by integrating additional indicators that fit, as much as possible, different contexts, and especially by developing clear sets of indicators to measure the power of state forest organizations.

The guideline questions should be simple and well-focused to ensure an easy data collection process for data providers. The answers will be collected following an interactive method on the digital platform. Building the database by providing data on the digital platform will be supervised by different groups of this network following an agreed task distribution process. For example, some groups from the network should develop tools for reviewing data that already exist online (e.g., statistics about forest cover evolution) to avoid long data collection guidelines for experts. Other groups would focus on completing missing data by targeting experts or organizations and asking them to provide specific information directly linked to their activity area and avoid asking them about available online data. They can also organize multiple expert meetings, workshops.

In the EKLIPSE project mentioned above, 21 data synthesis methods have been identified, including systematic and non-systematic literature review, meta-analysis, participative mapping, and expert consultations. A combination of these methods that will be selected jointly by experts should be adopted to develop and answer the guideline's questions. Collected data should be reviewed by scientists and expert groups of the Network before being available for public use.

5.1.3 Governance of the network of knowledge

Governing such a platform would require the creation of several structures charged with specific responsibilities. These structures may include:

(i) Knowledge coordination body; (ii) A small secretariat (iii) a strategic advisory board, (iv) business and IT experts, (v) small evaluation body.

In addition to these structures, working groups on different topics should be formed from the established network of knowledge to conduct data collection and synthesis processes in practice. The number of members should be optimized in order to avoid high costs.

5.2 Creation of a digital platform

The digital platform has different functions. It allows to present and explain the concept clearly and interactively based on the power-linked model figure (see Annexes 2 and 3).

The data collection guideline will be translated into interactive questions on the platform, which should be clear and offer a good experience and an easy data provision process (Annex 4).

In addition to publications, the results will be presented attractively and clearly, allowing the user to select different filters and compare countries' results (Annex 5).

The platform will also be used as a forum for the community of interest. Each user will have the possibility to create an account and interact with other users and experts on the platform but also to make suggestions and give feedback (Annex 6). In this vein, the platform can additionally support webinars and online meetings for the community and the expert meetings. Furthermore, each user will have the advantage of staying tuned by receiving notifications regarding new inputs and collaboration opportunities based on the users' expressed interests (Annex 7).

The digital platform can also be used for flipped classrooms where students can read about theories and get access to empirical results to actively prepare for the classes.

5.3 Possible funding models and partners

Several funding models can support the network of knowledge. It can be (i) one major donor, (ii) project-based funding that is limited in terms of time, or (iii) core funding by the network members, which is considered as the most suitable to make the network operational in a short time by covering its basic costs (KNEU project 2014). Several organizations can be approached to support this concept, such as the International Union of Forest Research Organizations (IUFRO), the European Forest Institute (EFI), the United Nations Economic Commission for Europe (UNECE).

5.4 Specific content and advantages of a power-linked 3L platform

As mentioned above, the data collection process and the digital platform will build on the power-linked 3L model. The figure of this model (see figure 1) will serve as a navigation map for the user who can learn more about the model and the applied theories and be guided to provide data. Data providers will be guided through different criteria and indicators of the model. The indicators will be based on those developed in the existing 3L model manual that will be optimized when needed. Besides, indicators to measure power will be added. The first example of questions for the user is detailed in Annex 1. However, not all these questions will be included in the guideline. To keep it simple, only questions that cannot be answered from available online data should be included in this guideline. The example of Annex 1 concerns the sustainability of forest stands criterion. For each indicator, a set of precise questions is developed. The indicators are mainly focused on 1) achieving the requirements for sustainability, 2) Forest management plans, and 3) available power sources used by the state forest organizations to achieve the sustainability of forest stands' goal. These power-linked questions will be focusing on identifying the significance of power elements use (coercion, (dis)incentives, dominant

information). Using the same guideline for data collection will ease the process of obtaining relevant data and allow comparability between different case studies.

The platform that is based on the new power-linked 3L model has several advantages. The main advantage is the focus on a specific topic regarding state forest organizations. Other platforms have a very broad scope, such as biodiversity and environmental issues. The requests to conduct evaluation related to biodiversity or the environment can be from different perspectives and disciplines, which needs to develop suitable measurement indicators for each case. These evaluations would need more resources (e.g., financial, staff, time) to run the platform and collect data. The power-linked model will have a predefined simple guideline focusing on the state forest organizations' performance and their power sources, making data collection clearer and easier to achieve.

In addition, knowledge holders will not be asked to answer questions that can be answered from data available online, such as those related to sustainability requirements (e.g., forest cover evolution) and countries' policy goals and programs. Several tools, such as those based on artificial intelligence, can help extract such data from available online sources, saving time and financial and staff resources.

The focus on specific data to collect with short and clear guidelines for each criterion will ease running the platform. It will encourage data providers to contribute by avoiding the duplication of information that can be found online.

Overall, this platform will build on two analytical frameworks that are empirically applicable in order to centralize data on state forest organizations and their related power sources in different contexts worldwide. The platform can expand the evaluation of state forest organizations based on the power-linked 3L model and offer the opportunity for knowledge sharing and development. This knowledge can support reform decisions and the optimization of state forest organizations' performance.

References

Allison, G. T.; Zelikow, P. (1971): Essence of decision: Explaining the Cuban missile crisis: Boston: Little, Brown (327. No. 729.1).

Awung, Nvenakeng; Marchant, Rob (2016): Investigating the Role of the Local Community as Co-Managers of the Mount Cameroon National Park Conservation Project. In *Environments* 3 (4), p. 36. DOI: 10.3390/environments3040036.

Ba, Feng; Liu, Jinlong; Zhu, Ting; Liu, Yonggong; Zhao, Jiacheng (2020): CDM forest carbon sequestration projects in western China: An analysis using actor-centered power theory. In *Forest Policy and Economics* 115, p. 102139. DOI: 10.1016/j.forpol.2020.102139.

Bach, Ngo Duy (2018): Powerful actor identification in community forestry via actor-centered power theory: a case study in Son La province. In *Management of forest resources and environment* (5), pp. 62–70.

Basnyat, Bijendra; Treue, Thorsten; Pokharel, Ridish Kumar; Baral, Srijana; Rumba, Yam Bahadur (2020): Re-centralisation through fake Scientificness: The case of community forestry in Nepal. In *Forest Policy and Economics* 115, p. 102147. DOI: 10.1016/j.forpol.2020.102147.

Basnyat, Bijendra; Treue, Thorsten; Pokharel, Ridish Kumar; Lamsal, Lok Nath; Rayamajhi, Santosh (2018): Legal-sounding bureaucratic re-centralisation of community forestry in Nepal. In *Forest Policy and Economics* 91, pp. 5–18. DOI: 10.1016/j.forpol.2017.08.010.

Brereton, Pearl; Kitchenham, Barbara A.; Budgen, David; Turner, Mark; Khalil, Mohamed (2007): Lessons from applying the systematic literature review process within the software engineering domain. In *Journal of Systems and Software* 80 (4), pp. 571–583. DOI: 10.1016/j.jss.2006.07.009.

Burns, Sarah L.; Giessen, Lukas (2016): Dismantling Comprehensive Forest Bureaucracies Direct Access, the World Bank, Agricultural Interests, and Neoliberal Administrative Reform of Forest Policy in Argentina. In *Society and natural resources* 29, No.4, pp. 493–508. DOI: 10.1080/08941920.2015.1089608.

Burns, Sarah L.; Krott, Max; Sayadyan, Hovik; Giessen, Lukas (2017): The World Bank Improving Environmental and Natural Resource Policies: Power, Deregulation, and Privatization in (Post-Soviet) Armenia. In *World Development* 92, pp. 215–224. DOI: 10.1016/j.worlddev.2016.12.030.

Chiabai, Aline; Travisi, Chiara M.; Markandya, Anil; Ding, Helen; Nunes, Paulo A. L. D. (2011): Economic Assessment of Forest Ecosystem Services Losses: Cost of Policy Inaction. In *Environ Resource Econ* 50 (3), pp. 405–445. DOI: 10.1007/s10640-011-9478-6.

Chudy, R.; Stevanov, M.; Krott, M. (2016): Strategic Options for State Forest Institutions in Poland: Evaluation by the 3L Model and Ways Ahead. In *International Forestry Review* 18, pp. 387–411.

Crozier, M.; Friedberg, E. (1980): Actors and systems: The politics of collective action: University of Chicago Press.

da Motta Bustamante, Juliana; Stevanov, Mirjana; Krott, Max; Ferreira de Carvalho, Edson (2018): Brazilian State Forest Institutions: Implementation of forestry goals evaluated by the 3L Model. In *Land Use Policy* 79, pp. 531–546. DOI: 10.1016/j.landusepol.2018.09.004.

Dahl, R. A. (1957): The concept of power. In *Behavioral science* 2 (3), pp. 201–215.

Daisog, Jenylyn (2020): The Impact of State Forest Institutions on community-based forest management: The Philippines' case. Master. Faculty of Forest Sciences and Forest Ecology, Göttingen.

Dobšinská, Zuzana; Živojinović, Ivana; Nedeljković, Jelena; Petrović, Nenad; Jarský, Vilém; Oliva, Jiří et al. (2020): Actor power in the restitution processes of forests in three European countries in transition. In *Forest Policy and Economics* 113, p. 102090. DOI: 10.1016/j.forpol.2020.102090.

Ekawati, Sulistya; Subarudi; Budiningsih, Kushartati; Sari, Galih Kartika; Muttaqin, Muhammad Zahrul (2019): Policies affecting the implementation of REDD+ in Indonesia (cases in Papua, Riau and Central Kalimantan). In *Forest Policy and Economics* 108, p. 101939. DOI: 10.1016/j.forpol.2019.05.025.

Fatem, Sepus M.; Awang, San A.; Pudyatmoko, Satyawan; Sahide, Muhammad A.K.; Pratama, Andita A.; Maryudi, Ahmad (2018): Camouflaging economic development agendas with forest conservation narratives: A strategy of lower governments for gaining authority in the re-centralising Indonesia. In *Land Use Policy* 78, pp. 699–710. DOI: 10.1016/j.landusepol.2018.07.018.

Foucault, M. (1991): On Governmentality, Lecture at the College de France (1978). In Graham Burchell, C. Gordon, Peter Miller (Eds.): The Foucault Effect. Studies in governmentality. with two lectures by and an interview with Michel Foucault. USA: The university of Chicago Press, pp. 87–104.

Giessen, Lukas; Sarker, Pradip; Rahman, Md (2016): International and Domestic Sustainable Forest Management Policies: Distributive Effects on Power among State Agencies in Bangladesh. In *Sustainability* 8 (4), p. 335. DOI: 10.3390/su8040335.

Grundmann, Ralf (2001): Benchmarking in der Sparkassenorganisation : konzeptionelle Überlegungen zu einem Informations- und Kommunikationssystem zur Unterstützung der Benchmarkingaktivitäten in einem möglichen Benchmarking-Netzwerk der Sparkassenorganisation. Stuttgart: Dt. Sparkassen-Verl.

Guillén, Luis Andrés; Wallin, Ida; Brukas, Vilis (2015): Social capital in small-scale forestry: A local case study in Southern Sweden. In *Forest Policy and Economics* 53, pp. 21–28. DOI: 10.1016/j.forpol.2014.12.006.

Hans Klijn, Eric (2012): New Public management and governance: a comparison. In David Levi-Faur (Ed.): The Oxford Handbook of Governance: Oxford University Press, pp. 201–214.

Hapa, Mihai-lonut (2019): Evaluation of state forest institutions in Romania based on the 3L Model. Master. Southern Swedish Forest Research Centre, Alnarp, Sweden.

Harrer, Constantin (2016): By whose rules, for whose needs? The power of elites, livelihood implications and potential for resistance in two Nepalese community forest user groups. Master. Swedish University of Agricultural Sciences, Alnarp, Sweden.

Hasnaoui, Ameni; Krott, Max (2018): Political drivers of forest management in Mediterranean countries: a comparative study of Tunisia, Italy, Portugal and Turkey. In *Journal of New Sciences* 14, pp. 3366–3378.

Hasnaoui, Ameni; Krott, Max (2019a): Forest governance and the Arab spring: A case study of state forests in Tunisia. In *Forest Policy and Economics* 105, pp. 99–111. DOI: 10.1016/j.forpol.2019.04.016.

Hasnaoui, Ameni; Krott, Max (2019b): Optimizing State Forest Institutions for Forest People: A Case Study on Social Sustainability from Tunisia. In *Sustainability* 11 (7), p. 1954. DOI: 10.3390/su11071954.

Hasnaoui, Ameni; Ongolo, Symphorien; Hasnaoui, Foued; Aloui, Kamel; Mouelhi, Fida, Krott, Max (2020): Contesting State Authority in Forestland Use: A Power-Based Case Study Within Arab Spring Transformations in Tunisia. In *Journal of rural studies (Manuscript submitted for publication)*.

Hay, Colin (2006): Globalization and Public Policy. In Michael Moran, Martin Rein, Robert E. Goodin (Eds.): Th e Oxford Handbook of public policy. New York: Oxford University Press, pp. 587–604.

Hibou, Béatrice (2019): Lire la bureaucratisation néolibérale avec Weber. In Nicolas Matyjasik, Marcel Guenoun (Eds.): En finir avec le new public management. Paris: Institut de la gestion publique et du développement économique, pp. 97–125.

Holeindre, Jean-Vincent (Ed.) (2014): Le Pouvoir. Concepts, Lieux, Dynamiques. Auxerre: Sciences Humaines Éditions.

Hufti, Marc (2011): Governance: Exploring Four Approaches and Their Relevance to Research. In U. Wiesmann, H. Hurni (Eds.): Research for Sustainable: Development: Foundations, Experiences, and Perspectives. Perspectives of the Swiss National Centre of Competence in Research (NCCR) North-South. Bern: Geographica Bernensia, pp. 165–183.

Islam, K.; Kimihiko, Hyakumura; Tani, Masakazu; Krott, Max; Sato, Noriko (2014): Actors' Power, Livelihood Assets and Participatory Forestry in Bangladesh: Evidence from the Sal Forests Area. In *Open Journal of Forestry* (4), pp. 1–9.

Islam, K. K.; Jose, S.; Tani, Masakazu; Hyakumura, Kimihiko; Krott, Max; Sato, Noriko (2015): Does actor power impede outcomes in participatory agroforestry approach? Evidence from Sal forests area, Bangladesh. In *Agroforest Syst* 89 (5), pp. 885–899. DOI: 10.1007/s10457-015-9822-x.

Islam, K. K.; Sato, N. (2018): Actors and Their Power in Social Forest Management. In *Springer Nature Singapore* 10, pp. 143–153. DOI: 10.1007/978-981-10-5475-4_11.

Juerges, Nataly; Krott, Max; et.al. (2018): Report on actors driving forest management in selected European countries. Deliverable 4.1. ALTERFOR project. European Union.

Kirchner, Michael; Hasnaoui, Ameni; Kleemayr, Karl; Krott, Max (2019): Report on 'Conflicts and influences on acceptance for ecosystem-based risk management in the AS'. Green Risk 4 Alps project. Interreg Alpine space. Göttingen.

KNEU project (2014): A recommended design for "BiodiversityKnowledge",a Network of Knowledge to support decision making on biodiversity and ecosystem services in Europe. Edited by European Union.

Krott, Max (2005): Forest Policy Analysis. Dordrecht: Springer.

Krott, Max; Bader, Axel; Schusser, Carsten; Devkota, Rosan; Maryudi, Ahmad; Giessen, Lukas; Aurenhammer, Helene (2014): Actor-centred power: The driving force in decentralised community based forest governance. In *Forest Policy and Economics* 49, pp. 34–42. DOI: 10.1016/j.forpol.2013.04.012.

Krott, Max; Stevanov, Mirjana (2008): Comprehensive comparision of state forest institutions by a causative benchmark-model. In *Allgemeine Forst und Jagdzeitung* 4, pp. 57–64.

Marques, Marlene; Juerges, Nataly; Borges, José G. (2020): Appraisal framework for actor interest and power analysis in forest management - Insights from Northern Portugal. In *Forest Policy and Economics* 111, p. 102049. DOI: 10.1016/j.forpol.2019.102049.

Maryudi, Ahmad; Citraningtyas, Erlita R.; Purwanto, Ris H.; Sadono, Ronggo; Suryanto, Priyono; Riyanto, Slamet; Siswoko, Bowo D. (2016): The emerging power of peasant farmers in the tenurial conflicts over the uses of state forestland in Central Java, Indonesia. In *Forest Policy and Economics* 67, pp. 70–75. DOI: 10.1016/j.forpol.2015.09.005.

Möhring, Bernhard; Rüping, Ursula (2008): A concept for the calculation of financial losses when changing the forest management strategy. In *Forest Policy and Economics* 10 (3), pp. 98–107. DOI: 10.1016/j.forpol.2007.06.004.

Möhring, Bernhard; Wilhelm, Stefan; Dög, Markus (2017): The Relevance of Economic Data from Forest Accountancy Networks for Forest Management, Research and Politics Consultation. In *Small-scale Forestry* 17 (1), pp. 25–40. DOI: 10.1007/s11842-017-9373-2.

Mulyani, Mari; Jepson, Paul (2017): Does the 'One Map Initiative' Represent a New Path for Forest Mapping in Indonesia? Assessing the Contribution of the REDD+ Initiative in Effecting Forest Governance Reform. In *Forests* 8 (1), p. 14. DOI: 10.3390/f8010014.

P.K. Sarker; MD. S. Rahman; L. Giessen (2017): Empowering state agencies through national and international community forestry policies in Bangladesh. In *International Forestry Review* 19, pp. 79–101.

Petticrew, Mark; Roberts, Helen (2006): Systematic review in social sciences. A practical guide. USA/ Australia: Blackwell Publishing Ltd.

Phommachanh, Chaipheth (2019): Evaluation of Laotian State Forest Institutions: forest policy goals and performance of institutions by the 3-L model. Master. Faculty of Forest Sciences and Forest Ecology, Göttingen.

Prabowo, Doni; Maryudi, Ahmad; Senawi; Imron, Muhammad A. (2017): Conversion of forests into oil palm plantations in West Kalimantan, Indonesia: Insights from actors' power and its dynamics. In *Forest Policy and Economics* 78, pp. 32–39. DOI: 10.1016/j.forpol.2017.01.004.

Purnomo, Herry; Okarda, Beni; Dewayani, Ade Ayu; Ali, Made; Achdiawan, Ramadhani; Kartodihardjo, Hariadi et al. (2018): Reducing forest and land fires through good palm oil value chain governance. In *Forest Policy and Economics* 91, pp. 94–106. DOI: 10.1016/j.forpol.2017.12.014.

Rahman, Md Saifur; Giessen, Lukas (2017): The power of public bureaucracies: forest-related climate change policies in Bangladesh (1992–2014). In *Climate Policy* 17 (7), pp. 915–935. DOI: 10.1080/14693062.2016.1197093.

Rahman, Md Saifur; Sarker, Pradip Kumar; Giessen, Lukas (2016): Power players in biodiversity policy: Insights from international and domestic forest biodiversity initiatives in Bangladesh from 1992 to 2013. In *Land Use Policy* 59, pp. 386–401. DOI: 10.1016/j.landusepol.2016.09.013.

Rahman, Md Saifur; Sarker, Pradip Kumar; Sadath, Md. Nazmus; Giessen, Lukas (2018): Policy changes resulting in power changes? Quantitative evidence from 25 years of forest policy development in Bangladesh. In *Land Use Policy* 70, pp. 419–431. DOI: 10.1016/j.landusepol.2017.11.029.

Revault d'Allonnes, Myriam (2014): Le pouvoir existe-t-il? In Jean-Vincent Holeindre (Ed.): Le Pouvoir. Concepts, Lieux, Dynamiques. Auxerre: Sciences Humaines Éditions, pp. 37–45.

Sadath, Md. Nazmus; Schusser, Carsten; Kabir, Md. Enamul: Actor-Centered Interest Power Analysis of Participatory Biodiversity Conservation Policy Program in and Around the Bangladeshi Sundarbans 55, pp. 85–97. DOI: 10.1007/978-4-431-56481-2_6.

Sahide, M.A.K.; Supratman, S.; Maryudi, A.; Kim, Y.-S.; Giessen, L. (2016): Decentralisation policy as recentralisation strategy: forest management units and community forestry in Indonesia. In *International Forestry Review* 18 (1), pp. 78–95.

Sahide, Muhammad Alif K.; Fisher, Micah; Nasri, Nasri; Dharmiasih, Wiwik; Verheijen, Bart; Maryudi, Ahmad (2020): Anticipating a new conservation bureaucracy? Land and power in Indonesia's Essential Ecosystem Area policy. In *Land Use Policy* 97, p. 104789. DOI: 10.1016/j.landusepol.2020.104789.

Sahide, Muhammad Alif K.; Fisher, Micah R.; Maryudi, Ahmad; Dhiaulhaq, Ahmad; Wulandari, Christine; Kim, Yeon-Su; Giessen, Lukas (2018): Deadlock opportunism in contesting conservation areas in Indonesia. In *Land Use Policy* 77, pp. 412–424. DOI: 10.1016/j.landusepol.2018.05.020.

Schusser, Carsten; Krott, Max; Logmani, Jacqueline; Sadath, Nazmus; Movuh, Mbolo C. Yufanyi; Salla, Manjola (2013): Community Forestry in Germany, a Case Study Seen Through the Lens of the International Model. In *JSD* 6 (9). DOI: 10.5539/jsd.v6n9p88.

Schusser, Carsten; Krott, Max; Yufanyi Movuh, Mbolo C.; Logmani, Jacqueline; Devkota, Rosan R.; Maryudi, Ahmad et al. (2015): Powerful stakeholders as drivers of community forestry — Results of an international study. In *Forest Policy and Economics* 58, pp. 92–101. DOI: 10.1016/j.forpol.2015.05.011.

Scott, J. C. (2010): The art of not being governed: An anarchist history of upland Southeast Asia: Nus Press.

Stanzel, Jens; Krott, Max; Schusser, Carsten (2020): Power alliances for biodiversity—Results of an international study on community forestry. In *Land Use Policy* 97, p. 102963. DOI: 10.1016/j.landusepol.2017.09.038.

Stevanov, Mirjana (2014): Evaluation of forest institutions by political science: State forest administrations and forest research institutions. Examples from Serbi and Croatia. PhD. Faculty of Forest Sciences and Forest Ecology, University of Göttingen, Göttingen, Germany.

Stevanov, Mirjana; Krott, Max (2006): Role of state forest institutions in the implementation of forest law. In Franz Schmithüsen (Ed.): Legal aspects of European forest sustainable development. Proceedings of the 7th international symposium, Zlatibor Mountain, Serbia, May 2005. International Symposium on Legal Aspects of European Forest Sustainable Development. Zurich: ETH (Forstwissenschaftliche Beiträge, der Professur Forstpolitik und Forstökonomie = Forest science contributions, Chair Forest Policy and Forest Economics, 35).

Stevanov, Mirjana; Krott, Max (2013): Measuring the success of state forest institutions through the example of Serbia and Croatia. In *Int. Forest. Rev.* 15 (3), pp. 368–386. DOI: 10.1505/146554813807700146.

Stevanov, Mirjana; Krott, Max (2019): State Forest Organizations (SFOs). In : Who owns our forests? Forest ownership in the ECE region. United nations publication-ECE.

Stevanov, Mirjana; Krott, Max; Curman, Marta; Krajter Ostoić, Silvija; Stojanovski, Vladimir (2018): The (new) role of public forest administration in Western Balkans: examples from Serbia, Croatia, FYR Macedonia, and Republika Srpska. In *Can. J. For. Res.* 48 (8), pp. 898–912. DOI: 10.1139/cjfr-2017-0395.

Weber, Max (1978[1922]): Economy and Society. USA: University of California Press.

White, Andy; Martin, Alejandra (2002): Who owns the world's forests? Forest tenure and public forests in transition. Center for International Environmental Law. Washington, DC.

Wibowo, Agung; Giessen, Lukas (2015): Absolute and relative power gains among state agencies in forest-related land use politics: The Ministry of Forestry and its competitors in the REDD+ Programme and the One Map Policy in Indonesia. In *Land Use Policy* 49, pp. 131–141. DOI: 10.1016/j.landusepol.2015.07.018.

Wibowo, Agung; Giessen, Lukas (2018): From voluntary private to mandatory state governance in Indonesian forest certification: Reclaiming authority by bureaucracies. In *FS* 2 (1), p. 28. DOI: 10.24259/fs.v2i1.3164.

Wight, Martin (2002): Power politics. London: Royal Institute of International Affairs.

Yusran, Yusran; Sahide, Muhammad Alif K.; Supratman, Supratman; Sabar, Adrayanti; Krott, Max; Giessen, Lukas (2017): The empirical visibility of land use conflicts: From latent to manifest conflict through law enforcement in a national park in Indonesia. In *Land Use Policy* 62, pp. 302–315. DOI: 10.1016/j.landusepol.2016.12.033.

Zeb, Alam; Hamann, Andreas; Armstrong, Glen W.; Acuna-Castellanos, Dante (2019): Identifying local actors of deforestation and forest degradation in the Kalasha valleys of Pakistan. In *Forest Policy and Economics* 104, pp. 56–64. DOI: 10.1016/j.forpol.2019.04.005.

Annexes

Annex 1: Example of data collection questions (first ideas to be developed)

- *Each question and technical term will be defined for the user before answering*
- *When relevant, questions will be followed by suggestions defined by experts*
- *Data collection questions to be answered by experts will not concern data that is available online.*

Criterion 3: Sustainability of forest stands.

1. Sustainability requirements: *the majority of this data can be found online and will not be included in the manual of data collection to be answered by experts (except the cases with poor available online data)*

a- Forest cover evolution?

b- Growing stock evolution?

c- Annual increment evolution?

d- Biodiversity indicators?

e- Statistics about the impact of illegal logging for the last 20 years?

How recent is this data?

☐ Cover last ten years

☐ Cover last 20 years

☐ Other: …….

2. Management plans

a- Validity of plans

- What is in percentage the number of valid management plans
- What is in percentage of the forest area covered by valid plans

How recent is this data?

☐ Cover last ten years

☐ Cover last 20 years

☐ Other: …….

3. Available state forest organizations' power sources to support sustainability

a- coercion power

- Is there an obligation in the law to sustain forest stands?

- In case of illegal logging or other infractions, who intervenes first? (police, forest officers…?)
- What is the budget allocated to control activities and its proportion compared to the total budget?
- How large is the forestland area (in%) where the sanctions are applicable?
- How much of these sanctions are effectively followed by a completely legal process (in %)? Please provide yearly statistics for at least ten years.

b- (Dis)incentives power

- How much of the recorded financial sanctions (disincentives) resulting from a legal process effectively flow to the state's treasury (value and percentage)? Please provide yearly statistics for at least ten years
- Does the state forest organization provide incentives for sustainability? If yes:
  - For which activities?
  - For which actors?
- What is the percentage of the budget allocated to sustainability activities (e.g., management plans, inventories updates)?

c- Dominant information power

- Does the state forest organization provide extension services? If yes, how much of the budget is allocated for such activity?
- In the case of forest development projects funded by foreign donors, are the consulting experts national (from the state forest organization) or foreigners? Please provide the ratio of national and foreign experts for the last 20 years.
- Does the state forest organization have enough personnel and financial/technical resources to control forests? Please explain the reasons and provide evidence supporting your answer
- Availability of updated inventories/frequency of inventories realizations?

4. Natural conditions: *this data will be collected mainly through available online literature and will not be asked from data providers (except the cases with poor available online data)*

a- Rainfall

Please enter information about the pluviometry in mm/m^2:

b- Natural wildfire

- How frequent were natural wildfires in the last ten years?
- Are there official statistics about forest area damaged annually by natural wildfire?

- Are wildfire an issue for state forest organizations (e.g., included in policy programs)

c- Forest stands (ecological) conditions

- How is the situation of natural regeneration of forest stands?
- How is the situation of the soil?
- What is the ratio of natural and artificial stands?
- Is there a recent orientation to integrate new species? If yes, for which reasons?

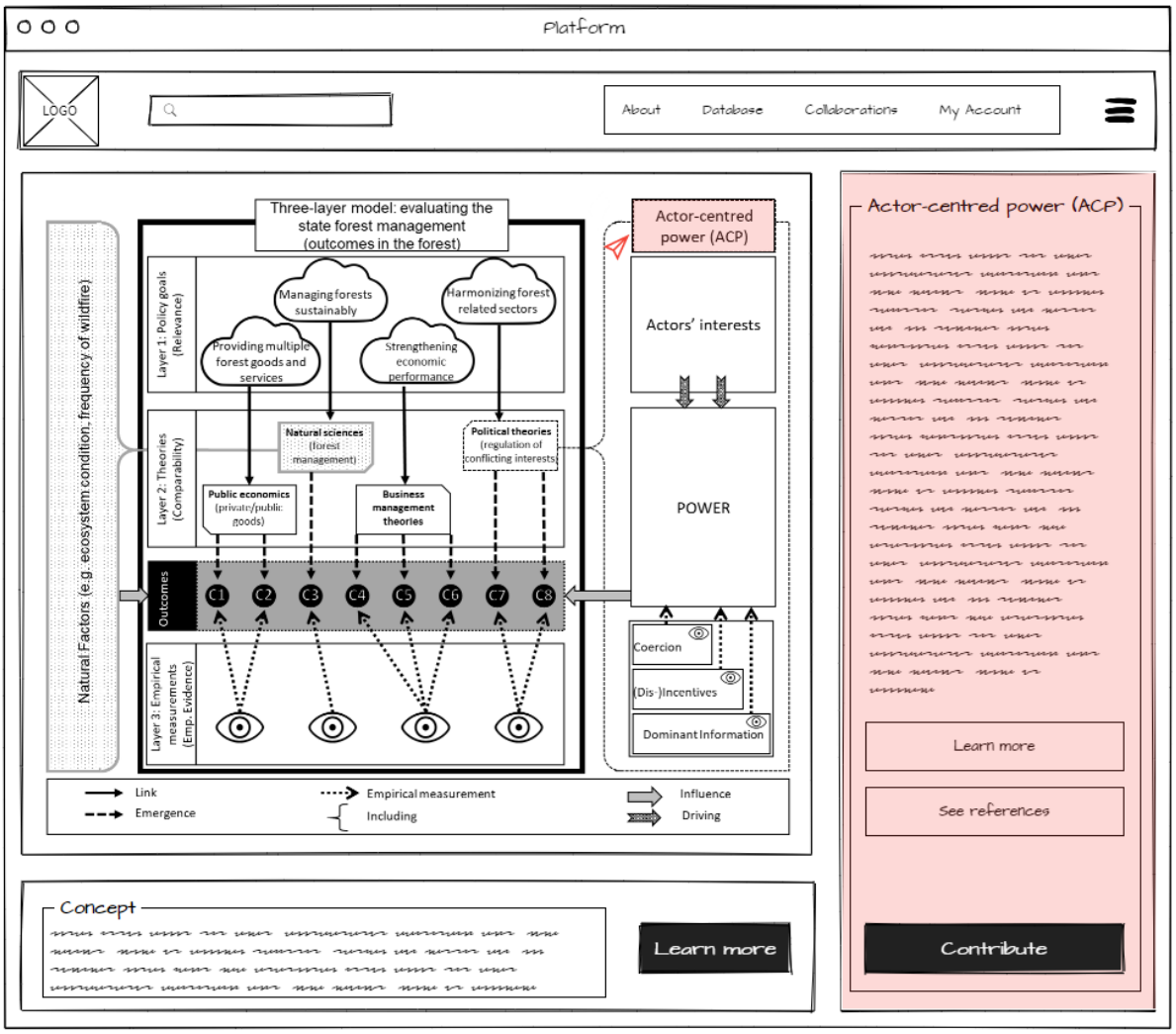
How recent is this data?

☐ Cover last ten years

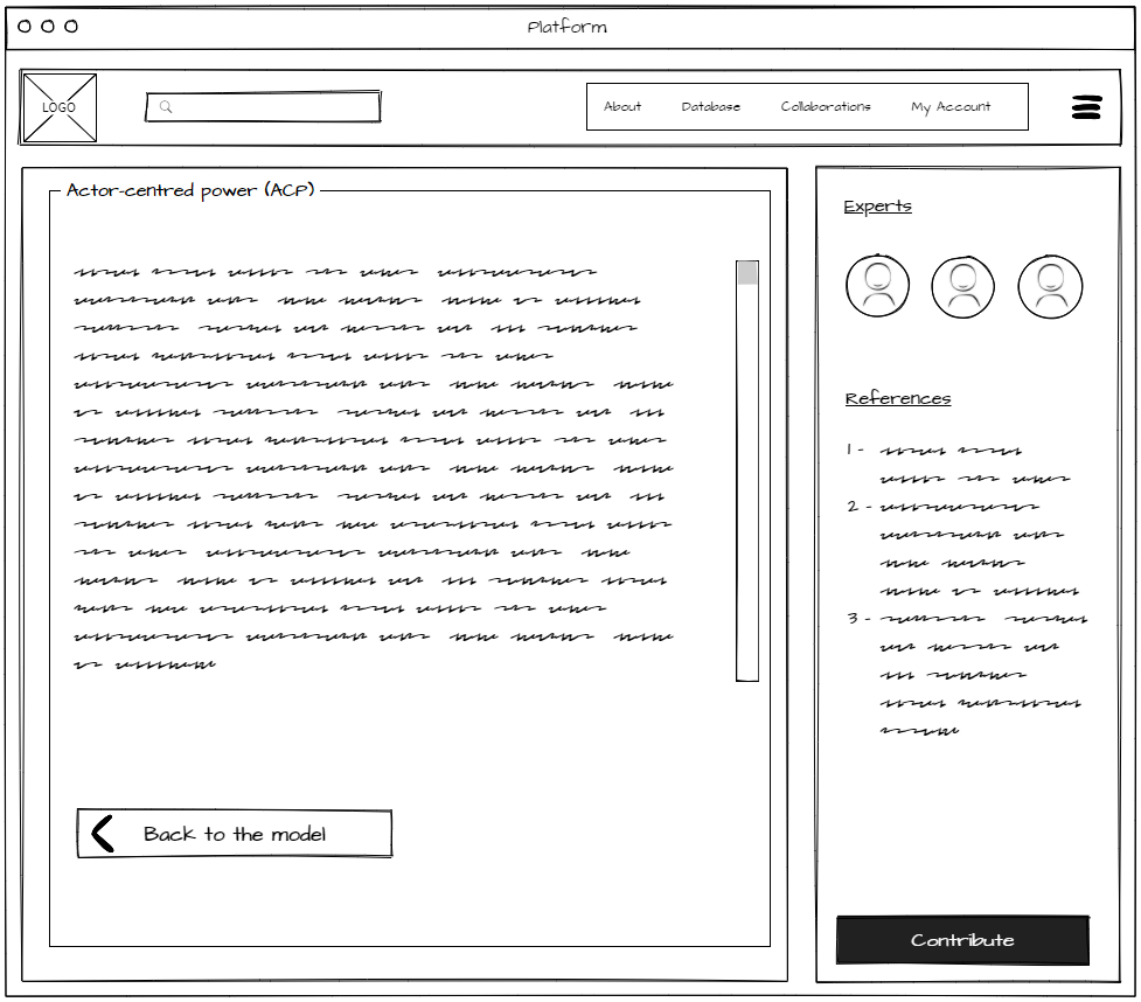
☐ Cover last 20 years

☐ Other: …….

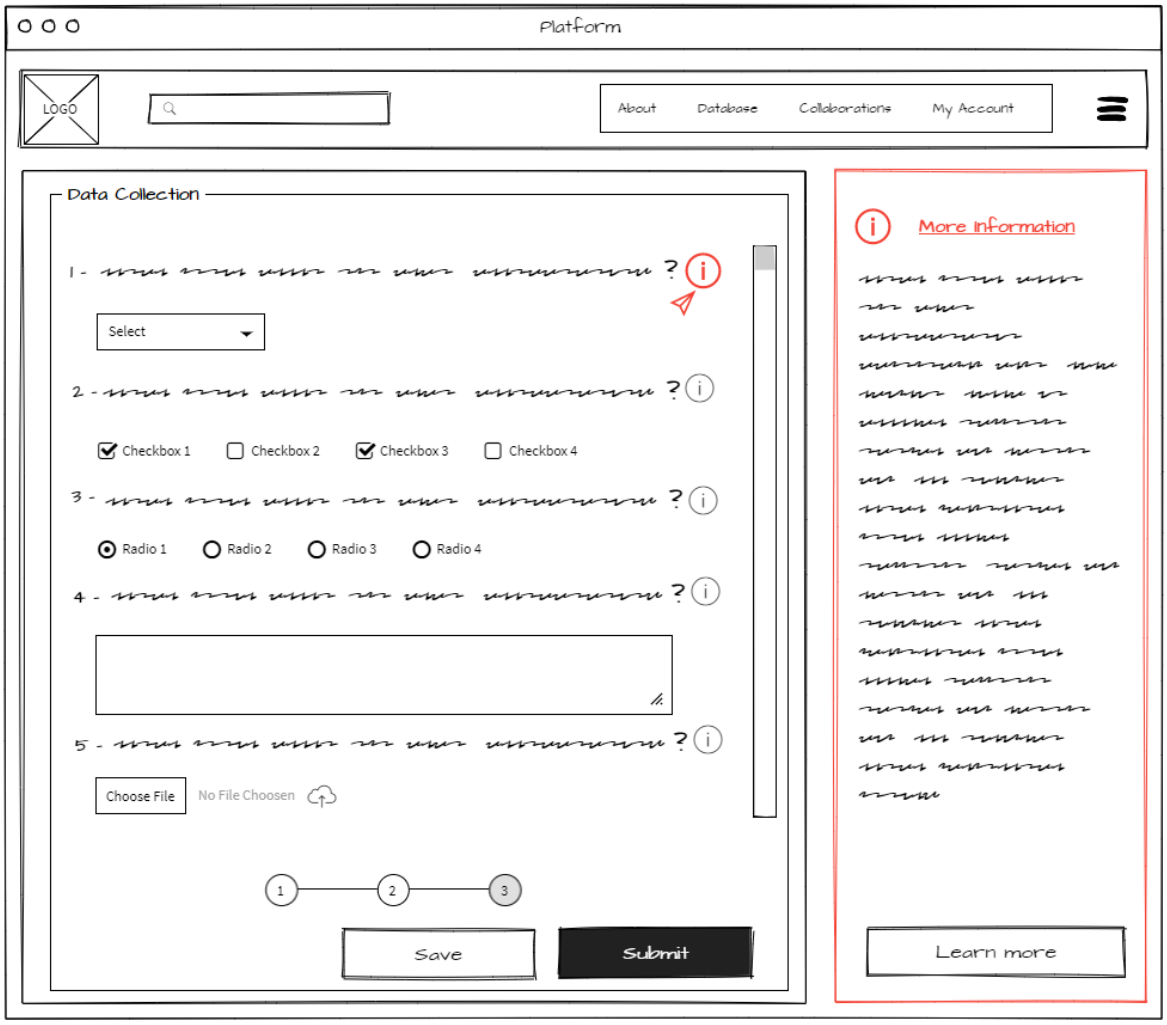
Annex 2. Sketch of the digital platform: the power-linked 3L model as a navigation map.



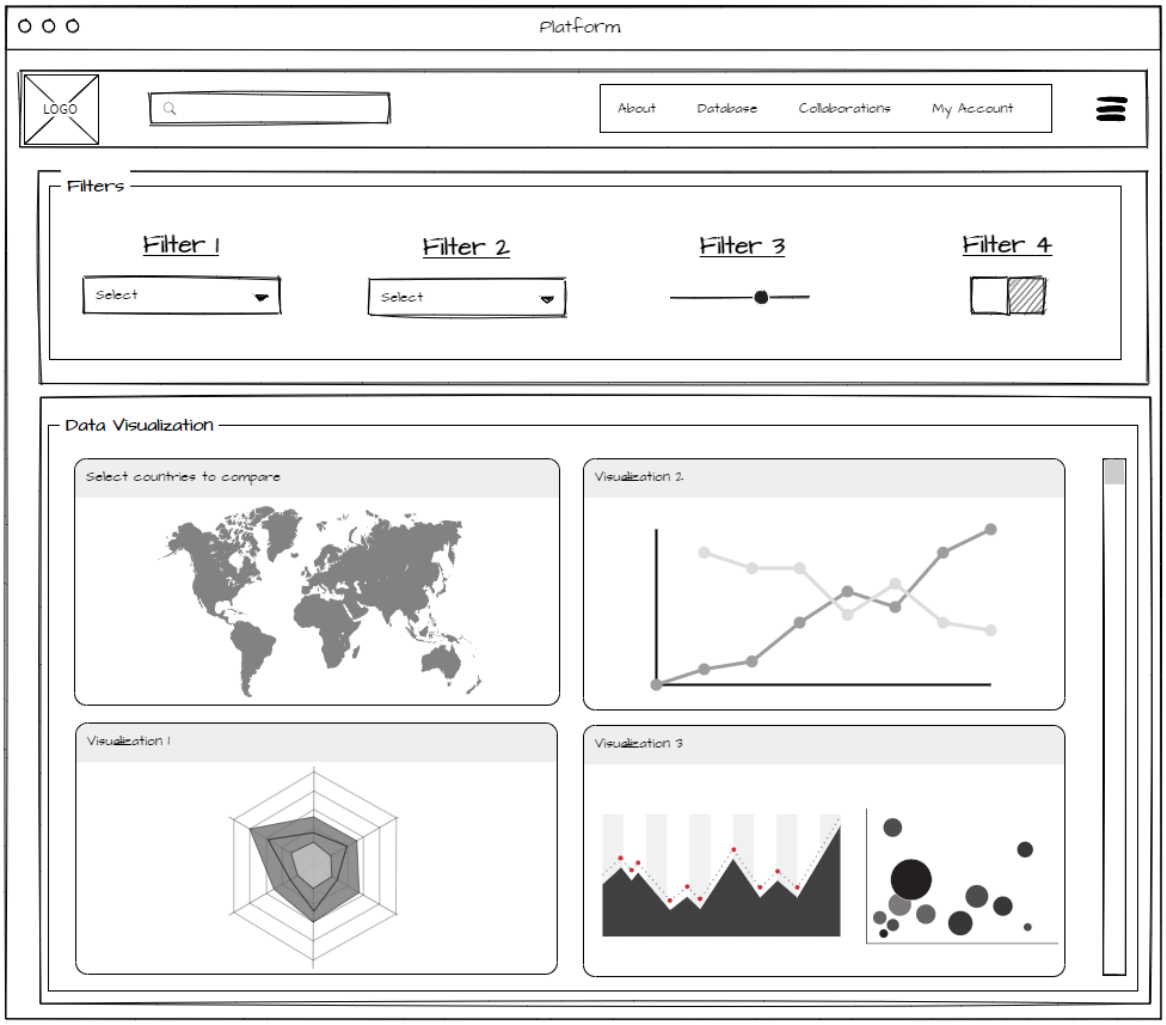
Annex 3. Sketch of the detailed theory explanation on the digital platform



Annex 4: Sketch of the interactive process of data collection on the platform

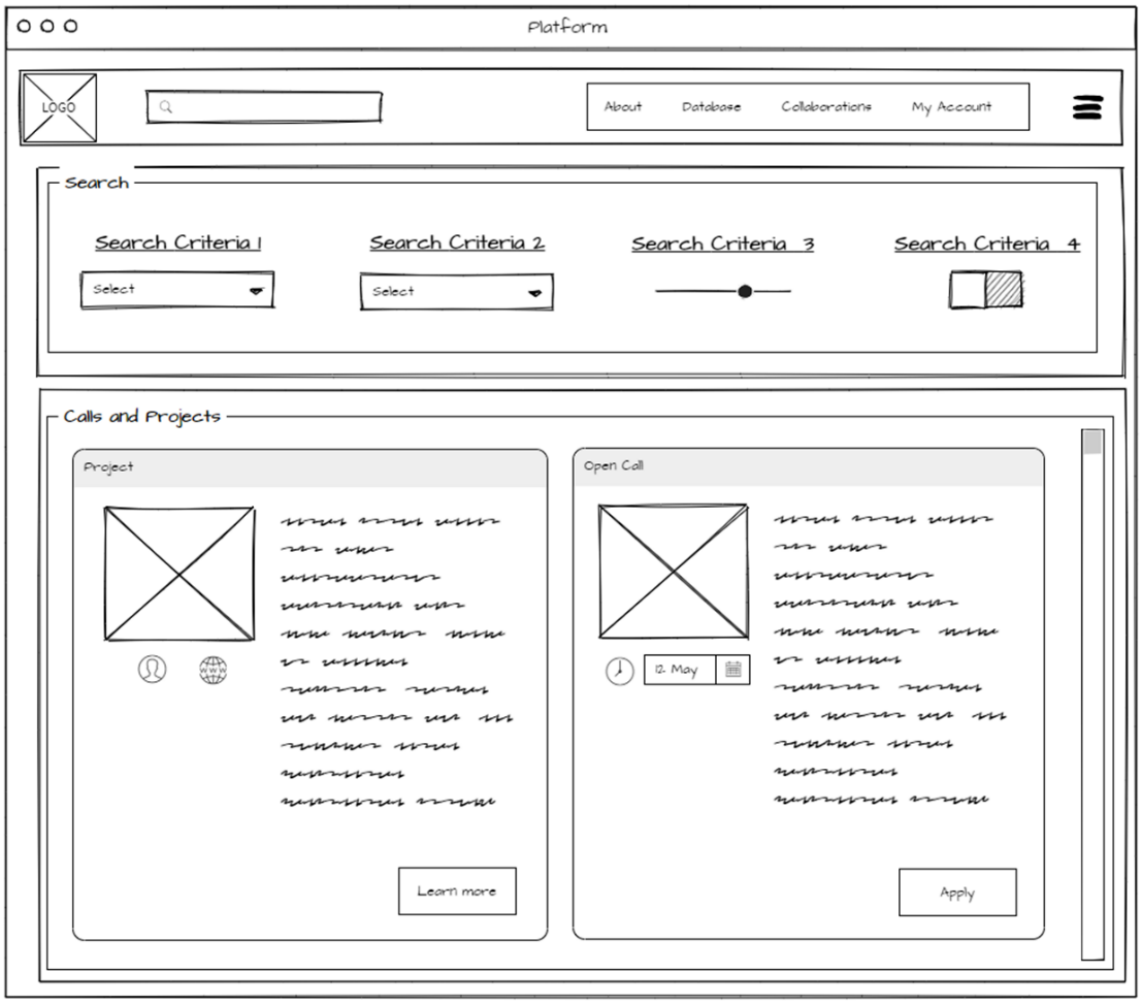


Annex 5. Sketch of data visualization using several filters



Annex 6. Sketch of the user's profile on the platform

Annex 7. Sketch of the available calls and projects on the platform



Constitutive publications

Article 1. **Hasnaoui, Ameni**; Krott, Max (2018): Political drivers of forest management in Mediterranean countries: a comparative study of Tunisia, Italy, Portugal, and Turkey. In *Journal of New Sciences* 14, pp. 3366–3378.

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*Article 3***. Hasnaoui, Ameni**; Krott, Max (2019): Forest Governance and the Arab Spring: A case study of state forests in Tunisia. In *Forest Policy and Economics* 105, pp. 99–111. DOI: 10.1016/j.forpol.2019.04.016.

Article 4. **Hasnaoui, Ameni**; Ongolo, Symphorien; Hasnaoui, Foued; Aloui, Kamel; Mouelhi, Fida, Krott, Max (2020): Contesting State Authority in Forestland Use: A Power-Based Case Study Within Arab Spring Transformations in Tunisia. In *Journal of rural studies(submitted for publication)*.

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Political Drivers of Forest Management in Mediterranean Countries: A Comparative Study of Tunisia, Italy, Portugal and Turkey

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Abstract - The ecological basis of forests in Mediterranean countries is quite similar, but the management of ecosystem services differs substantially. The question is which political factors drive the different forest management concepts. Our political analysis looks on private and public actors and their power and interests which shape the management of the ecosystem services of the forests in Tunisia and compares the results with Italy, Portugal and Turkey. We apply an analytical study of interests, conflicts and actor-centered power with a triangulation of qualitative data (document analysis, qualitative interviews and observations) in 2016-2017. We compare our results with the results of ALTERFOR project covering European countries.Thestudy shows that in all cases the key actors are the state institutions, whereas the importance of other actors varies between the countries.In Tunisia and Turkey all forests are state-owned and the governmental institutions dominate forest management. However, in Portugal, actors from timber sector are considerably strong by providing incentives. A particularity of Tunisia is the noticeable impact of international organizations in forest management by the means of incentives and dominant information. In all cases, the shift from government to governance did not happen, but some indicators and previous experiences from other developing countries show the potential in Tunisia.

Keywords: actor-centered power, interests, forest governance, ecosystem services, Mediterranean countries

1. Introduction

The management systems of forests in the Mediterranean countries present diversity and particularities for each country despite the similarities in climate and vegetation. These differences are mainly noticeable in land ownership (private or state-owned forests) and in goal setting for ecosystem services. In countries where forests are in majority state-owned, the most powerful actor is the government, while in other countries presenting a great proportion of private forests, such as Portugal with only 3% of state-owned forests (Juerges et al. internal report 2017:167), actors related to timber-based activities are dominant. The interests of the actors may vary from ecosystem services' provisioning, supporting, regulating and cultural interests, leading not only to the shaping of forest management policy, but also to many conflicts of interests among different actors. It is possible to identify the political drivers behind the ecosystem services of forests. Such knowledge might be important for implementing innovative management ideas in practice and for learning from other experiences. For this purpose, we identified different actors and mapped their interests in ecosystem service categories (provisioning, supporting, regulating and cultural ones) after describing roughly the most visible conflicts for each case study. Then we aggregate the actors in three main categories (governmental, market and civil society), evaluate their overall power resources regarding different ecosystem services and determine the power mechanisms that they use. The results about the power of actors allow checking whether there is a shift from government (classical regulation with a strong state

actor formulating and implementing policies) to governance (modern regulation empowering civil society and market actors to share power with the state) (Krott 2008).

2. Materials and methods

2.1. Analytical framework

This work is based on the analysis of interests and power of actors implicated in forest management. Interest is defined by Krott (2005) as being "*based on action orientation, adhered to by individuals or groups, and designating the benefits the individual or group can receive from a certain object, such as a forest"*. Power can be defined as "*the capability of an actor to influence other actors*" (Krott et al. 2013 in Juergeset al.internal report 2017:30). This power definition is used to assess the power of actors in the actor-centered approach (ACP) which has been developed by Krott et al. (2013). The theoretical roots of this approach are detailed elsewhere (in Krott et al. 2013). According to this actor-centered power approach, coercion, (dis)incentive, and dominant information are the mechanisms used by actors to influence other actors allowing, consequently, to evaluate these actors' power. These mechanisms are defined as following:

- Coercion: is defined as "*altering the behavior of the subordinate (other actors) by force*". This definition concerns physical (real) force, the threat of force and even bluffing with force that does not exist in reality. In addition, illegal harvesting is considered as coercion since it is a kind of disobedience to other actors' rules. However, influencing nature (cutting, planting trees) is not considered as coercion because it does not affect other actors directly. Other actions are considered as power by means of coercion such as implementing laws by the governmental authorities, fencing a forest (legally or illegally) to stop access to this area by recreationalists, climbing over the fence to access the forest, wood harvesting for domestic heating in an illegal way, etc. (Juerges et al. internal report 2017:30).
- (Dis)Incentive: isconsidered as "*altering the behavior of the subordinate by means of advantages or disadvantages*". (Dis) incentives can be material or immaterial. Material (dis) incentives concern money but also technical support such as machines, plants, etc. (e.g. subsidies for forest management activities, providing extension services by the state institutions for free, etc.) while immaterial incentives are based on social and psychological benefits (e.g. appealing to social conventions or to a moral purpose such as protecting some species from extinction) (Juerges et al. internal report 2017:31).
- Dominant information: can be defined as "*altering the behavior of the subordinate by means of unverified information*". In others words, the subordinate cannot check the validity and quality of informationprovided by the other actor, and the subordinate makes decisions by referring to this unverified information. This dominant information is provided by superior experts or can be based on particular ideologies (Juerges et al. internal report 2017:31).

2.2. Methods

The methodology of this work is based on triangulation of qualitative data (interviews, document analysis, participatory observations) which is used in social science research by making observations from different points of view increasing the precision and accuracy of the work (Neuman, 2014:166). Data was collected in 2016-2017. The interviews were realized face-to-face, with questionnaires, via email or phone calls. We selected by the snowball system best informed eight experts from different institutions linked to the forest sector (General Directorate of Forests (*interviews 1,2 and 3*); Forest Use Authority (*interview4*); Ministry of Environment (*interview 5*); Research institutions (*interviews6 and 7*) and the Northwest Silvo-Pastoral Development Office (*interview8*). In addition, the author had access and cooperation with the Tunisian General Directorate of Forests and other research institutions in the frame of previous research work which allowed a better understanding of the forest sector and the different actors involved. The validity of this comparison work is supported by the use of the same methodology in the European project entitled "Alternative models and robust decision-making for future forest management" (ALTERFOR) from which we used the obtained data, compiled in a detailed internal report (Juerges et al. internal report 2017), for the cases of Italy Turkey and Portugal.

2.2.1. The actor-centered power approach

To measure the power of actors for the Tunisian case, we identified the main actors who have interest in forest ecosystem services at several levels. We specified and evaluated these actors' interests (strong interest (+++), medium (++), low (+), no interest (0)) or even if some actors are against specific ecosystem services (-). Next, we compared Tunisia to other European cases in terms of actors with strong interest in different categories of ecosystem services. In addition, we made an overall assessment of power resources of three main groups of actors (governmental, market and civil society) regarding all cases to get an overview and a comparison of power for these groups. Based on the tables we compared the overall power concerning different categories of ecosystem services and the power mechanisms used by strong actors (coercion, (dis)incentives, dominant information) in different cases. This approach provided a qualitative and relative judgment of different actors' power driving forest management.

2.2.2. About the selected cases

(a) Tunisia

According to the second national forest inventory (2010), the forest area in Tunisia is estimated at at1.141.628 ha, from which more than 90% are state property (Boussaidi, 2012). In these areas owned and managed by the state, forest people have always been an issue. In fact, from a total number of population estimated at 10.982.754 inhabitants (National Institute of Statistics, 2014), 733.613 persons live in and around five kilometers from forests (Tounsi and Ben Mimoun2012) and present a considerably high poverty rate (45.8%) compared to the average national one (15.5%) (Tounsi and Ben Mimoun 2012). The main conflicts existing in the Tunisian forest sector are between the governmental actors (responsible for law implementation and policy formulation and advocating nature protection and conservation) and other actors who are more interested in ecosystem services provisioning and especially forest people who live from forest resources.

(b) Italy

The total forest area in Italy is about 10.9 million ha with 9.3 million ha of real forests and 1.6 million ha of other wooded lands. This refers to nearly 36% of the total area of the country (Juerges et al. internal report 2017:85). There are roughly 66% of Italian forests which are privately owned with an intense fragmentation of ownership, while 34% of forests are public and characterized by a dominating role of municipalities (Juerges et al. internal report 2017:86). Italian forests are underused despite the important forest cover that doubled in the last 50 years (Juerges et al. internal report 2017:86). The main forest policy problem in Italy is the fragmentation and inconsistency due to the failure of the decentralization process which started in the seventies. In addition, due to a lack of vertical integration in terms of forest policy implementation, there are permanent conflicts between municipalities, protected areas' authorities and regional departments which feel as well embarrassed by sharing their decision-making with environmentalists (Juerges et al. internal report 2017:87; Juerges et al. Forthcoming).

(c) Portugal

Forests cover 35% of the total land area and are about 3.15 million ha. These forests are facing degradation due to repeated and severe wildfires. The majority of forests are privately owned (87%). A great priority is given to wood production in Portuguese forest management. However, there are different perceptions of priorities to formulate the forest policy and to implement multi-functional forestry (Juerges et al. internal report 2017:167; Juerges et al. Forthcoming).

(d) Turkey

The area of forests in Turkey is 22.3 million ha and represents 28% of the total land (Juerges et al. 2017:259). Out of this area, 99.9% belongs to the state and only 0.01% are private forests (Juerges et al. internal report 2017:259). The majority of these forests are managed by the state forest organization named General Directorate of Forestry or Turkish Forest Service under the Ministry of Environment and Forestry (Sivrikayaet al. 2008).

Over the years, the Turkish forest management has evolved to become more oriented towards the multiple use of ecosystems concepts (Juerges et al. Forthcoming). The common conflict of setting priorities for the different ecosystem services and the way to implement their multiple uses does exist mainly within the state forest organization.

3. Results and discussion

3.1. The different stakeholders' interests related to forest ecosystem service

The ecosystem services (ES) concept consists of the benefit that humans can obtain from ecosystems (MA 2005). The ecosystem services are classified into four main categories, namely *provisioning ES* (such as food, timber, water, fiber etc.), *supporting ES* (such as primary production, soil formation, etc.), *regulating ES* (climate and flood regulation disease regulation, water purification, etc.) and *cultural ES* (aesthetics, education, recreation, etc.) (MA 2005; Szücs et al. 2014; Blicharska et al. 2016).

3.1.1. The case of Tunisia

In Tunisia the main actors interested in forests are the governmental actors (the General Directorate of Forests and the regional institutions representing it, state research institutions, Forest Use Authority responsible for forest products' sales, The Northwest Silvo-Pastoral Development Office, Ministries of Tourism, Agriculture and Environment interested in nature protection and ecotourism), market actors (mainly the industries of wood and non-wood products such as cork, rosemary, nuts...). International organizations are particularly interested in Tunisian ecosystem services by financing development projects and realizing studies (*interviews 2,5 and 8*). In addition, forest people living in and around forests have great interest in forest ecosystem services since they depend on them to survive.

Regarding ecosystem services provisioning, timber industries have interest in them. However, it cannot be considered as strong interest since 90% of industry's need is imported (Daly-Hassan et al. 2014).Non-wood products are more interesting for industries. For instance, there are five big enterprises of cork transformation which benefit from the resource and they export 100% of their products (*interview 4*). In fact, industrials buy a tone of cork (already harvested in the charge of the forest authorities) with an average price of 1700 Tunisian dinars (TND) (equivalent to 600 euros in August 2017), while one tone of cork gives, after transformation, 10 thousand bottle plugs sold for 0.5 euros per plug (*interview 4*)**.** For the extraction of essential oil from rosemary, according to the National Institute of Statistics (2015), the total value of exported oil in 2014 was estimated at 11.219.336 TND, while in the Forest Use Authority activity's report of 2014, the total value of rosemary sales was 1.524.000 TND. Forest households are also interested in wood provision (especially fire wood which is for some of them the only source of energy, unlike in European countries where people have more options). In addition, they are particularly interested in non-wood products such as extracting traditionally essential oils from plants, bee-keeping, and transforming different types of nuts, especially pine nuts which are economically valuable (Hasnaoui 2014). Forest people benefit as well from grazing in forests to feed their livestock which provides 58% of the forest income for these people (Tounsi and Ben Mimoun 2012). Also, international organizations and research institutions show great interest in wood and non-wood product provision by working in the frame of development and research projects. All actors except industry which seeks increasing harvesting rate and access to the forest support Biodiversity and Habitats. Forest people, despite depending on the provision of wood (mainly fire wood) and non-wood products, contribute to the conservation by protecting and intervening in fire-fighting.

Soil protection is particularly an issue in Tunisia. Fixing sand dunes (for example in the northwest coastal line of the country) was realized in a natural way by planting trees (especially pine trees). These activities of soil protection are performed by the state in collaboration with international funds and research institutions.

With regards to cultural aspects, there is low to medium interest in these activities. As an example, the General Directorate of Forests, which manages 17 national parks and 27 natural reserves in Tunisia, does not apply any entry fees for entering these spaces despite the existence of law for some of them that refer to the obligation to pay entry-fees to access (*interview 6*). The following table (Table 1) illustrates these interests in different ecosystem services in Tunisia.

Table1: Interests of selected actors in ecosystem services in Tunisia
+++: Strong, ++:Medium, +:Low, -:against, --: medium to strong against, 0: no interest
NGO: Non-Governmental Organization; ES: Ecosystem Services
Source: own field work

	Forest Owner and manager (state)	Wood and non-wood Industries	NGOs and Governmental actors representing nature conservation, soil protection	International organizations	Forest households (individuals)	Governmental actors and NGOs representing ecotourism, recreation, Hunting	State research institutions
Provisioning ES							
Wood provision	++	++	**0**	++	+++	-	++
Game provision	+/-	**0**	**0**	**0**	++	+++	**0**
Non-wood products provision	+++	+++	**0**	+++	+++	+	+++
Supporting ES							
Biodiversity	+++	--	+++	+++	++	++	+++
Habitats	+++	--	+++	+++	++	++	+++
Regulating ES							
Carbon sequestration	++	--	-	+++	**0**	**0**	+++
Climate regulation	++	**0**	**0**	+++	**0**	**0**	+++
Soil protection	+++	--	+++	++/+++	+	**0**	++/+++
Cultural ES							
Outdoor recreation	+	-	-	+	+	++	+
Tourism	+	-	-	++	++	++	+

3.1.2. Tunisia in comparison with Turkey, Italy and Portugal

The following table (table 2) presents the actors with strong interests in ecosystem services. It is important to mention that the table contains only actors with the relatively stronger interest as compared to other actors in their case. There might be some actors who have considerable interest, but who are not cited in the table since there are others with stronger interests. Table 2 allows identifying many important aspects of interests in forest ecosystem services.

The first aspect concerns the comprehensiveness of interests in ecosystem services. In other words, it shows whether actors are interested in all ecosystem services or focus on only a few of them. In Portugal there is more comprehensiveness regarding ecosystem services than in the other countries. The actors are strongly interested in 12 out of 13 ecosystem services while in Italy, Tunisia and Turkey there are respectively six, eight and ten from these 13 services. The orientation of these three countries actors is more focused on specific ecosystem services.

The second aspect is to identify which category of ecosystem services is most attractive. In all cases there are actors with strong interest in wood provision even though the number of these actors is different according to the importance and the multiple use of wood in the country. However, game and fish provision may interest fewer actors. Interests in regulating ecosystem services differ in the four countries. While carbon sequestration and climate regulation interest actors in almost all of the countries, wildfire reduction is a special issue in Portugal gaining strong interest from an important number of actors. The cultural ecosystem services are interesting strongly in Portugal and Turkey but not in Tunisia and Italy.

The third point is to identify for each country the ecosystem services in which the most actors are interested. In Tunisia the non-wood product provision is of great interest for different kind of actors (the state forest institutions, forest households, industries, research institutions and international organizations) in addition to supporting biodiversity in which state forests and research institutions, Non-Governmental Organizations (NGOs) and governmental institutions related to nature conservation (e.g. the Ministry of Environment) are interested.In Turkey the interest in ecosystem

services is more balanced with less focus of many actors on one particular service. This could be explained by the comprehensive multiple use approach of governmental actors which are the owners and managers of the Turkish forests (Juerges et al. internal report 2017:259). However, it is still possible to identify the ecosystem services that are gathering a relatively higher number of actors and which are pest control and non-wood products provision.

In Italy wood provision is the service with the highest number of strongly interested actors. However, this is not due to the importance of domestic wood provision as it is the case in Portugal, but it is due to the multiple use of this wood. While the Italian Ministry of Agriculture focuses on rural development and support for local economies by producing wood and other forest products, public forest owners consider forest products as a source of income for their institutions and have strong interest in them (Juerges et al. internal report 2017:94). Private forest owners and forestry enterprises have determined interests in wood provision (wood imports in Italy are very important and the domestic production of wood is used almost for energy purposes; about 65% of the domestic production is used as energy (Juerges et al. internal report 2017:86). The bio-energy actors are directly interested in the provision of wood, while wood and paper industry rely more on imported wood. Regarding Portugal, two main ecosystem services noticeably aggregate the highest numbers of actors. These services are wood provision and wildfire reduction. Wildfire is a big issue in Portugal (from 1980 to 2009 there were more than half a million fires which burned 3.2 million ha (Rego and Joaquim 2014)).

The last aspectis to identify the role of governmental actors (in bold in the Table 2). In Tunisia state actors with their different functions and positions present strong interest in all ecosystem services. This could be explained by the state ownership of the forest. Similarly, in Turkey forests are state-owned and the state institutions from different fields are strongly interested in different types of ecosystem services except ecotourism and recreation. In Italy state actors dominatein terms of interest in supporting ecosystem services, especially in biodiversity where they have strongest interest without any competition from other actors. Regulating ecosystem services are also of great interest for them, while service provisioning is less important. In Portugal the state institutions are not dominant as compared to the other actors. The NGOs are attracted by supporting and regulating ecosystem services stronger than the state. This contradicts the European Union strategy claiming that the state should have more interest in supporting and regulating ecosystem services, while the provisioning of these services should be of interest for market actors. The cultural services are in general not in the focus of state institutions in all cases.

Table 2: Comparative synthesis about the number and types of actors with the strongest interest in ecosystem services in the four cases
-: does not exist

	Number of actors (categories) with strong interest in the ecosystem services (ES)				Type of the actor with strong interest in the ecosystem services			
	Tunisia	**Turkey**	**Italy**	**Portugal**	**Tunisia**	**Turkey**	**Italy**	**Portugal**
Provisioning ES								
Wood provision	1	2	5	3	- Forest households	- **Forest management institutions** - Timber industries	- Chartered agronomists and foresters - Industry (wood and pulp, bio-energy) - Forestry enterprises - Private forest owners - **Public forest owners**	- **Forest management institutions** - Timber industries - NGOs representing employment in forests
Game provision	1	0	0	1	- Governmental actors and NGOs (ecotourism, recreation, Hunting)	_	_	- Hunting NGOs
Non-wood products provision	5	3	1	0	- **Forest owner and manager (state forest institutions)** - Forest households - Non-wood industry - International organizations - **Research institutions**	- **Forest management institutions** - NGOs and **governmental actors of nature** conservation in forests - NGOs of ecotourism and recreation	-**Public forest owners**	_
Fish Provision	0	0	0	1	_	_	_	- Fishing NGOs
Supporting ES								
Biodiversity	4	1	3	1	- **Forest owner and manager (state forest institutions)** - NGOs+ **state institutions of nature conservation and soil protection** - International organizations - **Research institutions**	- NGOs and **governmental actors of nature** conservation in forests	- **Ministry of Environment** - **State forest service** - Environmental NGOs	- Nature and Environment conservation NGOs
Habitats	4	1	3	2	- **Forest owner and manager (state forest institutions)** - NGOS+ **state institutions of nature conservation and soil protection** - International organizations - **Research institutions**	- NGOs and **governmental actors of nature** conservation in forests	- **Ministry of Environment** - **State forest service** - Environmental NGOs	- Nature and environment conservation NGOs - Outdoor recreation NGOs

Table 2 (continued)
-: does not exist; NGO: Non-Governmental Organization; ES: Ecosystem Services
Source: Own field work, ALTERFOR project (2017)

	Tunisia	Turkey	Italy	Portugal	Tunisia	Turkey	Italy	Portugal
Regulating ES								
Carbon sequestration	2	1	2	1	- International organization - **Research institutions**	- NGOs and **governmental actors of nature conservation in forests**	- **Ministry of Environment** - Environmental NGOs	- Nature and environment conservation NGOs
Climate regulation	2	1	0	1	- International organization - **Research institutions**	- NGOs and **governmental actors of nature conservation in forests**	_	- Nature and environment conservation NGOs
Soil protection	4	2	0	2	- International organization - Research institutions - **Forest owner and manager (state forest institutions)** - NGOS+ **state institutions of nature conservation and soil protection**	- **Water and soil protection institutions** - NGOs **and governmental actors of nature conservation in forests**	_	- Water associations and companies - Nature and environment conservation NGOs
Water quality	0	2	2	3	_	- NGOs and **governmental actors of nature conservation in forests** - **Water and soil protection institutions**	- **Ministry of Environment** - Environmental NGOs	- Water associations and companies - Nature and environment conservation NGOs - Hunting and fishing NGOs
Wildfires reduction	0	0	0	5	_	_	_	- **Forest management institutions** - NGOs representing employment in forests - Outdoor recreation NGOs - Hunting and fishing NGOS - Water associations and companies
Pest control	0	3	0	2	_	- **Forest management institutions** - Timber industries - **Governmental actors of nature conservation in forests**	_	- **Forest management institutions** - Timber industries
Cultural ES								
Outdoor recreation and tourism	0	1	0	1	_	- NGOs of ecotourism and recreation	_	- Outdoor recreation NGOs

3.2. Power of actors driving the management of forest ecosystem services

A first insight into different power resources in Tunisia, Turkey, Italy and Portugal is provided in Table 3. The actors are aggregated intothree categories: governmental, market and civil society actors, while their power resources are indicated. These three categories enable to test a shift from government to governance, which is an important issue for forest and environmental policy (Juerges and Newig 2015; Arts 2014; Jedd and Bixler 2015). The governmental actors gather all the actors who have authority based on legislative, executive or jurisdictional responsibilities. Market actors are non-public actors interested in generating an economic benefit including enterprises and all non-state organizations representing the interest of the enterprises. Civil society actors are the non-public and non-economic interest actors like environmental organizations (Juerges et al. Forthcoming).

Table 3 shows that the governmental actors have strong power resources in all countries. Market actors' power differs from one case to another. In Portugal these actors are dominant and in Italy they are remarkably strong too. On the contrary, in Tunisia and Turkey market actors are weak.

Civil society actors are not strong in any country, but they get some influence in Portugal and Turkey. Land ownership is a strong power source of the governmental actors in Tunisia and Turkey. In Portugal private forests dominate and market actors compete with governmental actors to become the strongest, especially in regards to timber provision.

Table 3: Power resources of governmental, market and civil society in the different cases
+++: Strong, ++:Medium, +:Low
Source: own field work, ALTERFOR project (2017)

	Governmental actors	Market actors	Civil Society actors
Tunisia	+++	+	+
Portugal	+++	+++	++
Italy	+++	++	+
Turkey	+++	+	++

Table 4 presents an overall evaluation of power resources in the four countries regarding different ecosystem services. The power support differs strongly in regards to different forest ecosystem services. Supporting of ecosystemshas strong power assistance in all four countries. Concerning regulating ecosystem services, the power resources are in majority medium. The only two exceptions are soil protection in Turkey and wildfire reduction in Portugal, which get strong support. The power resources behind provisioning wood are in two countries strong and in two weak. In Portugal a strong wood industry pushes timber provision. In Turkey the General Directorate of Forestry represents the forest owner and has therefore the power to set two priorities: wood provision and biodiversity. In contrast to all other ecosystem services cultural ecosystem services, even outdoor recreation and tourism, are not subject to great power resources.

Regarding power mechanisms, coercion and dominant information are the most used. However, the dominant information is not highly applied by the Italian actors where coercion prevails. In addition, there is a relation between overall power resources and the number of power mechanism. Stronger power behind specific ecosystem services is based on a higher number of different power mechanisms.

Table 4. Power resources and mechanisms used by actors interested in different ecosystem services

-: does not exist; ES: Ecosystem Services

Source: own field work, ALTERFOR project (2017)

	Overall power resources				**Strongly-used power mechanism(s) by actors**			
	Tunisia	**Turkey**	**Italy**	**Portugal**	**Tunisia**	**Turkey**	**Italy**	**Portugal**
Provisioning ES								
Wood provision	Low to medium	Strong	Medium	Strong	Coercion	Coercion Incentives Dominant information	Coercion	Coercion Incentives Dominant information
Game provision	Medium	Low	Medium	Medium	Coercion	-	Coercion	-
Non-wood products provision	strong	Low to medium	Medium to Strong	Low	Coercion Incentives Dominant	Dominant information	Incentives	-

					information			
Fish Provision	-	-	-	Low	-	-	-	-
Supporting ES								
Biodiversity and Habitats	Strong	Strong	Medium to strong	Strong	Coercion Incentives Dominant information	Coercion Dominant information	Coercion	Coercion Dominant information
Regulating ES								
Carbon sequestration	Medium	Medium	Low	Medium	Dominant information	Dominant information	-	-
Climate regulation	Medium	Medium	Low	Medium	Dominant information	Dominant information	-	Dominant information
Soil protection	Medium to strong	Strong	-	Medium	Coercion	Coercion Dominant information	-	-
Water quality	-	Medium	Low	Medium	-	Incentives	-	-
Wildfires reduction	-	-	-	Strong	-	-	-	Coercion Incentives Dominant information
Pest control	-	Medium	-	Medium	-	-	-	Coercion
Cultural ES								
Outdoor recreation and tourism	Low	Low to Medium	Low	Low to medium	-	-	-	-

In practice power mechanisms are applied by specific actors. These actors are part of these three types: governmental, market and civil society actors. We will ask whether these different types make use of different power mechanism.

To start with, the governmental actors' power in Tunisia is based on coercion, since these actors are responsible for law implementation, for protecting forests and regulating their use. Tunisian forests are protection forests rather than production ones. For this, the authority tasks are a priority despite the difficulties that state institutions have been facing to implement laws after the revolution of 2011. The general Directorate of Forests, with its different departments, regional and local representations, is responsible for producing management plans, the implementation the forest code laws, protecting biodiversity (creating and managing national parks and natural reserves) and even coastal lines by fixing sand dunes (World Bank 2016 (not published); annual report of activities of the General Directorate of Forests, 2015). The Ministry of Environment also has power based on incentives from financing and implementing conservation projects (in general, it is foreign money obtained in the frame of international collaborations) and dominant information while collaborating to record, for example, the species status (*interview 5*). The state research institutions use dominant information to produce reports and papers especially in collaboration with forest institutions and international organizations.In Turkey, where similarly to Tunisia, almost all forests are owned by the state, governmental actors have strong power based on coercion, while the immaterial incentives by appealing to morals for a higher nature conservation are important as well. Additionally, in most cases the governmental actors use the dominant information to influence forest management (producing inventories, recording species status, statistics, etc.). In Portugal, in addition to immaterial incentives, the use of media and regional agencies as dominant information is a common way of influencing forest management models (Juerges et al. internal report 2017:177).

The power of market actors depends on the importance of wood industry in the country. Tunisia imports 90% of its need of wood and timber-derived products and the industrials do not appreciate the Tunisian wood since it has higher density than the imported one (Daly-Hassan et al. 2014). Thus, the timber industry's power to influence forest management in Tunisia is not strong. However, coercion and incentives might be applied by industrials interested in non-wood products (e.g. by illegally harvesting herbs outside the limit defined by the government), but it is still far from being a strong power. Similarly, in Italy market actors have medium power (and low interest) since the domestically produced wood has no great economic importance (only 24% of the net annual increment is utilized) and also, the economic value of this domestic wood production has halved during the last 50 years (Juerges et al. internal report 2017:86). Nevertheless, this domestic woodis valued by the bio-energy

industry. In Portugal, market actors strongly impact the wood and pulp industry and this power is essentially based on incentives by paying higher prices for some species than for others. These actors in Portugal also apply the mechanism of dominant information to influence forest management through expert knowledge and ideology (Juerges et al. Forthcoming). Market actors in Turkey use this unverified information by lobbying processes, participation in public discourse, etc. (Juerges et al. internal report 2017:265).

Civil society has low impacts on forest management compared to the market and governmental actors. Moral incentives and dominant information are the main mechanisms used by the civil society actors. In Tunisia, since the revolution, many actors have emerged trying to influence management by contributing to research projects or strategy/policy formulation. In the program of forest investment published in 2016, the civil society has contributed to the elaboration of this program by participating in workshops organized by the concerned state authorities. However, the role of civil society in Tunisia needs more time and autonomy since the different actors still depend on international funders, the governmental budget and even political parties (Abbou, 2016; Ben Hassen 2013) which makes their contribution in many cases an expression of the funders' agendas. In Portugal, the groups representing hunters have moderate power to influence legislation in favor of "associative hunting zones". In Turkey, the civil society has medium power as well, since the state is the strongest actor and the civil society just pushes and contributes in a second position to implement new legislations and use basically the unverified information disseminated in public discourses and lobbying processes.

The particularity of Tunisia, in comparison with the European cases, is the important impact that international organizations have by the means of incentives (financing development projects) and the dominant information spread by the reports and studies realized by overseas and national consultants. For example, the World Bank reports (e.g. second phase deliverable about forest and pastoral value chains development realized in 2016) call for adapting the legislative framework to improve the economic situation of forest peopleby adopting the co-management of resources as one of the possible solutions. The international organizations finance and collaborate even for the elaboration of forest strategies. The formulation of the Tunisian forest strategy (2015-2024) was supported by the German Corporation for International CooperationGIZ.

The illegal use of forests is considered as coercion because illegal users avoid control. Tunisian forest people, who live in and around forests, have considerable power to avoid implementation of regulations and thus have coercive power. For example, they use the pinion of pine illegally by harvesting even before the adequate period and avoid public auctions to sell this product to industrials and big traders. Since 2010, the state institutions have not been able to organize auctions for pinions and they have not even got seeds for planting new stands (Hasnaoui 2014).

3.3. Discussion

In this study, actors interested in different ecosystem services were identified in four countries. Their different interests, their power resources and mechanisms to influence forest management are described and compared.

The results show that the governmental actors are the most powerful in all cases (except in the case of Portugal where they are still strong, but they compete with the market actors in terms of timber provision). This state domination means that there is no real shift of power from the government to the market and civil society actors (from government to governance). In a policy steered by conflicts, it is not possible that non-binding processes such as governance take the place of binding ones from forest government supported by the state power (Krott 2008). However, some actors can influence the formulation of these binding solutions. In Tunisia, the international organizations are becoming more and more powerful by benefiting from the weakness of the state budget (*interviews 2 and 5*). They are funding many projects (with donations or loans) and they may influence the formulation or the change of laws and policy. The currently suggested reform about the co-management of resources between forest people and the General Directorate of Forests was initiated in the national strategy 2015-2024 funded by the German Corporation for International Cooperation GIZ and then supported by other projects such as the World Bank. The estimation of a strong role of international organizations in Tunisia in the future is supported by other experiences from developing countries. In Bangladesh, international funders caused 17 policy changes from 1993 until 2012 and these changes are in majority substantive (Rahman et al. 2016). Also, in Armenia, by the means of dominant information and incentives, the World Bank consultants argued that the main cause of deforestation is the access of

local users to resources and proposed in their project to support production which allowed privatization of forest lands and a reform of forest administration that moved from the Ministry of Nature Protection to the Ministry of Agriculture. These changes that restrict the access of local people are in favor of transnational private companies leading to an increase in wood harvesting and exports (Burns et al. 2016).

The shift from government to governance may lead to fragmentation in forest policy. In Italy, the decentralization process has failed despite the fact that the process has started in 1977. However, up to now, no solid state institution organizations have been established to face different challenges of the sector. In fact, central institutions which kept the policy-making role have transferred all forest tasks to the regional institutions and provinces. These regional administrations are not all able to have effective policy and political actions, and they cannot play their political role in the sector interest, causing inconsistency and deficits in implementation (Secco et al. 2017). Thus, many responsibilities have been transferred back to central administration. The result of such a defective decentralization process was expressed by the total absence of a valid national forest program in Italy and the non-existence of comprehensive policy supported by coordinated budget allocation (Secco et al. 2017).

4. Conclusion

The most powerful actors in all cases drive the forest management process and compete to realize their interests in forest ecosystem services. There is a link between forest management models and these powerful actors and their interests. In Portugal the orientation toward the maximization of timber provision is driven by the strong power of market actors in the country creating conflicts between actors interested in provisioning ecosystem services (market actors) and those focusing on supporting ecosystem services (state actors). In Turkey, there is a comprehensive forest planning from state actors (Juerges et al. internal report 2017: 259). The power of the Turkish governmental actors is not reduced despite the strong interest in timber and the existing conflicts related to the use of resources. In Tunisia the governmental actors (forest administration, nature protection, etc.) are still the strongest and forest management is more oriented toward supporting ecosystem services. In Italy, too, the governmental actors are the most powerful despite fragmentation due to the failure of the decentralization process. This strong position of governmental actors in all cases explains the absence, until today, of a power shift from government (governmental actors) to governance (market and civil society actors). However, in the case of Tunisia, where state institutions depend on foreign money, the role of international organizations is increasing and trying to push toward the market demand which might be critical for many ecosystem services. The success of forest management concepts in practice depends strongly on the most powerful actors driving the sector, pursuing specific interests in the ecosystem and ignoring others which might be important as well from a common interest point of view.

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Disclaimer

Responsibility for the information and views set out in this article lies entirely with the authors.

5. Références

Abbou S (2016) La société civile: concepts, défis et enjeux. http://www.iace.tn/wp-content/uploads/2016/11/Societe-civile-concept-enjeux-defis-1. Accessed on August 2017.

Anonymous (2016) Programme d'investissement forestier (PI-PIF Tunisie) aide-mémoire première mission conjointe. Tunis.

Arts B (2014) Assessing forest governance from a 'Triple G' perspective: Government, governance, governmentality. Forest Policy and Economics 49 :17-22.

Ben Hassen M (2013) Synthèse de l'état des lieux issu des rapports produits avec l'appui de l'Union européenne, de la Banque africaine pour le développement, du Programme des Nations Unies pour le développement, du CAWTAR et du Réseau Euro-méditerranéen des Droits de l'Homme. Programme des Nations unies pour le développement (PNUD).

Blicharska M et al (2016) Shades of grey challenge practical application of the cultural ecosystem services concept. Ecosystem services 23 (2017): 55-70. Doi: 10.1016/j.ecoser.2016.11.014

Boussaïdi N (2012) Impacts de l'action anthropique sur la subéraie tunisienne: Essai de projection dans le futur d'un écosystème (cas de la subéraie de Kroumirie- Nord-Ouest de la Tunisie). Dissertation. National Agronomic Institute of Tunisia.

Burns, S. L, Krott M, Sayadyan H, Giessen L (2016) The World Bank Improving Environmental and Natural Resource Policies: Power, Deregulation, and Privatization in (Post-Soviet) Armenia. World Development92:215–224. Doi: 10.1016/j.worlddev.2016.12.030

Daly-Hassen H, Kasraoui M, Karra C (2014) Le bois industriel en Tunisie: aggravation de la dépendance extérieure malgré les reboisements. Bois et forêts des tropiques 324 (4):29-37

General Directorate of forests and GIZ (Gesellschaft für Internationale Zusammenarbeit) (2014) The national strategy for the development and sustainable management of forests and rangelands and for the action plan 2015-2024.

Hansaoui A (2014) Cogestion de la pinède à pignes (Pinus pinea L.) de Zouarâa (NordOuest tunisien): exploitation des ressources et devenir de l'écosystème. Dissertation. National Agronomic Institute of Tunisia.

Jedd T, Bixler P (2015) Accountability in Networked Governance: Learning from a case of landscape-scale forest conservation. Environmental Policy and Governance 25:172–187.

Juerges N, Newig J (2015) How interest groups adapt to the changing forest governance landscape in the EU: A case study from Germany. Forest Policy and Economics 50: 228-235.

Krott M (2005) Forest policy analysis. Springer. Doi: 10.1007/1-4020-3485-7

Krott M (2008) Forest Government and Forest Governance within a Europe in change. The multifunctional role of forests-policies, methods and case studies. EFI Proceedings 55:14-25;

Krott M, Bader A, Devkota R, Maryudi A, Giessen L, Aurenhammer H (2013) Actor-centered power: the driving force in decentralized community based forest governance. Forest policy and economics 49,34-42.

Millennium Ecosystem Assessment (MA) Framework (2005). Ecosystems and Human Well-being. Island Press, Washington DC

National Institute of Statistics (2014) Recensement Général de la Population et de l'Habitat 2014. http://census.ins.tn/fr/resultats#horizontalTab2. Accessed on August 2017

Neuman W. L (2014) Social Research Methods: Qualitative and Quantitative Approaches. Relevance of social research (Vol. 8). Doi:10.2307/3211488

Rahman MS, Sadath MN, Giessen L (2016) Foreign donors driving policy change in recipient countries: Three decades of development aid toward community-based forest policy in Bangladesh. Forest policy and Economics volume (66): 39-53 10.1016/j.forpol.2016.03.013

Rego FC, Joaquim S (2014) Wildfires and landscape dynamics in Portugal: a regional assessment and global implications. Forest Landscapes and Global Change: Challenges for Research and Management. Doi: 10.1007/978-1-4939-0953-7_3

Secco L, Favvero M, Masiero M, Pettenella DM (2017) Failures of political decentralization in promoting network governance in the forest sector: Observations from Italy. Land Use Policy Volume 62: 79-100. Doi: 10.1016/j.landusepol.2016.11.013

Selmi K, Tissaoui M, Bacha S (2010) Résultats du deuxième inventaire forestier et pastoral National. Tunis

Silvikaya F, Cakir G, Keles S, Karahalil U, Köse S (2008) Evaluation of forest management planning approaches within the context of multifunctional role of forests in Turkey. The Multifunctional Role of Forests-Policies, Methods and Case Studies. EFI Proceedings 55:14-25

Szücs L, Anders U, Bürger-Arndt R (2014) Assessment and illustration of cultural ecosystem services at the local scale-A retrospective trend analysis. Ecological indicators 50 (2015): 120-134. Doi: 10.1016/j.ecolind.2014.09.015

Tounsi K, Ben Mimoun A (2012) Forest Population in Tunisia: towards a national socio-economic referential framework. General Directorate of Forests and GIZ. Tunis.

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Optimizing State Forest Institutions for Forest People: A Case Study on Social Sustainability from Tunisia

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Abstract: In Tunisia the livelihoods of nearly 750,000 "forest people" strongly depend on state forests. State forest institutions that manage more than 90% of forests have a special responsibility for the social sustainability of these people's situation. Thus, it is important to evaluate the performance of these institutions, as such evaluations represent an option to help formulate sustainable development strategies for forest people. This study evaluates the performance of state forest institutions in regard to forest people based on a comprehensive three-layer model. The data were collected in 2016 and 2017 from documents, observations and interviews. The results partly supported the first hypothesis that "state forest institutions employ different market, non-market and political instruments to influence the use and the protection of forests", with an exception for market instruments. The second hypothesis stating that "the outcomes of these instruments for forest people differ from those for the general forest sector" was supported by empirical evidence. The evaluation revealed practices in Tunisia that provide a basis for organizational reforms supporting forest people. Adapted technologies that fit the traditional know-how of forest people and a better representation are required. Furthermore, the strengthening of state forest institutions against the influence of foreign donors would contribute to elaborating a development strategy for forest people.

Keywords: state forest institutions; forest people; evaluation; criteria and indicators; social sustainability; Tunisia

1. The Unsolved Sustainability Issue of "Forest People"

In international literature, the term "forest people(s)" has often been used to describe local forest people [1], people living in forests and having customary rights [2], or local and indigenous communities [3,4]. In the Tunisian context, two languages are officially used to write legal and official texts: Arabic and French. The Arabic texts use the term "forest inhabitants" (سكان الغابات) while the translation from French is "forest people/population" (*population forestière*). Both terms are used to describe forest users (only subsistence use) living in forests as well as those living within a five-kilometer radius around forests [5,6]. Based on this definition, the term "forest people" is used in this study to describe this category of people who live in and around forests and who have the legal rights of access to forest resources for subsistence use.

Forest areas in Tunisia cover around 1.2 million ha and are considerably inhabited. Therefore, forest people are an important social part of sustainable forestry. The social aspects of sustainability considered in this study are focused on the contribution of forests to the living conditions of forest people. From the total population of Tunisia estimated at 11 million inhabitants [7], nearly 750,000 people live in forests and within five kilometers from forests [5]. In general, there is no real diversity

of ethnic groups in Tunisia due to the unity of language and culture, except in the case of some minorities [8]. Nevertheless, in specific regions there are still cases of social organization in families and tribes that are not significantly different from an ethnic perspective. In Tunisian forested areas, the poverty rate is high (45.8%) compared to the national average (15.5%) [5]. Since more than 90% of these forests are state-owned [9], the responsibility of state institutions to manage these resources is high. During the pre-colonial period, most forests were owned by communities. When French colonization started in 1881, these communities lost all property rights and the state became the legal owner and manager of the resources. Moreover, forest people lost even their traditional user rights in 1890 [10].

From 1900 to 1970 there was a decline of 50% of the total forest area within the context of an exceptional rural population growth and an increase of agricultural land areas [11]. Despite the stabilization of this situation, forest people were subject to a continuous and repressive forest policy regarding user rights, something that was inherited from the French colonists [11]. Forest people expressed their hostility toward this coercive policy, which explains the development of many "illegal" activities of product exploitation and the difficulties in registering many state-owned forest areas [11]. In 1988, forest people were given the possibility of organizing themselves within associations after the Forest Code reform [6,12]. Despite the existence of initiatives to support these associations, the representation of forest people remained weak. Furthermore, forest people faced a social crisis resulting from the increasing competition of households to obtain social aid and temporary employment from the state [11]. After the Forest Code reform, forest people gained access to resources only for subsistence use and they were (and still are) not allowed to commercialize any forest product. The change in legislation was not sufficient to stop or reduce the daily activities of illegal forest product sales by forest people. Sales, especially those of charcoal, represent a way to gain a small additional income in order to survive [11,12]. The incapacity of the state to control the use of forest products led to a certain "legitimization of the illegal" [11]. Very often, forest officers or rangers responsible for control and monitoring used to write fines only in case of "obvious" offenses. This made sound and sustainable forest management impossible [11].

In general, limited customary rights, the deprivation of land tenure, and the weak representation of forest people are among the main challenges in the Tunisian forest sector. Furthermore, the conflicting situation has been amplified since the revolution of 2011. After the collapse of the old regime, the forest administration lost much of their repressive control of forestlands, and this benefited forest people. International pressure, as well as the increase of illegal logging and wildfires, led to the formulation of a new forest strategy for 2015–2024, which claims to focus on solving this conflict between the Tunisian administration and forest people, and to design strategic solutions to improve the living conditions, by increasing people's income from forests. At the same time, it should consider ecological sustainability and the rational use, protection and development of natural resources.

What is more, in the new forest strategy the forest administration remains the main actor, with the greatest responsibility regarding forest resources and forest people. Therefore, the issues of forest people cannot be solved without considering the state forest organizations. This is not a question of reforming forest bureaucracy in general, as discussed frequently, but of focusing on the specific role the state forest organizations play in the issues affecting forest people. The existing evaluations and conceptualizations of forest administrations provide no sufficient basis for such an analysis, since they are more focused on the organizations as such [13,14]. Therefore, the aim of this paper is to find out how state forest organizations deal with the important social issue of sustainability regarding forest people and how they contribute to solving their problems and conflicts. It is essential to consider economic as well as political interventions by state forest organizations in order to form a broad picture. The purpose behind including forest administrations in the analysis of forest people's issues is to add one factor that will be highly relevant for the design of solutions to be applied in the future. In this paper, the three-layer-model (3L-model) is described as a theoretical basis that is very suitable for the evaluation of the role of state forest organizations in regards to forest people's issues. Later, the study presents the empirical methods of fieldwork carried out in 2016 and 2017, as well as the results.

2. Comprehensive Model and Hypotheses Focused on Forest People

State forest organizations are often evaluated from an economic point of view focusing on areas such as profit or cost efficiency. Such a narrow focus does not cover the multiple duties and activities of state forest institutions well. In order to improve the evaluation Krott and Stevanov (2008, 2013) have designed the 3L-model of state forest organization evaluation, which covers a broad range of activities and goals [15,16]. It measures the performance of state forest institutions comprehensively, covering economic, political and ecological aspects of sustainability. This model allows researchers to approach the complex issues of forest people in an adequate way.

The 3L-model enables its users to make evaluations that are politically relevant and have a solid foundation on theory and empirical data. Thus, political relevance, theories and empirical measurements make up the three layers of this model, as shown in Figure 1: (1) the layer of policy programs comprises all political statements formulated not only in forest laws and strategies, but also in international agreements and dialogues; (2) the layer of theoretical frameworks consists of suitable theories—from economics, natural sciences and political science—that are linked to relevant goals of the first layer and are used to describe and define the factors driving the performance of state forest institutions; (3) the layer of empirical measurement consists of empirical data produced quantitatively and qualitatively [15,16]. The political goals of the first layer in Figure 1 are deduced from the current forest laws and political strategies in Tunisia. This way, the evaluation becomes relevant for the political discourse. The integration of a theory layer linking political programs to empirical measurements is a specific strength of the 3L-model. Theories turn vague political terms of the political discourse into specific terms that can be analyzed soundly. For example, one of the specific evaluation criteria is "sustainability of forest stands", which results from linking the vague and complex political goal of sustainable forestry to precise forest management/natural science theories. Thus, the linkage between policy and theories contributes to the emergence of eight evaluation criteria (from C1 to C8 in Figure 1 and Table 1) observed empirically by means of indicators (I) (Figure 1). The selection of suitable theories was made by researchers who developed the model [15,16]. Choosing these specific theories to develop a set of evaluation criteria does not imply that other theories cannot be linked to the same political goals. In other words, the vague political discourses described earlier cannot be restricted to one particular theory.

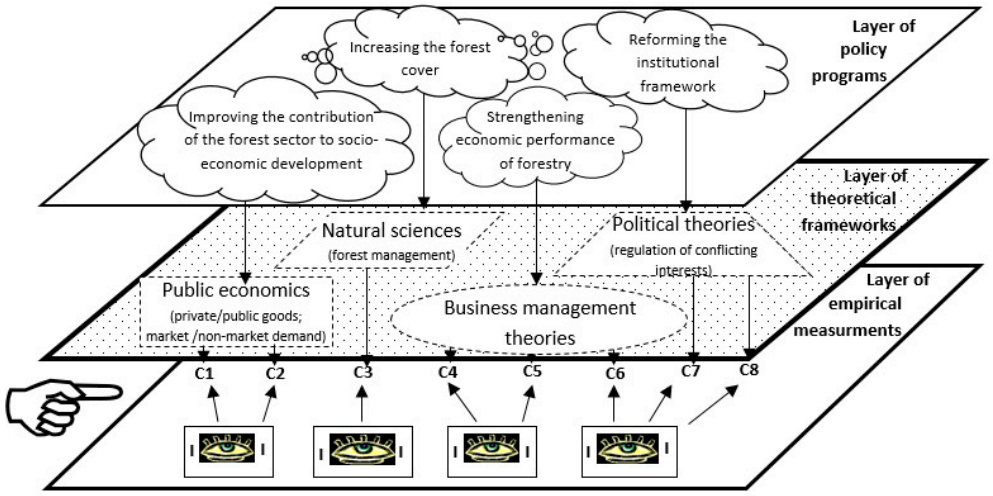

Figure 1. The three-layer model (3L-Model): designing criteria (C) and indicators (I) for a comprehensive evaluation of state forest institutions [16,17].

The selection of the criteria is oriented toward such prominent issues of the forest policy debate as efficiency and profitability, performance in timber markets, new forest products, and also the contribution of forestry to general interests, which often serves non-market demands. Additionally,

the political role of representing the forest sector in the policy process is taken into account [15,16]. The theoretical basis of the criteria was detailed earlier [15,16]. The 3L-model makes explicit the link to the political debate, theory and empirical evidence, whereas most other comprehensive evaluation methods, e.g., the criteria and indicators by Forest Europe, are based on expert judgments that mingle all aspects together [17]. This way they risk losing the link to politics as well as to scientific arguments. There are other applicable frameworks relevant to the analysis of the issue of social and ecological sustainability in general. For example, Ostrom in 2009 developed a general framework analyzing the social-ecological systems that considers governance to be a subsystem interacting with many other components [18]. However, in the current study the focus is on the performance of the forest administration that manages almost all of the forest area in Tunisia, an area which can be better evaluated by using the specific 3L-model.

Table 1. The eight evaluation criteria of the 3L-model (source: combination of own and previous research [16,19].)

Criteria (C)	Explanation of the Criteria
Orientation toward market demand	Concerns forest goods and services that can be exchanged on the market (e.g., wood) and the market limits.
Orientation toward non-market demand	Relates to forest goods and services that cannot be exchanged on the market (public goods) or those which are considered as necessary to secure public welfare (merit goods)
Sustainability of forest stands	Refers to the policy goal of maintaining forest size and the capability to continually produce wood using forest management theories.
Technical efficiency	Refers to the efficiency that allows production to approach the maximum.
Profit from forests	Concerns the evaluation of the importance of revenue generated from forests.
Orientation toward new forest goods	Focuses on the orientation of institutions toward developing new sources of revenue from forests.
Advocacy for forestry	Relates to the role, within political processes, of forest institutions in managing the use and protection of forests. The advocacy's role shows the focus of the institution on specific interests in forests without considering all different actors' interests.
Mediation between all interests in the forest	Deals with the capability of the institution to apply forest governance. It is an opportunity for stakeholders to take part in policy processes.

The main challenge related to the use of the 3L-model is the operationalization of indicators to measure the performance of the forest administration in different contexts. This model was applied in several contexts, including selected Western Balkan countries, Poland and Brazil [17,19,20]. However, some indicators were not applicable for this case study and needed to be adapted. For example, initially the criterion "orientation toward market demand" was designed to evaluate the institution's market orientation. However, Tunisian state forest institutions do not generate any revenue from forests. All revenue goes directly to the national treasury. Thus, the indicators of this criterion were adapted in order to evaluate the support provided by state forest institutions to forest people in obtaining market revenue. The details of the criteria and indicators will be explained later, together with the results.

Institutions are evaluated by means of a score, on a scale from zero (zero performance) to three (strong performance). These scores result from a specific combination of indicators, as shown in Appendices B and C (Tables A2 and A3). Some indicators may vary depending on the type of tasks fulfilled by the institution evaluated (authority or management tasks) or on a particular characteristic of the institution as determined through fieldwork and document analysis.

The criteria and indicators are able to cover the different activities of the forest administration, ranging from key economic tasks, such as selling forest products in market, to political tasks, like

playing the mediator role between different interests. This broad set of activities will lead to the elaboration of a first hypothesis. However, focusing on the question of the impact of the orientation of state forest institutions on forest people requires an additional theoretical framework for these criteria. For example, within a stronger market orientation, it is important to differentiate between the impact of high technical efficiency on the whole forest sector and that on forest people. The orientation of state forest institutions toward market demand will transform these institutions into influential market actors, a role they will play instead of being involved in poverty alleviation and livelihoods development [21].

The following hypotheses were formulated based on the aforementioned theoretical framework:

H1. *State forest institutions employ different market, non-market and political instruments to influence the use and the protection of forests.*

The 3L-model assumes that state forest institutions perform multiple activities to fulfill their tasks. These comprehensive means can also be tested in regard to the issue of forest people.

H2. *The outcomes of these instruments for forest people differ from those for the general forest sector.*

It makes a difference whether state forest organizations are evaluated by their contribution to the overall forest sector or to such specific issues as those related to forest people. For example, the technical efficiency of the forest sector in Tunisia might increase by employing technologies relying on harvesting machines. However, such a gain in efficiency for the overall forest sector will reduce the opportunities for forest people to take part in forest activities and consequently they will benefit less from forest resources. This evaluation study should make these differences visible.

3. Triangulation of Multiple Empirical Methods

The fieldwork applies multiple empirical methods and checks the collected data by means of triangulation. Triangulation is applied in social science research by making observations from different points of view, increasing the accuracy of work [22].

One important source of data was a senior civil servant. This key informant, who has an experience of three decades in a state forest organization, provided important indications on relevant actors, documents and developments. Thus, the contact with this person generated much more data (documents, interviews) than other interviewees and helped to explain many complex issues related to the functioning of forest administration during the whole study. This knowledge is checked by examining the original documents, statistics and field observations. Very often, the experience of the key senior civil servant who had participated in international project studies, including work with different stakeholders involved in the forest sector, contributed to the examination of different data that would have otherwise been left unconsidered.

During the fieldwork from May 2016 to May 2017, 90 documents were collected. Most are in Arabic and French, and 80% are non-public. The majority of these documents were obtained under request (especially internal documents, statistics, annual reports, and projects of law reform). The collection and analysis of documents relevant to the Tunisian forest sector was a substantial part of this work. It made possible an understanding of the overall functioning of the forest administration, and of the different laws and political goals set for the sector. In addition, prior field observations made in 2013 and 2014 were an important source to check data about causative factors that drive Tunisian forest policy.

Based on this first analysis, expert interviews were performed with key actors from state forest institutions, the Ministry of Environment and researchers from the forest-related sector. At many times, it was important to contact the same interviewee several times (by phone or email) in order to understand the collected data. Thus, the majority of these interviews were short and related to specific topics. Conducting many short interviews revealed more information and provided better understanding than did carrying out long ones. In total, forty email contacts and more than sixty

phone interviews were made with the actors illustrated in Table A4 (Appendix D). In this table, only 15 interviews that revealed crucial information employed in the analysis are presented.

Finally, regular meetings with the research group provided an important theoretical triangulation to avoid a personal bias. The logic of the arguments and the theoretical basis were checked.

4. Overview of the Main Actors Involved in the Forest Policy in Tunisia

According to Hasnaoui and Krott [14], the main actors involved in the forest sector in Tunisia are:

- The governmental actors: the General Directorate of Forests and its regional representations, state research institutions, the forest use authority, the Northwest Silvo-Pastoral office, different ministries (Agriculture, Tourism and Environment).
- Market actors, including wood and non-wood product industries.
- International organizations/donors who finance development projects, but also intervene in the elaboration of forest strategies and studies.
- Forest people living in and around forests who have limited legal use rights.

Given that the focus of this study is to evaluate the performance of state forest institutions regarding forest people, it will present insights into the two following categories of actors: Forest people and state forest institutions.

4.1. Insights into the Situation of Forest People in Tunisia

The total number of people living in forests is estimated at 750,000, occupying 14 governorates (from a total of 24) with an average density of 86 users per km^2 of forest. This number of forest people, who have user rights, includes those living in forests and in the area within five kilometers of a forest [5]. Before this reference material about forest people was collected in 2012, the customary rights for those living around forests had been abolished, and only people living inside forested areas kept these rights. Thus, it is essential to define who forest users are. Furthermore, the referential framework about forest people was realized with the support of the forest administration. This reveals the difficulties that the state is facing in enforcing the law that deprives a large number of forest people living around forests of their user rights.

The income of users living in forests includes livestock breeding (58%), logging yards organized by the state to use or maintain forests (28%), charcoal use (5%) and other forest product use (9%) [5]. This indicator shows the importance of forests in supporting livestock breeding activities, mainly by providing a pastoral resource.

Based on the statistics of the referential framework [5], Figure 2 was elaborated presenting key indicators related to forest people in comparison to the national average.

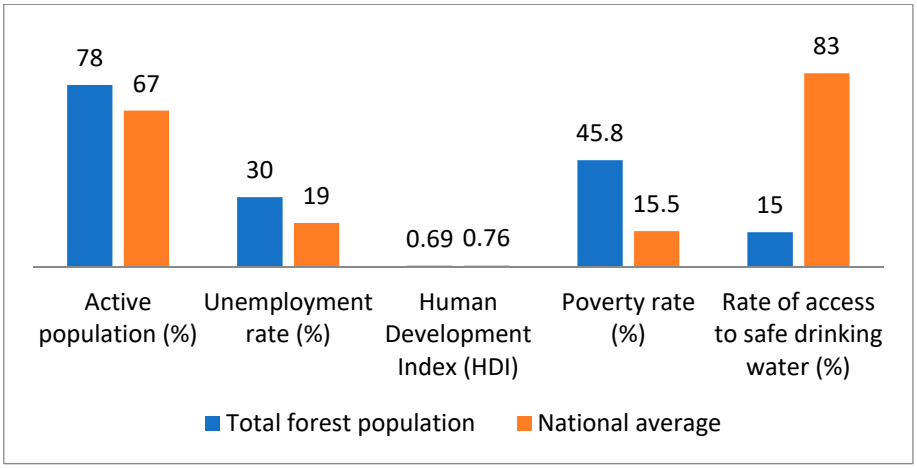

Figure 2. Indicators for forest people in Tunisia [5].

The indicators in Figure 2 show the socio-economic problems forest people are facing. The poverty rate reached 45.5%, while the national average is 15.5%. This is in addition to an unemployment rate of 30% against 19% at the national level. Furthermore, forest areas are characterized by very limited infrastructure. For example, the rate of access to safe drinking water is estimated at 15%, while the national average is 83%. All these statistics reflect the complexity of the situation and the need for a forest policy reform that reduces these discrepancies.

4.2. Relevant State Forest Institutions

The evaluation involved two institutions, namely the General Directorate of Forests and the Northwest Silvo-Pastoral Office. The regional institutions were evaluated together with the General Directorate despite being administratively independent (under the Regional Commissions of Agricultural Development existing in every governorate of the Republic). In fact, they are functionally (technically) managed by this directorate and represent it in regions.

Considering the focus of this study, an evaluation of the Forest Use Authority was not carried out, since the activities of this institution focus on the use and sales of forest products according to the forest code and management plans designed by the General Directorate of Forests. It has low decision-making power and a small impact on forest people, and it collaborates with regional institutions to control the harvesting process and fieldwork. Nevertheless, the data collected from this institution (for example the annual reports) were used to evaluate other institutions. Different tasks of forest institutions at national and regional levels are specified in Appendix A (Table A1). Table A1 was made based on observations and document analyses, and its information was corroborated by means of interviews.

4.2.1. The General Directorate of Forests and the regional institutions

The first administrative body of forestry in Tunisia was created in 1883. This body had always been a separate service assigned to such other entities as the agriculture administration. It evolved over the years until the creation of the General Directorate of Forests in 1990. This directorate is located in the Ministry of Agriculture, Water Resources and Fishing and is composed of four sub-directorates: forest conservation, socio-economic development, silvo-pastoral development and regulation and control. In addition to 1.2 million ha of forests, the Directorate (in collaboration with regional institutions) also manages grazing lands estimated at 4.5 million ha, as mentioned in the second national forest and pastoral inventory [23]. This institution fulfills management as well as the authority tasks, which are defined by Stevanov and Krott to include policy implementation [16].

The regional institutions are under the administration of the Regional Commissions for Agriculture (known as CRDA in Tunisia). In every commission, there is a division of reforestation and soil and water conservation supervising a district of forests. This district has many representations at the local level, which are called units. The link between districts and units is ensured by subdivisions created to divide the area for better management. The number of districts and subdivisions may vary depending on the importance of the forest area within a governorate.

The administrative and the technical hierarchies are different. The administrative organization is as following: (1) The Regional Commissions for Agriculture; (2) Division; (3) Districts; (4) Subdivisions; (5) Units. However, technically, the General Directorate cooperates directly with the districts so that the hierarchy is (1): General Directorate of Forests; (2) Districts; (3) Subdivisions; (4) Units [13]. In other words, to elaborate the annual national program, the Regional Commissions for Agriculture, as well as the divisions, do not intervene and the cooperation is directly between the national level (General Directorate of Forests) and the districts. On the other hand, the procurement and maintenance of equipment for the districts are the tasks of the Regional Commissions of Agriculture.

Since this institution implements both management and authority tasks, the evaluation was performed by integrating the authority and management indicators in the same evaluation.

4.2.2. Northwest Silvo-Pastoral Office

This office was established in 1981 in order to manage watersheds in this region. Later, its activities were extended to provide extension services, donations and micro-credits through the implementation of development projects funded by international donors. The most relevant contribution of this institution to such activities was within the project of the Northwest Forest Development (PNO), with its different phases funded mostly by the World Bank. Collected data show that the Northwest Silvo-Pastoral Office is implementing the fourth phase of this project (PNO4). The investment budget of this institution is very limited and highly depends on development projects.

Despite its limited area and scope of intervention, this study focused on the evaluation of the performance of this institution, since it is the only one whose main task is to support and integrate rural people. In addition, the Northwest of Tunisia includes an important forest area that represents nearly 50% of the total forest area [23]. The governorate of Jendouba, which is located in the Northwest of Tunisia, has the highest number of users and the greatest share of forest area in the country [5].

5. Results: Evaluation of the Performance of the Selected State Forest Institutions

The evaluation by means of the 3L-model showed the multiple contributions of state forest organizations to the issue of forest people (Figure 3). Tables A2 and A3 of the Appendices B and C provide detailed information about the criteria and indicators. The results on the General Directorate of Forests and the Northwest Silvo-Pastoral Office are discussed separately, as shown in Figure 3 and summarized in Table 2. To keep the size of the results section down to a reasonable length, only the detailed evaluation of the General Directorate is presented, since this institution is the main state administration dealing with both management and authority tasks. Concerning the Northwest Silvo-Pastoral Office, the evaluation is summarized in this section. The complete evaluation is found in the supplementary material section.

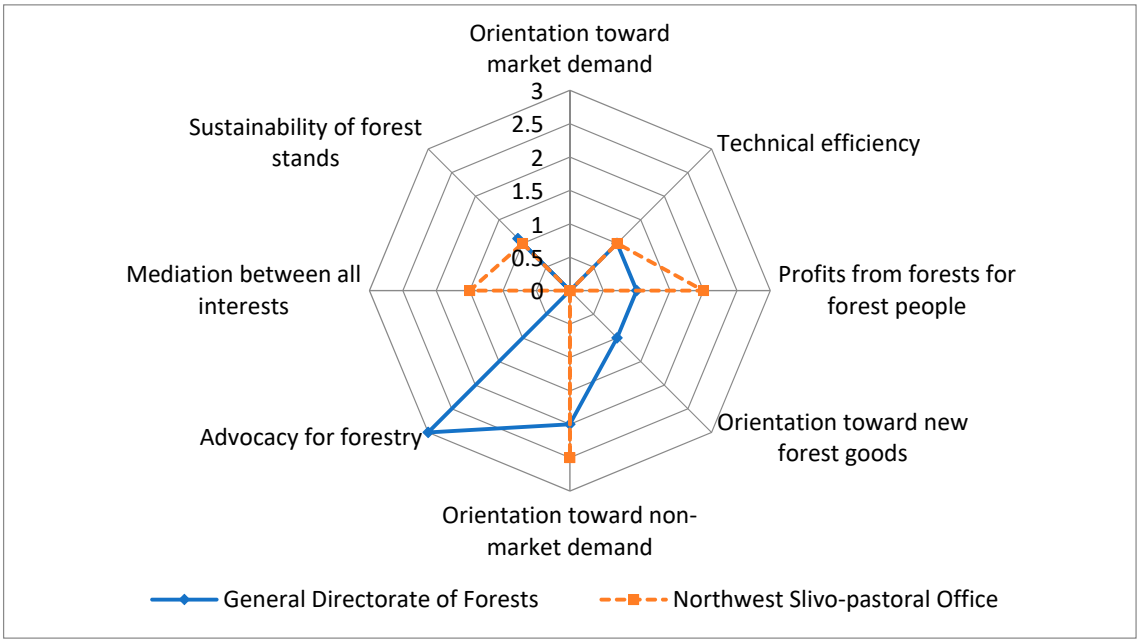

Figure 3. Performance of state forest institutions in Tunisia in regard to forest people (Source: own evaluation).

5.1. The General Directorate of Forests and the regional institutions

5.1.1. Criterion 1: Orientation toward Market Demand

The first criterion shows whether an institution supports the market orientation of forest people. Two indicators were used to measure this: supporting market revenue for forest people and the existence of professional marketing competence.

I.1 Supporting market revenue for forest people: This indicator covers the institution's support for forest people to allow them to generate revenue from selling goods and services on the market. The General Directorate of Forests (in collaboration with regional institutions) takes part in the legislation formulation and has a role in the enforcement of the law. Legally, selling forest goods is the task of the Forest Use Authority, which organizes auctions for the majority of these forest products. However, pursuant to Article 37 of the Forest Code, forest people can use products only to satisfy their personal need and this use should not have a commercial or industrial aspect [6].

This legislative context can explain the poor socio-economic situation of people living in Tunisian forests. Despite having the right to participate in public auctions, the competition with wood and non-wood product industries is very high and unfair. If the orientation is pushed toward market revenue, it will benefit industrialists and traders but not forest people who are weak within the market competition. The prohibition of market revenue for forest people means that the support does not exist.

I.2 Supporting marketing/professional competence: This competence concerns the capacity of the institution to collect, analyze and utilize market information and to support forest people to develop marketing and professional skills. In the General Directorate of Forests, as well as at the regional level, there are no marketing departments or competencies working professionally to promote or tailor products. The performance of the directorate and the regional institutions can be considered not to be professional and, consequently, they cannot support forest people in this way (except by means of some initiatives based on foreign money to develop revenue-generating activities).

Performance judgment: By taking into consideration both indicators, the General Directorate of Forests' orientation toward market demand can be estimated to be zero or "0" for forest people and even for the wood-based sector (Table 2 and Appendix B, Table A2).

5.1.2. Criterion 2: Orientation toward Non-market Demand

The second criterion concerns forest goods that are not exchangeable on the market (public goods) or that are considered to be essential to ensure public welfare. Thus, the contribution of state forest institutions to poverty alleviation for forest people can be assessed under this criterion by using the indicators below.

I.3 Plans for production and provision of public/merit goods: These plans concern the area in which the main goal is protection. They describe the specific amount of public goods that should be produced in that area. Tunisian forests have an essential role in protection, and the General Directorate of Forests, as well as regional institutions, have a wide scope of intervention in the whole country, with its varied climate and vegetation from the North to the South. The General Directorate collaborates with regional institutions to elaborate the plans of annual activities (e.g., annual reports of 2015 and 2014 [24,25]) to be performed in terms of protection, such as the management of natural reserves and national parks, plantations on the coasts and in deserts to fix the coastal and desert sand dunes, the protection of habitats, firefighting, etc. To support the protection of forests means to indirectly support forest people who depend greatly on forest resources to survive (grazing, firewood, etc.). In addition, the directorate and the regional institutions contribute to the elaboration of community development plans that are produced within the framework of development projects (e.g., Ordha-Khadouma 2015, and Jbel Zaghouan 2015 [26,27]). These community plans necessarily contain a section dedicated to poverty alleviation by supporting some activities to generate revenue (e.g., beekeeping) for people or by integrating them in implemented forest activities, as well as by improving their living environment (e.g., opening forest tracks, providing safe drinking water, etc.).

I.4 Financial inflow for public/merit goods production/provision: This inflow is defined as the amount of funding coming from outside the institution in order to finance the different activities related to producing or provisioning merit/public goods. A substantial financial inflow reflects the importance given to the orientation toward non-market demand. According to the budget of the national program of 2015 [28], the amount of money dedicated to forest protection and conservation (protected areas, firefighting, guarding and protecting forest wealth, etc.) represents about 40% of the total budget dedicated to different activities within forests. However, the budget devoted to the protected areas represents 3.7% of the total budget. This budget is considered to be very small (Interview 1). For this reason, there is strong cooperation between the forest conservation department, in the General Directorate of Forests, and the Ministry of Environment, which invests in these protected areas. However, the sources of these funds invested by the Ministry of Environment are mainly international projects, since the Ministry also has a limited budget (Interview 4). The General Directorate receives a substantial amount of money to perform protection activities in forests, as well as to support forest people to create sources of income for them, in order to reduce poverty in these areas. The money comes mainly from international organizations (Food and Agriculture Organization of the United Nations, World Bank, French Development Agency, Japanese project, etc.) and the budgets of these projects are very important in comparison to the state budget.

I.5 Auditing: It is conducted in order to allow the institution to evaluate the satisfaction of other public institutions that finance the production/provision of public goods. These professional examinations indicate the importance of the investment and the orientation toward non-market demand for the investing institution.

Despite receiving substantial funds from external institutions to conduct some public tasks, there is no auditing conducted by the ordering side (public institution). For example, some activities inside protected areas are subject to collaboration between the Ministry of Environment and the Directorate of Forests to define specifications (Interview 4). Thus, there is no ordering side and no task ordering taking place for such activities. The organization financing these projects may conduct audits to monitor budget utilization and different implementations. Therefore, auditing can be considered to be weak in these institutions.

Performance judgment: By considering all the indicator manifestations, the orientation toward non-market demand can be evaluated as moderate or "2" (Table 2 and Appendix B, Table A2).

5.1.3. Criterion 3: Sustainability of Forest Stands

The policy goal captured under this criterion is the maintenance of forest size and the capability to continually produce wood by applying forest management theories. However, maintaining the ability to produce wood is a narrow goal for sustainability. Other activities such as firefighting should be considered as well. A broader vision of sustainability benefits forest people.

I.6 Obligation to sustain forest stands: This obligation concerns the maintenance of the production capacity of forests stands and soil. In the Tunisian Forest Code there is an obligation to protect and develop forest heritage, which is described as being a part of national wealth that should be extended and safeguarded by the citizens [6].

I.7 Forest management plans: These plans are produced in order to protect the sustainability of wood production in the future. The Tunisian Forest Law includes an article clearly stating the obligation of forest institutions to produce management plans for forests. This document should contain technical details about wood removal in a determined period, and information about territories to close or open, such as grazing lands [6]. However, by referring to the latest statistics of the General Directorate of Forests in 2016, more than 50% of forests do not have management plans [29]. One can conclude that forest management plans exist for limited forest areas in Tunisia.

I.8 Requirements for sustaining forest stands: This indicator takes into consideration the growing stock and the current annual increment, which should not decline over the years. This indicator is based on the information available in national forest inventories. In Tunisia there have been two

inventories published, in 1995 and 2010 [23,30]. Based on this data the requirements of sustainability are fulfilled. The current annual increment value for a period of 5 years has recorded a slight increase, from 513,241 m^3 per year to 525,400 m^3 per year in 1995 and 2010 respectively. Similarly, the growing stock has increased, based on the two inventories, from 17.3 million m^3 to 22.2 million m^3. However, since the revolution of 2011, other factors should be considered such as the increase of illegal logging and the number of wildfires and areas they affected. Statistics on illegal logging recorded after the revolution are not reliable, particularly during the first several years (especially in 2011). For security reasons, forest agents could not accomplish their task of recording offenses. Concerning wildfires, the statistics of the General Directorate of Forests [31] showed an important increase in the extent of the areas burned after the revolution of 2011 (from 227.5 ha in 2001 to 5946 ha in 2014). In addition, there are exceptional fires caused by military intervention in some zones (Governorates of Kef and Kasserine), which reached a peak at 8900 ha in 2014 [31]. As a conclusion, we can state that the requirements for sustainability are not accomplished appropriately.

Performance judgment: By combining these three indicators the performance of the General Directorate of Forests for this criterion can be assessed as weak or "1" (Table 2 and Appendix B, Table A2).

5.1.4. Criterion 4: Technical Efficiency

This criterion refers to the impact of technical efficiency of production on the situation of forest people. This efficiency can be defined as "the degree to which an actual output of a production unit approaches its maximum" [32]. One type of opportunity for forest people to improve their incomes is having a temporary job that consists of taking part in state forest activities. High efficiency diminishes such options for forest people.

I.9 Managerial accounting: This kind of accounting contains the information available for the use of the managers of the institutions at the internal scale and it serves to support the decision-making process for a better use of the resources. The General Directorate of Forests has no revenues from forest activities or products and is not profit-oriented. Moreover, there is no financial department within the institution. There is only one employee with an economic management background who manages financial tasks within a development project and who makes additional efforts to deal with daily financial procedures of the General Directorate (e.g., purchases). This employee also collaborates with the general director to elaborate the functioning budget of the General Directorate (purchases, maintenance, etc.) (Interview 13). In addition, by observing different forest programs from 2011 until 2015, the program and the budget are nearly the same [28,33–36]. To conclude, there were no efforts made in terms of managerial accounting.

I.10 Technical productivity of work: Basically, this indicator is a calculation of the ratio of annual removals of wood (output) and the total number of employees (input) and it is calculated for at least three institutions to create intervals of evaluation [16,19]. In Tunisia this calculation is not feasible since the majority of wood is sold by the Forest Use Department in auctions as standing wood (Interview 3). According to the annual reports of the Forest Use Department (e.g., 2014 and 2015 [37,38]), a small quantity of wood can be processed by the administration and sold in private sales by the Use Department. The General Directorate and the regional institutions intervene in this type of use by conducting forestry activities (thinning, sanitary cutting, etc.). The evaluation is based on the comparison of the productivity in fieldwork (yards) managed by the administration and the same activities allocated to private enterprises (also designated by the administration based on specifications). In 2016, there were no requirements from the administration for the daily productivity of employees, while private enterprises required of workers a productivity of two to three cubic meters per day (Interview 15). The administration does not focus on the technical productivity in these yards because such activities have a political target of reducing unemployment by assigning the maximum number of working days to the highest possible number of contractual employees (who are generally old people, people with handicaps or nonqualified persons who do not have another source of income).

With the absence of productivity requirements for institutions, technical productivity is clearly lower there than for private enterprises. This low productivity requirement is very convenient for forest people who are not skilled and who need this work to survive.

Performance judgment: The performance of the institution concerning this criterion can be assessed as "1" or weak (Table 2 and Appendix B, Table A2).

5.1.5. Criterion 5: Profits from Forests for Forest People

This criterion deals with the support of the state forest institution for forest people in making a profit from forests.

I.11 Freedom of harvesting: As mentioned previously, the Forest Law provides freedom of harvesting to forest people as users of the resource. The commercialization of these products is forbidden. The freedom of harvesting to make a profit is limited, but it allows these people to survive (by grazing, the use of firewood, etc.)

I.12 Profit-driven reforms: This indicator concerns the presence of reforms or projects for reform (orientation) to encourage profit making from forests for forest people. The collected data contain several projects for reform in the Tunisian Forest Law, including the co-management agreement model elaborated in 2014 [39]. These agreements are developed to allow forest people belonging to local associations (namely the Agricultural Development Groups) to have access to resources for use, transformation and profit generation from selling them in the market. However, these reform projects cannot be considered to be substantial, since they act only at a legal level.

Performance judgment: For this criterion this institution performance has been rated as "1" or low (Table 2 and Appendix B, Table A2).

5.1.6. Criterion 6: Orientation toward New Forest Goods

The sixth criterion concerns the efforts of the institution to develop new sources of revenue that benefit forest people.

I.13 Professional market information: The indicator concerns the information collected, treated and disseminated in a professional way. Such communication does not exist in the General Directorate and regional institutions (Interview 13). In addition, the majority of forest products are traditionally sold in auctions by the Forest Use Department, and the revenues generated go directly to the national treasury. State forest institutions do not benefit from this income.

I.14 Investments into new forest goods: This refers to an investment in transformed or completely new services and goods that can be considered to be innovative for the institution. This kind of investment is not a priority for the institution. According to the annual budgets and reports, the expenditure orientations have been kept the same for several years. There have been some efforts within national parks to create ecotourism tours and eco-museums (financed almost entirely by development projects), but there are no applicable entry fees to these parks. The particularity of legislation and decrees related to the creation of each park and natural reserve makes the applicability of the entry fees complicated. In some cases, fees for entering the protected areas are required and in other cases entry is free. Some protected areas are created on collective lands and the problems related to the land ownership are not solved. No fees are paid to the forest institution to access protected areas, while private agencies for ecotourism or related associations generate revenues from organizing tours within these areas (Interview 14). The General Directorate of Forests supports non-wood products such as mushrooms, pine nuts, etc., based on foreign development project budgets. This institution is currently discussing the possibility of providing some concessions for creating innovative projects (e.g., the creation of cable cars in the mountain in the Northwest of Tunisia), which will create job opportunities for forest people by providing services to visitors. Despite having the intention to produce innovative forest products, the investment in new forest goods and in the transformation of existing goods is not substantial since it cannot achieve 30% of the total investments of the institution.

I.15 New external partners: These partners can be from different companies and organizations collaborating with the institution to produce or provide new forest goods and services. The main partners of the General Directorate of Forests are international organizations, NGOs, research institutions, Ministries of Environment and Tourism, etc. By means of concessions the institution can form new partnerships that have a market orientation, such as the creation, by innovative people to whom the concessions have been granted, of eco-touristic projects, or the production of new forest essences.". These types of concessions are currently being discussed in the institution, but there has been no progress in terms of their implementation.

Performance judgment: The performance of the General Directorate of Forests can be judged as scoring a "1" or "weak" for this criterion by combining these three indicators (Table 2 and Appendix B, Table A2).

5.1.7. Criterion 7: Advocacy for Forestry

This criterion is related to the role played by forest institutions within the political processes that manage the utilization and the protection of forest resources. The advocacy's role reflects the fact that the institution dominates the representation of the forest sector.

I.16 Trustful cooperation with actors from the wood-based sector: Such cooperation is based mainly on a partnership with actors from the wood industry or other sectors related to the forest sector. The main partners mentioned in interviews (Interview 1 and Interview 5) are state institutions (ministries of environment, tourism and other departments from their institution), research institutions, and associations that deal with the environment and forests. These answers reveal the orientation toward cooperation with actors from the wood-based sector. The situation with forest people is considered to be conflictive, and the main causes for this conflict are overcutting and the illegal exploitation of resources.

I.17 Aspiration to role of advocate: It refers to the intention of the institution to represent the forest sector. This role was approved (Interview 1 and Interview 5) by considering the position of the institution to be very strong in terms of the role of an advocacy for forestry.

I.18 Acceptance of role of advocate: It refers to the perspective of other institutions concerning the admission of the forest institution's role as an advocacy for forestry. It has been confirmed that the General Directorate is considered to be the advocacy for forestry (Interviews 2 and 7). Foresters, especially in regions, consider strict forest protection to be their main task despite the efforts in the central administration to build a strategy based on conciliation and the participatory approach of different actors (Interview 4).

Performance judgment: The General Directorate of Forests engages in trustful cooperation with actors from the wood-based sector, but not with forest people. In addition, it aspires to the role of an advocate for forestry and other actors accept it as such an advocate. Thus, the institution is a strong advocate for forestry and its performance can be judged as being strong or scoring a "3" (Appendix B, Table A2).

5.1.8. Criterion 8: Mediation of all Interests in Forests

This criterion concerns the capacity of the institution to ensure forest governance, which is considered an innovative role within processes of forest protection and use policies. This role represents a preferable option for forest people by considering their interests and offering them the opportunity to take part in policy processes.

I.19 Trustful cooperation with actors from all sectors: This refers to cooperation based mainly on partnership with several actors from different sectors, including forest people. In addition to participating in trustful cooperation, mainly with actors from the wood-based sector (as it was revealed in criterion 7), there are conflicts leading to a lack of trustful cooperation with other actors. For example, there is a permanent conflict between the directorate and people living in forests, as mentioned in the previous criterion. These people are subject to many restrictions related to grazing, since the forest

administration always advocates sustainable forest use by limiting the access to grazing, or even prohibiting (for a period of time) the breeding of some animals, such as goats, in some areas.

I.20 Aspiration to role of mediator: This refers to the intent of cooperation of an institution with actors from different sectors. The Directorate cannot be in a mediatory position, since its main role is to protect forests (Interview 1 and Interview 5). This fact, associated with a strong cooperation with actors from the wood-based sector, shows that it does not aspire to the mediator role.

I.21 Acceptance of role of mediator: This concerns the degree to which other actors recognize forest institutions as being mediators between different interests. State forest institutions in Tunisia claim to play a conciliatory role. However, the General Directorate of Forests, and especially the employees at the regional level in practice, are perceived as being very strict when dealing with the forest sector (Interview 4, Interview 7).

Performance judgment: The General Directorate cooperates mainly with actors from the wood-based sector. Moreover, it does not aspire toward a mediator role and it is not accepted as a mediator. By combining these indicators, the resulting score would be a zero or "0" performance (Table 2 and Appendix B, Table A2).

Table 2. Overview of the evaluation criteria, indicators and results.

Criteria (C)	Indicators for GDF Evaluation	Indicators for NWSPO Evaluation	Evaluation Result for GDF	Evaluation Results for NWSPO
C1 Orientation toward market demand	Supporting market revenue for forest people; Support for professional marketing competence	Supporting market revenue for forest people; Support for professional marketing competence	0	0
C2 Orientation toward non-market demand	Plans for production/provision of public/merit goods; financial inflow for public/merit goods production/ provision; Auditing	Plans for production/provision of public/merit goods; financial inflow for public/merit goods production/ provision; Auditing	2	2.5
C3 Sustainability of forest stands	Obligation to sustain forest stands; forest management plans; fulfilment of sustained forest stand requirements	Obligation to sustain forest stands; forest management plans; fulfilment of sustained forest stand requirements	1	1
C4 Technical efficiency	Managerial accounting; technical productivity of work	Managerial accounting; Support for new technology and high productivity	1	1
C5 Profits from forests for forest people	Freedom of harvesting; profit-driven reforms;	Revenue from forests for forest people; integration of people in the implementation of activities defined by development plans/projects	1	2
C6 Orientation toward new forest goods	Existence of professional market information; investments in new forest goods; existence of new external partners	Existence of professional market information investments in new forest goods; existence of new external partners	1	0
C7 Advocacy for forestry	Trustful cooperation with actors from the wood-based sector; aspiration to role of advocate; acceptance of role of advocate	Trustful cooperation with actors from the wood-based sector, aspiration to role of advocate; acceptance of role of advocate	3	0
C8 Mediation of all interests	Trustful cooperation with actors from different sectors; aspiration to role of mediator; acceptance of role of mediator	Trustful cooperation with actors from different sectors; integration of people in the decision-making process	0	1.5

5.2. Northwest Silvo-Pastoral Office

As mentioned earlier, the complete evaluation of the performance of this institution is in the supplementary material of this paper. The results are summarized below, presenting the highlights of the performance of the institution vis-à-vis the evaluation criteria of the 3L- model.

The office has no *orientation toward market demand*. Its main task is to implement international development projects. These projects provide some funding to support forest people in the creation of micro-enterprises that improve their limited incomes. The revenue generated from such enterprises is limited [40] and is considered to be a contribution to poverty alleviation. It helps to support small *profits from forests* with these activities rather than supporting a market orientation. The *orientation toward non-market demand* is the focus of the institution, this by contributing to the implementation of Community Development Plans within development projects. Parts of these plans are dedicated to forest activities targeting the improvement of forest people livelihoods. Forest activities included in the Community Development Plans contribute to the *sustainability of forests*. Nevertheless, this contribution is not substantial since it is geographically limited to the Northwest region. Also, the main entity responsible for producing management plans is the General Directorate of Forests. In terms of *technical efficiency*, the focus of the institution on poverty alleviation does not make high technical efficiency and productivity a priority, despite some attempts to slightly improve and use innovative technologies in the context of microenterprise creation (see supplementary materials).

Similarly, there is no orientation toward creating *new forest goods*. The office has kept the same investment line for several years, focusing on merit goods and implementing international projects without elaborating new orientation. *Advocating forestry* is the task of the general directorate. The office adopts a more participatory approach, trying to integrate forest people into the decision making process. That is to say, it plays a *mediator role*, considering the interests of local people in their programs. Nevertheless, it remains a weak mediator role, relying on foreign donors and covering limited areas that are concerned with the intervention zones of international projects and the office.

The results obtained for the General Directorate of Forests and the regional institutions as well as the Northwest Silvo-Pastoral Office, summarized in Figure 3 and Table 2, show that both institutions have similarities in their performance, which is marked by the absence of the orientation toward market demand, while their performance in the orientation toward non-market demand is considerably better. In addition, both of them display a weak performance with regard to technical efficiency and sustaining forest stands. Nevertheless, the institutions have some differences. While the General Directorate of Forests plays exclusively and strongly the role of the advocacy for forestry, the Northwest Silvo-Pastoral Office is oriented toward playing the mediator's role. A profit from forests for forest people is more supported by the Northwest Silvo-Pastoral Office, while the General Directorate of Forests tries, although weakly, to look for new forest goods. Given the absence of a market orientation for forest people, the results in part support the hypothesis that assumes that: *State forest institutions employ different market, non-market and political instruments to influence the use and the protection of forests.*

The results revealed also that, at times, a weak performance of the institutions might be advantageous for forest people. Generally, an institution is asked to improve its technical efficiency. However, low technical efficiency in the Tunisian case allows forest people with limited technical skills to remain competitive in terms of being able to realize forestry activities and to generate some additional income. This confirms the second hypothesis that considers that: *The outcomes of these instruments for forest people differ from those for the general forest sector.*

6. Discussion and Conclusions: Optimizing State Forest Institutions' Performance regarding Forest People

A specific policy mix is needed to solve the social sustainability issues related to forest people within the context of state-owned forest resources. A policy mix can be defined as "a combination of policy instruments which has evolved to influence the quantity and quality of biodiversity conservation and ecosystem service provision in public and private sectors" [41]. This section will discuss the results of the performance of state forest institutions in Tunisia regarding forest people. The eight criteria for evaluation show priorities in the activities of the two state institutions. After discussing the overall performance, we will highlight three important activities that include a future potential for support for forest people.

The market orientation of both state forest institutions is limited. The prohibition of forest product sales on the market outside the framework of public auctions supports self-supply. In fact, giving more freedom to market supply can lead to an increase in competition in the presence of market actors who have more power resources. In that case, forest people might lose their material bases, and they could have more difficulties in terms of satisfying their own needs as approved by the Forest Code. Also, strong market-based solutions require more competitive enterprises and can therefore weaken forest people. State forest institutions' inactivity in Tunisia regarding the market sector is not beneficial for the country's economy, but it does not influence forest people negatively, given their weak competitiveness. This result is well in line with the criticism by Dressler et al. (2015) on pushing state forest organizations strongly toward market demands [21].

The non-market demand orientation of state forest institutions is moderate in Tunisia. Poverty alleviation is considered to be one of the merit/non-market goods. Supporting poverty alleviation and protecting forests where forest people live directly and indirectly benefits forest people and contributes to social sustainability. Therefore, state forest institutions could focus more on this issue instead of supporting market orientation in the future.

For sustaining forest stands the performance of the General Directorate of Forests and the regional institutions, as well as the Northwest Silvo-Pastoral Office, is weak. Considering the defined policy goal used for this criterion, which is the "preservation of forest size and ability to produce wood continually by the use of forest management theories", the weak performance does not have a direct impact on forest people, at least in the short term. These people are not competitive in timber production within the wood market. However, an innovative definition of sustaining forest stands could support the forest people and the special issue of poverty alleviation. This innovation is based on considering the traditional know-how of local people in forest policy formulation, especially in regards to the use and transformation of non-wood forest products, firefighting, etc., without focusing on increasing the wood production.

Low technical efficiency as displayed by state forest institutions in Tunisia does not affect forest people negatively. It is even beneficial for them since they have very low technical skills in performing forest activities. If state institutions were focused on achieving higher technical efficiency, these people would be excluded from performing these activities and would be replaced by machines. Consequently, their income from forests would decrease. An adapted technology based on traditional knowledge and on more technical supervision from the state forest institutions' employees and experts would be preferable for forest people.

Profit from forests does not only comprise money gained from marketable products. It also includes the rights granted to forest people to use forest products. This profit could be supported and maximized for these people as a priority. In order to increase this profit, state forest institutions could provide more support for forest people by allowing more legal flexibility, and also by encouraging effectively the creation of local small markets to commercialize traditional products (essential oils, honey, etc.).

A future orientation toward creating new forest goods adapted to the needs of forest people would be of interest to them. For example, the ecotourism sector based on creating and developing local economies and directly implicating forest people could be one of these new forest goods. Currently, the ecotourism sector in Tunisia benefits the organizers (mainly travel agencies and individuals) rather than forest people.

The strong performance of the General Directorate of Forests and the regional institutions as the advocates for forestry is not in favor of forest people, since it leads to their exclusion from the decision-making process. Despite the claim that these institutions use a participatory approach that integrates forest people in their strategies and program formulations, the indicators revealed that the role of the advocate for forestry is strongly performed by the institutions. However, the Northwest Silvo-Pastoral Office performs, although weakly, the mediator's role. Its limited area of intervention, along with a small budget and dependence on foreign money, are the main causes of its

weak performance. A better performance of this office could be achieved by empowering its position and increasing the state budget in order to allow an independent, stable and powerful impact by this institution. The government could give more decision-making freedom to this institution within the forest sector in order to play properly the role of a mediator between all interests in forests and especially the interests of forest people.

(a) Innovative adapted forest technology for forest people: a future option

Adopting forest technology to fit forest people's needs would be a step forward in the poverty alleviation process and therefore in social sustainability. An adaptive forest management should be applied for this purpose. This concept is relatively recent in the management of resources and consists of "integrating local and scientific systems of knowledge and practice" [42]. The local or indigenous knowledge can be defined as the practices of local forest users who have received their knowledge from preceding generations, experts or science and used it to manage their own forests [43]. In the case of Tunisian forest people, local knowledge consists mainly of traditional technical skills applied in order to use and transform some forest products such as herbs, nuts, etc. It has been admitted that neglecting this local knowledge of resource users is one of the most usual defects in the conventional scientific management of resources [42]. In order to avoid this weakness in Tunisia it is important that state forest institutions take into consideration these traditional skills of local forest people rather than encourage high technical efficiency. Basically, state forest organizations have a key role to link and balance the local knowledge with a high standard of scientific knowledge [44].

(b) Diminishing the dependency of state forest institutions on foreign donors

The balance between national state organizations and international organizations has already been described [45]. International organizations are becoming more empowered and contribute even to deregulation in the presence of weak and dependent states [45]. These organizations form coalitions with domestic bureaucracies and use funding and capacity building through direct access to impact the reform process of administration structure and policy, which affects natural resources and forests more precisely [45]. Formally, international organizations may have the role of empowering sustainable ecological goals, but informally they weaken the role of state actors and support the extraction of forest production, which consists of an augmentation of wood harvesting and export. Using the pathway of discourse, the World Bank contributed to a restriction of the forest people's access to resources by considering this access to be illegal logging, since this is the main cause of deforestation in Armenia [45]. In addition, these organizations have informal political and economic interests since they bring foreign consultants, transfer technologies and extend their markets. Also, they have political and strategic interests [46]. The case of Armenia could be quite similar to the future of Tunisian forests, where foreign money received by the state institutions in the context of development projects, and the number of studies conducted, are increasing. Many of these projects encourage the market, as well as high productivity and efficiency under the umbrella of poverty alleviation, especially regarding non-timber products. International organizations encouraged the implementation of a Forest Code reform, which is oriented toward more open access to resources by investing into development projects such as the latest project of the World Bank, supporting production chains (The final project title is "Integrated Landscapes Management in Lagging Regions") or by financing and formulating strategies (Forest Strategy 2015–2024 [47]; Forest Investment Program [48], etc.). In Tunisia there is a great need for a strong national policy that is able to overcome the status of a "fragile state" characterizing "the countries where there is a lack of political will or capacity to provide the basic functions needed for poverty reduction, development and safeguarding of the security and human rights of their populations" [49].

To solve forest people's issues, it is essential to strengthen forest institutions, with a special focus on the Northwest Silvo-Pastoral Office, which since its creation has had the role of supporting the rural population. In order to strengthen it, this institution should first receive a solid state budget, allowing it to become independent from international funds. In addition, the Office could be legally supported in order for it to wield a stronger influence on the forest sector. With such a strong legal position and a

state budget, cooperation with international organizations would be more balanced and the position of the institution would shift from a limited implementation of projects to a decision-making role.

(c) Strengthening the mediator role of state forest institutions for forest people

In general, if many forest users are organized in groups, they can represent their interests in the political process more strongly and more efficiently than when they act as separate individuals ([50], p. 73). In fact, by lobbying, forest associations struggle to limit the impact of political programs on their interests in forests (e.g., limiting their business activities by imposing additional costs) ([50], p. 81).

In Tunisia, forest people have a weak representation in the forest sector, especially in the presence of a weak performance by state institutions as the mediators of different interests in the forests. The weak mediator role of state forest institutions means that forest people have little participation in the decision-making process and little access to policy formulation. Since 1988, the Forest Code has recognized in Articles 43 and 44 the right of forest people to participate in the management of forest resources by creating forest associations with a collective interest [6]. According to the forest investment program in Tunisia (2016), ten pilot operations of integrated development were implemented in 1994 [48]. These operations were supported by the Northwest Silvo-Pastoral Office and consisted of the implementation of ten forest associations with a collective interest [48]. However, these experiences failed due to the restrictions of resource use in the Forest Code. Later, the Agriculture Development Groups replaced these associations legally [48]. These groups were not adapted to the intervention in the forest sector management, since they targeted the organization of agricultural producers and fishermen for a better production and management of natural resources [48]. Since 2014, a process of reform has been initiated, along with the objectives of the forest strategy (2015–2024). One of these reforms is to sign co-management plans with forest structures/associations representing forest people [51]. The co-management concept can be defined as the compromise to share power between the state and the community utilizing a resource [52]. This definition fits the definition of community forestry, described as "forestry practices which straightly involve direct forest users in common decision-making processes and the implementation of forestry activities" [53]. However, powerful actors can drive community forestry, since there is a coherence of 82% to 90% between the interests of powerful stakeholders and the outcomes for local users [54]. In other words, the empowerment of direct users is essential to allow them to achieve poverty alleviation. The empowerment comprises: (1) access to information on forests, (2) access to decision-making, and (3) access to forest land and resources, including the ability to exclude others from using the resources. This relies upon "knowledge, information, legal restrictions, technical materials, money and informal access to the forest" [53].

To conclude, the comprehensive evaluation of the performance of state forest institutions revealed that the activities of the state are important factors in forest policy for forest people. Policy concepts that ignore state forest organizations have a high risk of failing in practice.

Furthermore, linking policy for forest people with reforms of state forest organizations might be tougher, but would achieve more relevant results regarding social sustainability, the promotion of which is a statement in the policy programs and development projects, rather than a concern in real actions.

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Appendix A

Table A1. Tasks of state forest institutions in Tunisia.

Tasks	State Institutions			
	National Level		Regional and Local Levels	
	Ministry of Agriculture			
	General Directorate of Forests (DGF)	Forest Use Authority (REF)	Northwest Silvo-Pastoral Office (ODESYPANO)	Forest Divisions, Districts, Subdivisions, and Units *
Forest policy formulation				
Engagement in designing forest laws, orders, decrees or other mandatory and/or voluntary prescriptions other than law, contribution to designing forest strategies and action plans.	++	+	0	++
Law implementation Enforcement of forest laws, implementation control	++	++	0	++
Information providing				
Extension services	+	0	++	+
Public reporting about forests	++	0	0	++
Economic support				
Financial support (incentives, compensations, investment credits, donations in kind)	+	0	++	0
Technical support (conducting operations in state-owned forests, extension excluded)	++	+	++	++
Implementation and support of development projects	++	0	++	++
Planning				
State-wide level	++	0	0	+
Regional level planning	++	0	++	++
Local level	++	0	++	++

Table A1. *Cont.*

Tasks	State Institutions			
	National Level		Regional and Local Levels	
	Ministry of Agriculture			
	General Directorate of Forests (DGF)	Forest Use Authority (REF)	Northwest Silvo-Pastoral Office (ODESYPANO)	Forest Divisions, Districts, Subdivisions, and Units *
Representing the owner (Setting the goals; Making decisions on concessions if some; etc.)	++	+	0	++
Management of state assets (Management of real estates, lands other than forests)	++	0	0	+
Management of forests				
Producing wood products	++	0	0	++
Producing non-wood products	++	0	0	++
Wood harvesting (organizing tenders for wood sales, thinning and sanitary cutting)	0	++	0	+
Non-wood products harvesting (Cork, Pistacia lentiscus, rosemary, mushrooms, charcoal, myrtle, thyme, Aleppo pine nuts, etc.)	0	++	0	+
Infrastructure amelioration and socio-economic development (Tracks, access to drinking water, etc.)	+	+	++	+

(+): task legally based; (++) task legally based and has high priority for the institution; (0) task not fulfilled by the institution; (*) administratively under the Regional Commissions of Agriculture (CRDA) and technically under the General Directorate of Forests.

Appendix B

Table A2. Performance of state forest institutions with management and authority tasks: General Directorate of Forests and regional institutions. (source: Stevanov and Krott, 2013, some indicators and "performance raw" modified).

Criterion (C)	Ordinal Scale	Combination of Indicators		Performance
C1: Orientation toward market demand	3	Supporting market revenue for forest people substantial [a] AND Support for professional marketing competence exists		0
	2	Supporting market revenue for forest people substantial AND Support for professional marketing competence does not exist		
	1	Supporting market revenue for forest people not substantial AND Support for professional marketing competence exists		
	0	Market revenue for forest people does not exist AND support for professional marketing competence does not exist		
C2: Orientation toward non-market demand	3	Plans for production/provision of public/merit goods exist AND financial inflow for public/merit goods production/provision substantial [b] AND auditing exists		2
	2	Plans for production/provision of public/merit goods exist AND financial inflow for public/merit good production/provision substantial AND no auditing		
	1	All other combinations		
	0	No plans for production/provision of public/merit goods AND financial inflow for public/merit good production/provision not substantial AND auditing exists OR not		
C3: Sustainability of forest stands	3	*alternative A* Sustained forest stands on the whole area (cca. 3/3)	*alternative B* (Obligation to sustain forest stands exist) AND (forest management plans exist for the substantial [c] forest part) AND (sustained forest stand requirements fulfilled on the whole area)	1
	2	Sustained forest stands on the greater area (cca. 2/3)	(Obligation to sustain forest stands exists OR not) AND (forest management plans exist on substantial forest part) AND (sustained forest stand requirements fulfilled on the greater area)	

Table A2. *Cont.*

Criterion (C)	Ordinal Scale	Combination of Indicators		Performance
	1	Sustained forest stands on the lesser area (cca. 1/3)	All other combinations	
	0	No sustained forest stands	(Obligation to sustain forest stands does not exist) AND (no forest management plans for the substantial part of the forest) AND (sustained forest stand requirements fulfilled on whole OR greater area OR lesser area OR not fulfilled)	
C4: Technical efficiency	3	Managerial accounting exists AND technical productivity of work is higher than the average for private enterprises		1
	2	Managerial accounting exists AND technical productivity of work is nearly the same as for private enterprises		
	1	Managerial accounting exists OR not) AND technical productivity is lower than the average for private enterprises		
	0	Presence OR absence of managerial accounting AND zero productivity		
C5: Profits from forests for forest people	3	Freedom of harvesting substantial [d] AND profit-driven reform substantial [e]		1
	2	Freedom of harvesting exists [f] AND profit-driven reform substantial		
	1	Freedom of harvesting exists AND profit-driven reform exist [g]		
	0	No freedom of harvesting AND no profit-driven reform		
C6: Orientation toward new forest goods	3	Existence of professional market information AND investments into new forest goods substantial [h] AND new external partners exist		1
	2	All other combinations		
	1	[Existence of professional market information AND no substantial investments into new forest goods AND no new external partners] OR [Absence of professional market information AND no substantial investments into new forest goods AND new external partners exist] OR [Absence of professional market information AND investments into new forest goods substantial AND no new external partners]		
	0	Absence of professional market information AND no substantial investments into new forest goods AND no new external partners		

Table A2. *Cont.*

Criterion (C)	Ordinal Scale	Combination of Indicators	Performance
C7: Advocacy for forestry	3	Trustful cooperation with actors from the wood-based sector AND advocate's role aspired AND advocate's role accepted	3
	2	Trustful cooperation with actors from the wood-based sector AND advocate's role not aspired AND advocate's role accepted	
	1	Trustful cooperation with actors from the wood-based sector AND advocate's role aspired AND advocate's role not accepted	
	0	Trustful cooperation with actors from wood-based sector AND advocate's role not aspired AND advocate's role not accepted	
C8: Mediation between all interests in forest	3	Trustful cooperation with actors from different sectors AND mediator's role aspired AND mediator's role accepted	0
	2	Trustful cooperation with actors from different sectors AND mediator's role not aspired AND mediator's role accepted	
	1	Trustful cooperation with actors from different sectors AND mediator's role aspired AND mediator's role not accepted	
	0	Trustful cooperation with actors from different sectors AND mediator's role not aspired AND mediator's role not accepted	

Legend: (3) strong, (2) moderate, (1) weak performance, (0) zero; a- substantial support of market revenue for forest people: when the state allows forest people to generate revenue from more than 70% of harvested forest products; b- inflow is considered substantial when ≥30% of total revenue flows in (from outside the institution) for public/merit goods production/provision; c- substantial forest part means more than 2/3 of the total forest area under the management of a state forest institution; d- freedom of harvesting is substantial when the state institutions allow harvesting for forest people for their own use and for commercialization as well; e- profit-driven reforms are substantial when they exceed 30% of the realized reforms and they are validated by the law (in execution); f- freedom of harvesting is only for subsistence use; g- profit-driven reforms exist when they consist of less than 30% of the reforms of the institution or/and they are still projects of reforms (not executed); h- substantial, making 1/3 of all investments or more.

Appendix C

Table A3. Performance of a state forest institution with management tasks: Northwest Silvo-Pastoral Office. (source: Stevanov and Krott, 2013, some indicators and "performance raw" modified).

Criterion (C)	Ordinal Scale	Combination of Indicators		Performance
C1: Orientation toward market demand	3	Supporting market revenue for forest people substantial [a] AND Support for professional marketing competence exists		0
	2	Supporting market revenue for forest people substantial AND Support for professional marketing competence does not exist		
	1	Supporting market revenue for forest people not substantial AND Support for professional marketing competence exists		
	0	Supporting market revenue for forest people not substantial AND Support for professional marketing competence does not exist		
C2: Orientation toward non-market demand	3	Plans for production/provision of public/merit goods exist AND financial inflow for public/merit goods production/provision substantial [b] AND auditing exists		2,5
	2	Plans for production/provision of public/merit goods exist AND financial inflow for public/merit goods production/provision substantial AND no auditing		
	1	All other combinations		
	0	No plans for production/provision of public/merit goods AND financial inflow for public/merit goods production/provision not substantial AND (auditing exists OR not)		
C3: Sustainability of forest stands	3	*alternative A* Sustained forest stands on the whole area (cca. 3/3)	*alternative B* (Obligation to sustain forest stands exist) AND (forest management plans exist for the substantial [c] forest part) AND (sustained forest stand requirements fulfilled on the whole area)	1
	2	Sustained forest stands on the greater area (cca. 2/3)	(Obligation to sustain forest stands exists OR not) AND (forest management plans exist on substantial forest part) AND (sustained forest stand requirements fulfilled on the greater area)	

Table A3. *Cont.*

Criterion (C)	Ordinal Scale	Combination of Indicators		Performance
	1	Sustained forest stands on the lesser area (cca. 1/3)	All other combinations	
	0	No sustained forest stands	(Obligation to sustain forest stands does not exist) AND (no forest management plans for the substantial part of the forest) AND (sustained forest stand requirements fulfilled on whole OR greater area OR lesser area OR not fulfilled)	
C4: Technical efficiency	3	Managerial accounting exists AND Support for new technology and high productivity high [d]		1
	2	(Managerial accounting exists OR not) AND Support for new technology and high productivity moderate		
	1	(Managerial accounting exists OR not) AND Support for new technology and high productivity low		
	0	(Presence OR absence of managerial accounting) AND No support for new technology and high productivity		
C5: Profits from forests for forest people	3	Revenue from forests for forest people substantial [e] AND integration of people in realizing activities defined by development plans/projects substantial [f]		2
	2	Revenue from forests for forest people exist AND (integration of people in realizing activities defined by development plans/projects Substantial OR exits)		
	1	(Revenue from forests for forest people exist OR not) AND integration of people in realizing activities defined by development plans/projects exits		
	0	NO revenue from forests for forest people AND no integration of people in realizing activities defined by development plans/projects		
C6: Orientation toward new forest goods	3	Existence of professional market information AND investments into new forest goods substantial [g] AND new external partners exist		0
	2	All other combinations		
	1	[Existence of professional market information AND no substantial investments into new forest goods AND no new external partners] OR [Absence of professional market information AND no substantial investments into new forest goods AND new external partners exist] OR [Absence of professional market information AND investments into new forest goods substantial AND no new external partners]		

Table A3. *Cont.*

Criterion (C)	Ordinal Scale	Combination of Indicators	Performance
	0	Absence of professional market information AND no substantial investments into new forest goods AND no new external partners	
C7: Advocacy for forestry	3	Trustful cooperation with actors from the wood-based sector AND advocate's role aspired AND advocate's role accepted	0
	2	Trustful cooperation with actors from the wood-based sector AND advocate's role not aspired AND advocate's role accepted	
	1	Trustful cooperation with actors from the wood-based sector AND advocate's role aspired AND advocate's role not accepted	
	0	Trustful cooperation with actors from wood-based sector AND advocate's role not aspired AND advocate's role not accepted	
C8: Mediation between all interests in forest	3	Trustful cooperation with actors from different sectors AND integration of people in the decision-making process substantial	1,5
	2	Trustful cooperation with actors from different sectors AND integration of people in the decision-making process moderately substantial	
	1	Trustful cooperation with actors from different sectors AND integration of people in the decision-making process exists	
	0	Trustful cooperation with actors from different sectors AND integration of people in the decision-making process does not exist	

Legend: (3) strong, (2) moderate, (1) weak performance; a- substantial support of market revenue for forest people: when the state allows forest people to generate revenue from more than 70% of harvested forest products; b- inflow is considered substantial when ≥30% of total revenue flows in (from outside the institution) for public/merit goods production/provision; c- substantial forest part means more than 2/3 of the total forest area under the management of a state forest institution; d- high support when more than 80% of realized activities support the use of new technology and pushes toward high productivity; e- Substantial when the institution helps to generate a revenue covering more than 80% of their needs; f- substantial when more than 70% of planned activities are realized by forest people; g- substantial, making 1/3 of all investments or more.

Appendix D

Table A4. List of interviews.

Date	Interview Number	Type of Interview	Position of the Interviewee	Institution
25/05/2016	Interview 1	Sent via email	Responsible for silvo-pastoral development	General Directorate of Forests
21/09/2016	Interview 2	Questionnaire	Responsible for forest protection	General Directorate of Forests
21/09/2016	Interview 3	Face-to-face	Responsible for forest product sales	Forest Use Authority
22/09/2016	Interview 4	Face-to-face	Responsible in the Environment department	Ministry of Environment
29/09/2016	Interview 5	Questionnaire	Responsible for silvo-pastoral development	General Directorate of Forests
29/11/2016	Interview 6	Sent via email	Responsible for silvo-pastoral development	General Directorate of Forests
09/12/2016	Interview 7	Phone interview	Lecturer in forest science	Silvo-Pastoral Institute of Tabarka (Tunisia)
15/12/2016	Interview 8	Sent via email	Responsible for silvo-pastoral development	General Directorate of Forests
24/01/2017	Interview 9	Sent via email	Responsible for silvo-pastoral development	General Directorate of Forests
30/01/2017	Interview 10	Sent via email	Responsible for and coordinator of projects	Northwest Silvo-Pastoral Office
30/01/2017	Interview 11	Sent via email	Responsible for silvo-pastoral development	General Directorate of Forests
01/02/2017	Interview 12	Sent via email	Responsible for and coordinator of projects	Northwest Silvo-Pastoral Office
08/02/2017	Interview 13	Sent via email	Responsible for administrative and financial affairs	General Directorate of Forests
10/02/2017	Interview 14	Phone interview	Doctoral students working on ecotourism	National Agronomic Institute of Tunisia
27/02/2017	Interview 15	Sent via email	Responsible for silvo-pastoral development	General Directorate of Forests

References

1. Pierce Colfer, C.J. Marginalized Forest Peoples' Perceptions of the Legitimacy of Governance: An Exploration. *World Dev.* **2011**, *39*, 2147–2164. [CrossRef]
2. Chao, S. *Forest Peoples, Numbers Across the World*; Forest Peoples programme: Moreton-in-Marsch, UK, 2012.
3. Sikor, T.; Stahl, J.; Enters, T.; Ribot, J.C.; Singh, N.; Sunderlin, W.D.; Wollenberg, L. REDD-plus, forest people's rights and nested climate governance. *Glob. Environ. Chang.* **2010**, *20*, 423–425. [CrossRef]
4. Smith, J. Afforestation and reforestation in the clean development mechanism of the Kyoto Protocol: Implications for forests and forest people. *Int. J. Glob. Environ. Issues* **2002**, *2*, 322. [CrossRef]
5. Tounsi, K.; Ben Mimoun, A. *Forest Population in Tunisia: Towards a National Socio-Economic Referential Framework*; Direction Générale des Forêts/Ministère de l'agriculture; GIZ-Tunis: Tunis, Tunisia, 2012.
6. République Tunisienne. *Code forestier et ses textes d'application*; Imprimerie Officielle de la République Tunisienne: Tunis, Tunisia, 2010.
7. National Institute of Statistics. Monthly Bulletin of Statistics: January 2017. 2017. Available online: http://beta.ins.tn/en/publication/statistics-monthly-bulletin-january-2017 (accessed on 21 April 2017).
8. Seklani, M. *La Population de la Tunisie*; Comité International de Coordination des Recherches Nationales de Démographie (CICRED): Paris, France, 1974.
9. Boussaïdi, N. Impacts of the Anthropogenic Activities on the Tunisian Cork oak Forest: A Test of Projection in the Future of an Ecosystem (Case of Cork Oak Forest of Kroumirie-Northwest of Tunisia). Ph.D. Thesis, Universite De Cartage Tunis, Tunis, Tunisia, 2012.
10. Bouju, S.; Gardin, J.; Auclair, L. La politique fait-elle pousser les arbres? Essai d'interprétation des permanences et mutations de la gestion forestière en Tunisie (1881–2016). *Les Cahiers d'Outre-Mer* **2016**, *273*, 221–248. [CrossRef]
11. Auclair, L.; Gardin, J. La gestion d'un milieu forestier: Entre intervention publique et stratégies paysannes (la Kroumirie, Tunisie). In *Environnement et Sociétés Rurales en Mutation: Approches Alternatives*; Picouet, M., Sghaier, M., Genin, D., Abaab, A., Guillaume, H., Elloumi, M., Eds.; IRD editions: Paris, France, 2004; pp. 291–306.

12. Auclair, L.; Saidi, M.R. Charbonnage en Tunisie: Les filières informelles révélatrices de la crise du monde rural. *Forêt Méditerranéenne* **2002**, *2*, 133–148.
13. Direction Générale des Forêts; Banque Mondiale. *Diagnostic institutionnel et juridique de l'administration des forêts, recommandations et scénarii cible: Réformes institutionnelles et juridiques du secteur forestier*; Direction Générale des Forêts; Banque Mondiale: Tunis, Tunisia, 2016.
14. Hasnaoui, A.; Krott, M. Political Drivers of Forest Management in Mediterranean Countries: A Comparative Study of Tunisia, Italy, Portugal and Turkey. *J. New Sci.* **2018**, *14*, 3366–3378.
15. Krott, M.; Stevanov, M. Comprehensive comparison of State forest institutions by a causative benchmark-model. *Allg. Forst Jagdztg.* **2008**, *179*, 57–64.
16. Stevanov, M.; Krott, M. Measuring the success of state forest institutions through the example of Serbia and Croatia. *Int. For. Rev.* **2013**, *15*, 368–386. [CrossRef]
17. Stevanov, M.; Krott, M.; Curman, M.; Krajter Ostoić, S.; Stojanovski, V. The (new) role of public forest administration in Western Balkans: Examples from Serbia, Croatia, FYR Macedonia, and Republika Srpska. *Can. J. For. Res.* **2018**, *48*, 898–912. [CrossRef]
18. Ostrom, E. A General Framework for Analyzing Sustainability of Social-Ecological Systems. *Science* **2009**, *325*, 419–422. [CrossRef] [PubMed]
19. Chudy, R.; Stevanov, M.; Krott, M. Strategic options for state forest institutions in Poland: Evaluation by the 3L Model and ways ahead. *Int. For. Rev.* **2016**, *18*, 387–411. [CrossRef]
20. da Motta Bustamante, J.; Stevanov, M.; Krott, M.; Ferreira de Carvalho, E. Brazilian State Forest Institutions: Implementation of forestry goals evaluated by the 3L Model. *Land Use Policy* **2018**, *79*, 531–546. [CrossRef]
21. Dressler, H.W.; McDermott, M.; Schusser, C. The politics of community forestry in a global age: A critical analysis. *For. Policy Econ.* **2015**, *58*. [CrossRef]
22. Neuman, W.L. *Social Research Methods: Qualitative and Quantitative Approaches*; Pearson New International: London, UK, 2014.
23. Selmi, K.; Tissaoui, M.; Bacha, S. *Results of the Second National Forest and Pastoral Inventory 2010*; Republic of Tunisia: Tunis, Tunisia, 2010.
24. DGF. *Rapport d'activités de l'année 2014*; Direction Générale des Forêts: Tunis, Tunisia, 2015.
25. DGF. *Rapport d'activités de 2015*; Direction Générale des Forêts: Tunis, Tunisia, 2016.
26. DGF; FAO. *Actualisation du Plan de développement communautaire Ordha-Khaddouma*; Direction Générale des Forêts; Food and Agriculture Organization: Tunis, Tunisia, 2015.
27. DGF; FAO. *Actualisation du plan de développement communautaire Jbel Zaghouan*; Direction Générale des Forêts; Food and Agriculture Organization: Tunis, Tunisia, 2015.
28. DGF. *Programme National d'activités pour l'année 2015*; Direction Générale des Forêts: Tunis, Tunisia, 2015.
29. DGF. *État des plans d'aménagement des forêts en Tunisie: Septembre 2016*; Direction Générale des Forêts: Tunis, Tunisia, 2016.
30. DGF. *Résultats du premier inventaire forestier national en Tunisie*; Direction Générale des Forêts/Ministère de l'agriculture, République Tunisienne: Tunis, Tunisia, 1995.
31. DGF. *Superficies incendiées en hectare par année (2001–2015)*; Direction Générale des Forêts: Tunis, Tunisia, 2016.
32. Färe, R.; Lovell, C.A.K. Measuring the technical efficiency of production. *J. Econ. Theory* **1978**, *19*, 150–162. [CrossRef]
33. DGF. *Programme National d'activités pour l'année 2011*; Direction Générale des Forêts: Tunis, Tunisia, 2011.
34. DGF. *Programme National d'activités pour l'année 2012*; Direction Générale des Forêts: Tunis, Tunisia, 2012.
35. DGF. *Programme National d'activités pour l'année 2013*; Direction Générale des Forêts: Tunis, Tunisia, 2013.
36. DGF. *Programme National d'activités pour l'année 2014*; Direction Générale des Forêts: Tunis, Tunisia, 2014.
37. REF. *Rapport annuel d'activité pour l'annnée 2014*; Régie d'Exploitation Forestière: Tunis, Tunisia, 2015.
38. REF. *Rapport annuel d'activités pour l'année 2015*; Régie d'Exploitation Forestière: Tunis, Tunisia, 2016.
39. DGF. *Exemple de convention pour la cogestion dans les forêts (Administration-Association)*; Direction Générale des Forêts: Tunis, Tunisia, 2015.
40. ODESYPANO. *Manuel de procédures opérationnelles pour la mise en œuvre de la sous composante promotion des activités génératrices de revenus: (Projet PNO4)*; Quatrième Projet de Développement des Zones Montagneuses et Forestières du Nord-Ouest; Office de Développement Sylvo-Pastoral du Nord-Ouest: Béja, Tunisia, 2015.

41. Ring, I.; Schröter-Schlaack, C. (Eds.) *Instrument Mixes for Biodiversity Policies*; POLICYMIX Report; Issue No. 2/2011; Helmholtz Centre for Environmental Research—UFZ: Leipzig, Germany, 2011.
42. Klooster, D.J. Toward Adaptive Community Forest Management: Integrating Local Forest Knowledge with Scientific Forestry. *Econ. Geogr.* **2002**, *78*, 43–70. [CrossRef]
43. Bala, P.A. The Potential Role of Local Knowledge in Community Forest Management: The Case of Kidundakiyave Miombo woodland, Tanzania. Master's Thesis, Copenhagen University, Copenhagen, Denmark, 2015.
44. Do Thi, H.; Krott, M.; Böcher, M.; Juerges, N. Toward successful implementation of conservation research: A case study from Vietnam. *Ambio* **2018**, *47*, 608–621. [CrossRef] [PubMed]
45. Burns, S.L.; Krott, M.; Sayadyan, H.; Giessen, L. The World Bank Improving Environmental and Natural Resource Policies: Power, Deregulation, and Privatization in (Post-Soviet) Armenia. *World Dev.* **2017**, *92*, 215–224. [CrossRef]
46. Rahman, M.S.; Giessen, L. Formal and Informal Interests of Donors to Allocate Aid: Spending Patterns of USAID, GIZ, and EU Forest Development Policy in Bangladesh. *World Dev.* **2017**, *94*, 250–267. [CrossRef]
47. DGF; PCFM. *Stratégie nationale de développement et de gestion durable des forêts et parcours et plan d'action (2015–2024)*; Direction Générale des Forêts/Ministère de l'agriculture; projet régional Silva Mediterranea-PCFM/GIZ-Tunis: Tunis, Tunisia, 2014.
48. République Tunisienne. *Programme d'investissement forestier en Tunisie: plan d'investissement*; République Tunisienne: Tunis, Tunisia, 2016.
49. Karsenty, A.; Ongolo, S.Y. Can "fragile states" decide to reduce their deforestation? The inappropriate use of the theory of incentives with respect to the REDD mechanism. *For. Policy Econ.* **2012**, *18*, 38–45. [CrossRef]
50. Krott, M. *Forest Policy Analysis*; Springer: Berlin, Germany, 2005.
51. DGF. *Projet de réforme du code forestier. proposition pour la modification d'articles sélectionnés*; Direction Générale des Forêts: Tunis, Tunisia, 2015.
52. Carlsson, L.; Berkes, F. Co-Management: Concepts and Methodological Implications Co-management: Concepts and methodological implications. *J. Environ. Manag.* **2005**, *75*, 65–76. [CrossRef]
53. Maryudi, A.; Devkota, R.R.; Schusser, C.; Yufanyi, C.; Salla, M.; Aurenhammer, H.; Rotchanaphatharawit, R.; Krott, M. Back to basics: Considerations in evaluating the outcomes of community forestry. *For. Policy Econ.* **2012**, *14*, 1–5. [CrossRef]
54. Schusser, C.; Krott, M.; Yufanyi Movuh, M.C.; Logmani, J.; Devkota, R.R.; Maryudi, A.; Salla, M.; Bach, N.D. Powerful stakeholders as drivers of community forestry—Results of an international study. *For. Policy Econ.* **2015**, *58*, 92–101. [CrossRef]

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Forest governance and the Arab spring: A case study of state forests in Tunisia

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ABSTRACT

Since the end of the 19th century, there have been three main periods of forest management evolution in Tunisia: (i) the French colonial period (1881–1956), characterized by a coercive and authoritarian management system, (ii) the postcolonial period (1956–2011), during which forest bureaucracy maintained and promoted this coercive and police management, and (iii) the period following the revolution of 2011, marked with policy reforms pushing more sustainable forest management. The paper analyzes the pre-revolution performance of forest administration and the reform discourses of post-revolution forest policy programs. From a methodological perspective, the three-layer model is applied to evaluate the performance of state forest institutions comprehensively before the revolution and then to illustrate the assumed impact of the new policy programs on this performance with two new forest policy programs serving as case studies. Data used in this paper were collected between 2016 and 2018 through field observations, public and non-public documents analysis and expert interviews. The results indicate that post-revolution forest policy programs fail to foster an efficient implementation of their objectives and the improvement of the performance of forest administration as well. Two major reasons can be put forward to explain this failure. First, the lack of comprehensiveness and coherence of the objectives. Second, the gap between these objectives and the time needed for an efficient implementation. To conclude, this study highlights the need to pay more attention to particular causative factors in the design and implementation of post-revolution `strong´ policies in the forest domain.

1. Introduction

Since 1881, Tunisian forests have been the object to a state management (Bouju et al., 2016). Over the years this management increasingly became authoritarian regarding the access and the utilization of resources (Bouju et al., 2016). After the independence of Tunisia from the French occupation in 1956, the first forest code was promulgated in 1966, anchoring the restrictive colonial decrees with more limitation regarding the access to resources. In 1988, the forest code was redesigned to recognize the right of forest people to participate in resource management (République Tunisienne, 2011). Later in 2005, the notion of public-private partnership was introduced with the law of concessions. However, according to the Program of Forest Investments (2016), this forest code does not contain any effective mechanism of incentive to encourage actors to invest and participate in the resource management. Furthermore, forest administration suffered from a lack of personnel and was unable to efficiently execute the strategic management activities (Bouzid et al. 2005). For example, the administration was able to spend only 47% of the budget allocated to the implementation of the National Strategy of Forest and Pastoral Development 2002–2011 (République Tunisienne, 2016).

After breaking down the old repressive regime on 14 January 2011, the first election was organized on 23 October 2011 to form the National Constitutional Assembly with 217 members, after which a government of coalition was born (The Carter center, 2011). This circumstance created many opportunities for formulating new policies. In the forest sector, some actors gained more power to influence the formulation of forest policy programs. However, these policies cannot be properly implemented without considering the state forest institutions since > 90% of Tunisian forests are state-owned (Boussaïdi, 2012; République Tunisienne, 2016). The focus of this study is not to make a comparison between the performance of state forest institutions before and after the revolution but to identify the new orientations of the post-revolution policy programs. Nevertheless, the post-revolution performance is built on the existing state actors and processes from the pre-revolution period. Thus, in addition to the evaluation of the

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performance of the forest administration before the revolution, this study (i) scrutinizes the post-revolution policy programs and their discourses (ii) highlights some factors that can hinder the implementation process and (iii) suggests some recommendations for improving this implementation which is an essential factor to evaluate the success of a policy program. In this study, the three-layer model (3L- model) was tested to evaluate the performance of state forest institutions before the revolution by applying criteria and indicators covering all the pillars of sustainability. This model was successfully applied in different contexts such as selected Western Balkan countries, Poland and Brazil (Stevanov et al., 2018; Chudy et al., 2016; da Motta Bustamante et al., 2018). In the case of Tunisia, which has different context and forest management, the challenge was to adapt the operationalization of this model. Some of the indicators were adapted in order to measure the performance of these institutions as described in the theoretical part. The theoretical basis of the 3L- model allows a causative evaluation which identifies the driving factors leading to the failure or the success of the institutions (Krott and Stevanov, 2008; Stevanov and Krott, 2013). In the case of Tunisia, the causative explanation in the results' section was also valuable to discuss the factors that could affect the implementation of post-revolution forest policy programs claiming to solve the problems related to the new context of the forest sector.

2. Theoretical framework

The first part of this study consists of the evaluation of the state forest institutions' performance before the revolution. For this purpose, theory is important for understanding the amount of tasks that state forest institutions conduct in the forest sector. The use of the 3L-model, designed by Krott and Stevanov (2008), as the theoretical basis in this study is relevant since it allows a comprehensive measuring of the state forest institutions' performance covering the economic, political and ecological aspects. This comprehensiveness is an advantage of the 3L-model compared to other evaluation models focusing only on economic perspective such as profit and efficiency. Further, the 3L-model makes clear the link between political debate, theories and empirical data. This is an additional specificity of the model in comparison to other comprehensive evaluation models mixing all aspects together (Stevanov et al., 2018). As shown in Fig. 1, political relevance, theories and empirical evidence form the main three layers of the model (Krott and Stevanov, 2008; Stevanov and Krott, 2013). The strength and the major advantage of this model is linking theory with political programs and empirical measurement. The theory (represented by geometric forms in Fig. 1) brings more accuracy to the terms used in political discourses, which are generally vague and thus illustrated in Fig. 1 by clouds (Chudy et al., 2016; Krott and Stevanov, 2008; Stevanov and Krott, 2013). In total, eight evaluation criteria (C1–C8 in Fig. 1 and Table 1) emerged by linking policy to theories. The empirical level allows to observe these criteria by the use of indicators I (Fig. 1). The theoretical basis that contributed to the emergence of these criteria are described elsewhere in Krott and Stevanov (2008) and Stevanov and Krott (2013).

One main challenge related to the model is the application of its indicators in different contexts. Nevertheless, the theoretical basis of the criteria creates a sufficient flexibility to adapt the indicators to the Tunisian context which has some particularities in comparison to other countries where the model has already been used such as selected countries of western Balkan, Poland and Brazil (Stevanov et al., 2018; Chudy et al., 2016; da Motta Bustamante et al., 2018). For example, state forest institutions in Tunisia do not generate revenue from selling forest products. This revenue goes to the national treasury. Thus, for the criterion “orientation toward market demand”, the evaluation concerns the support provided by state forest institutions to create profit from forests. There are different stakeholders from the private sector making market profit which is facilitated by the state forest institutions.

Table 1
The eight evaluation criteria of the 3L-model (Stevanov and Krott, 2013; Chudy et al., 2016).

C1	Orientation toward market demand
C2	Orientation toward non-market demand
C3	Sustainability of forest stands
C4	Technical efficiency
C5	Profit from forests
C6	Orientation toward new forest goods
C7	Advocacy for forestry
C8	Mediation between all interests in forest

After the evaluation, new forest policy programs that resulted from the revolution were analyzed. This analysis allowed to deduce the assumed influence of the newly formulated programs on the performance of the forest administration vis-à-vis the eight criteria. This was followed by a discussion of the driving factors that might lead to the failure of program implementation in the future.

A forest policy program can be defined as “statements by forest stakeholders made in a social context concerning the utilization and/or protection of a forest” (Krott, 2005). The main elements formulating a forest policy program are laws, administrative guidelines and budgets (Krott, 2005; Sadath and Krott, 2012). There are four main elements in a rational forest policy program: (1) specific policy issues to deal with, (2) goals and objectives of the policy program, (3) intended impacts of the program, and (4) the implementation of the program (Krott, 2005:29; Rahman et al., 2016; Sadath and Krott, 2012).

In a context of globalization, the influence of non-domestic actors on domestic policy-making processes is increasing (Bernstein and Cashore, 2010; Rahman et al., 2016). In general, there are four main ways in which international regimes influence domestic policies: (1) international regulations and rules, (2) international normative discourses, (3) the use of markets, and (4) direct access (infiltration) to domestic policy-making processes (Bernstein and Cashore, 2000; Bernstein and Cashore, 2012; Burns et al., 2017).

In the specific context of revolution in Tunisia, international actors got the opportunity to influence the formulation of forest policy at the national level using mainly the pathway of direct access to domestic-policy making processes. This direct access could be achieved through providing funding, contributing to capacity building, education and training, as well as technical assistance (Bernstein and Cashore, 2012; Rahman et al., 2016).

The theoretical framework provides a basis to formulate four hypotheses related to our research questions about the post-revolution forest policy programs, factors hindering their implementation and future solutions:

H1. Linking vague political programs to theory-based causative factors allows to identify the hindering elements causing implementation failures in the future. The post-revolution forest policy programs claim to solve major problems but an analysis of the vague programs' terms does not show the critical factors influencing the implementation process. The 3L-model leads to reveal such factors shaping the implementation of forest policy programs.

H2. Management plans and inventories' implementation require national human capacities to have an impact in practice. Core tools to achieve forest sustainability are inventories and forest management plans. However, they can only make a difference in practice if there are sufficient human capacities.

H3. Different policy goals need different periods for implementation. This means that if the implementation processes of different goals starts simultaneously, some can be immediately implemented (such as investing in agriculture, harvesting) while others will require much more time (such as forest protection or regeneration). This gap between the needed time to implement profit-driven changes (e.g. harvesting)

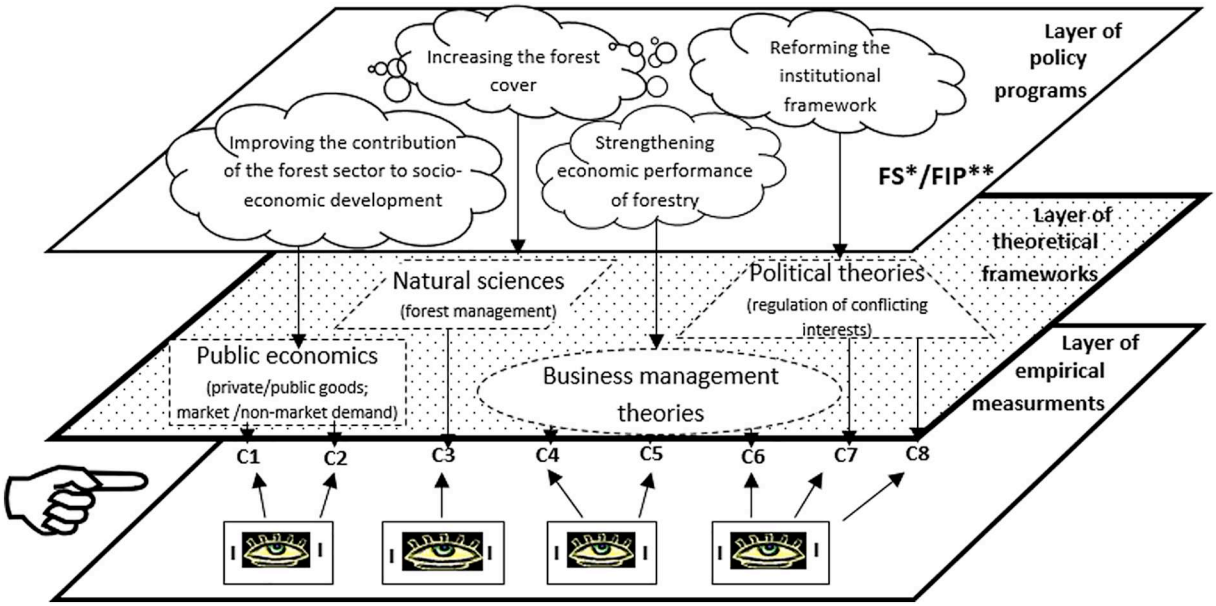

Fig. 1. The 3L-Model: designing criteria (C) and indicators (I) for a comprehensive evaluation of state forest institutions (Chudy et al., 2016; Stevanov and Krott, 2013).

*National Strategy for the Development and Sustainable Management of forests and Rangelands (2015–2024).

**Forest Invest Plan in Tunisia.

and planning the protection and production of forests can cause some imbalances.

H4. Developing and sustaining forest stands need to get the support of forest people by integrating and considering their subsistence use of resources first. The social dimension of sustainability requires an integration of people using forest resources for subsistence purposes. In addition, the potential of local forest people to support or hinder the implementation can be met by a better integration.

3. Empirical methods

To understand and analyze the forest sector's situation, multiple empirical methods were performed. Empirical data and documents were collected from May 2016 until February 2018.

A substantial part of this study was to collect documents related to the Tunisian forest sector. These documents consist essentially of the forest law (the forest code, projects of law reform realized in 2014), strategies and policy programs (National strategies for the development of forest sector for the periods of 2001–2011 and 2015–2024, Forest Investment Program, National Forest Program (2004–2006) and its elaboration studies), 20 annual reports in addition to statistics from the General Directorate of Forests and the Forest Use Department from the period before and after the revolution, workshop reports (two reports of the elaboration of the of the forest strategy and the lists of participants), five management plans covering different forested areas, 13 development projects, studies (e.g. study for institutional reform of the forest administration, 2016), etc. The documents are written in French and Arabic. The majority of these documents was obtained under request, especially when it comes to internal reports and statistics.

A senior civil servant with more than three decades of work experience within the Tunisian forest administration at central and regional levels is a substantial source of collected data. This person took part in the elaboration and implementation of several projects and strategies which involved different categories of stakeholders before and after the revolution of 2011. All data provided by this civil servant was checked by field observation made previously from 2013 in addition to the analysis of original documents.

All the document analysis, observations and collaboration with the civil servant were completed with the selection of key experts' interviews. More than 50 phone calls and email exchanges were made with the most relevant and key informative actors from the state institutions (research, forestry, Environment). The seventeen interviews in Table C (Appendix C) represent the key interviews which revealed substantial and key information regarding this study. These interviews were held face to face, as well as sent and filled in via e-mail or by phone calls. Concerning the criteria C7 and C8, a questionnaire was filled in by two experienced employees from two different departments of the general directorate of forests in order to obtain the maximum of information about the institutions' partners and cooperation. To avoid a personal bias in the analysis of the collected data, meetings within the research group took place regularly allowing to provide a substantial triangulation. In social sciences, triangulation is applied by making observations from different perspectives for more work accuracy (Neuman, 2014).

3.1. Insights into the forest sector in Tunisia

According to the second national forest and pastoral inventory (2010), Tunisian forests cover about 1.2 million ha, while grazing lands, which are also managed by state forest institutions, account to around 4.5 million ha. Nearly 750,000 people live in or close to a forest (five kilometers radius around) (Tounsi and Ben Mimoun, 2012). Forest resources represent the main source of income for these people. This use is limited to satisfy the individual needs of these people to survive and cannot be commercialized (République Tunisienne, 2011). More than 90% of forests are state-owned. Softwood species form the substantial part of forest stands. The main forest species existing in pure stands are the Aleppo pine (*Pinus halepensis Mill.*), representing 53% of the total area; cork oak (*Quercus suber* L.), 10%; Eucalyptus (Eucalyptus ssp.), 6%; in addition to Barbary Thuja (Tetraclinis articulata (Vahl) Mast.), 6%; and stone pine (*Pinus pinea* L.), representing 3% of the total area.

3.2. About the State forest institutions in Tunisia

State forest institutions in Tunisia consist mainly of three entities:

(i) The General Directorate of Forests: created in 1990, this

directorate is the result of the evolution process of an administrative forestry body created in 1883. The directorate is located in the Ministry of Agriculture, Water Resources and Fishing. The institution is responsible for the authority and management tasks covering forest and grazing lands (*Interview 6*).

(ii) Regional institutions: they depend administratively on the Regional Commission for Agriculture known in Tunisia as CRDA. These commissions exist in every governorate and have a broad scope of activities covering the agricultural sector. In every commission there is a division for reforestation and soil and water conservation under which there is a district. This district is represented at a local level by units, and the coordination between the district and the unit is achieved by a subdivision which is created to divide the forest area for easier management. Technically, regional institutions are under the General Directorate of Forests which cooperates directly with the districts.

(iii) Forest Use Authority: it was created in 1973 and has a financial autonomy. Its budget is linked to the state budget and is under the control of the Ministry of Agriculture. The main activities of this authority is cork and wood harvesting according to forest management plans realized by the General Directorate of Forests and regional institutions. Also, this authority is responsible for organizing forest product sales according to the procedures detailed in the forest code (The World Bank and DGF, 2016; *Interview 9*). Technically, the institution depends on the General Directorate of Forests.

State forest institutions have state partners such as the Northwest Silvo-pastoral Development Office which intervenes at the regional and local levels to implement many projects in collaboration with forest institutions.

Since the Forest Use Department has a limited activity related only to the use and the sales of forest products, and since regional institutions execute the activities of the General Directorate of Forests at the regional and local levels, all institutions will be considered as one institution for the evaluation. In other words, the complementarity of these institutions' activities allows a comprehensive evaluation regarding all 3L-model criteria.

4. Results and discussions

In the following, we evaluate the performance of state forest institutions before the revolution using the criteria and indicators of the 3L-model. The results and the combinations of indicators are summarized in Table A, Appendix A. Later, we assume the future impact on the performance in case the main forest policy programs formulated after the revolution of 2011 are implemented. This evaluation is based only on the impacts which are formally claimed. Then some of these assumed impacts are selected and discussed by analyzing the causative factors that could hinder the intended implementation process in practice.

Criterion 1: Orientation toward market demand

This criterion reveals whether a state forest institution supports the market demand orientation benefiting different stakeholders from private sector. In general, forest administration does not generate revenue from selling forest products. In other words, sales revenue goes directly to the national treasury except for a small amount generated from the private sales realized by the Forest Use Authority and spent on the functioning of this institution (*Interview 11*). For measuring the criteria, two indicators were developed: supporting market revenue and the support of professional marketing competence.

I.1 Supporting market revenue: This indicator concerns the support of the forest administration for market actors to allow them to generate revenue from selling goods and services on the market. Legally, the Forest Use Authority is responsible for organizing public auctions and private sales to sell forest products. Based on their annual reports (for example, those of 2009 and 2010), forest administration offered many products for sale such as wood, cork, non-wood products (pine nuts, Aleppo pine nuts, herbs…). The majority of forest products listed in the forest inventory of 2010 were available for use. Generally, forest administration allows hunting according to an annual code of hunting published by the General Directorate of Forests. Hunters pay hunting fees via the post service to the regional institutions and this money goes directly to the national treasury (*Interview 8*). In 2009 and 2010, respectively 99% and 100% of the proposed amount of wood was sold. This means that market revenue support is substantial.

I.2 Professional marketing competence: This competence refers to the ability of the institution to gather, analyze and use market information. Forest administration in Tunisia at the national and regional levels had no marketing departments or competencies professionally working to promote and tailor forest products before the revolution. Currently, this situation is still valid (The World Bank and DGF, 2016; *Interviews 17* and *13*). The performance of the institutions can be considered as not professional.

Performance judgment: By combining both indicators, state forest institutions' orientation toward market demand can be estimated at moderate or “2” (Table A, Appendix A).

Criterion 2: Orientation toward non-market demand

This orientation concerns forest goods that are not exchanged on market (public goods) or that are considered as e for maintaining public welfare.

I.3 Plans for production and provision of public/merit goods: These plans cover areas where the main target is protection and they give information about the amount of public or merit goods to be produced in this area.

State forest institutions in Tunisia were oriented toward the protection of forests, as well as the coastal line (for example, pine forests of Zouarâa in Northwest planted to fix the sand) and zones endangered by sand dunes in the south. The annual programs of activities elaborated by the General Directorate of Forests and regional institutions necessarily contain a section for forest protection, firefighting, national parks budgets, etc. They also collaborate with the Northwest Silvo-pastoral Development Office in order to produce Community Development Plans which have poverty alleviation as main target (*Interviews 10 and 12)*.

I.4 Financial inflow for the production/provision of public/merit goods: This financial inflow is the amount of money flowing from outside the forest institution to finance activities related to the production or provision of public/merit goods. In general, the state budget could not be considered as substantial. Between 2002 and 2004, 77% of the total budget allocated to the forest sector was dedicated to paying the workforce (Bouzid et al. 2005). Furthermore, the annual budget of the 1990s was multiplied 10 times as compared to the 1980s due to the implication of international projects in the implementation of the national strategy of reforestation and desertification fighting. Later, this budget considerably decreased starting from the year 2000 after the completion of development projects, especially the project of forest development funded by the World Bank (Bouzid et al. 2005). The Ministry of Environment is one of the important state partners of the General Directorate of Forests in terms of resource protection, particularly concerning national parks and natural reserves (*Interview 2)*. However, the Ministry of Environment also depends on international funds to support the General Directorate (*Interview 4*). Thus, financial inflow can be considered as substantial.

I.5 Auditing: It is used to allow state forest institutions to evaluate the degree of satisfaction of the other public institutions which provide funds for the production/provision of public goods. This kind of auditing has never existed within state forest institutions. The Ministry of Environment intervenes in national parks according to specifications made by the General Directorate of Forests. Thus, there is neither ordering side nor task ordering within this collaboration *(Interview 4)*. The only auditing that can take place is in the frame of international

projects and is realized by international organizations.

Performance judgment: By considering all the indicators, orientation toward non-market demand can be assessed as moderate or "2"(Table A, Appendix A).

Criterion 3: Sustainability of forest stands.

This criterion deals with the preservation of forest size and ability of continuous wood production by applying forest management theories. Nevertheless, other activities such as firefighting should also be considered in order to meet sustainability requirements.

I.6 Obligation to sustain forest stands: This concerns the compulsion to maintain the productive capability of soil and stands in forests. The Tunisian forest code clearly mentions this obligation to protect and develop forest heritage which is considered as a national wealth and every citizen has a duty to contribute to its extension and conservation.

I.7 Forest management plans: These plans are elaborated to protect sustained future wood production. The elaboration of these plans in Tunisia is limited. According to the statistics of the General Directorate of Forests (2016), in 2009 only 72 of 179 forest units had valid forest management plans. In addition, these 179 plans concern < 50% of the total forest area. Thus, these plans existed for a limited forest area.

I.8 Requirements for sustaining forest stands: Based on this indicator for sustained forest stands, the growing stock and the current annual increment should not decline over the years. According to two inventories published in 1995 and 2010, the requirements of sustainability were fulfilled. For a period of 5 years, the current annual increment slightly increased from 513,241 m^3 per year to 525,400 m^3 per year in 1995 and 2010 respectively. Also, the growing stock from 17.3 million m^3 to 22.2 million m^3 according to these inventories (DGF, 1995; Selmi et al., 2010). However, all this data is criticized regarding its reliability. In the old regime, many statistics were hidden, such as burned areas, to show a perfect situation of sustainability in reports (*Interview 16*). This means that the requirements for sustainability could not be considered as properly accomplished.

Performance judgment: These three indicators show that the performance of state forest institutions regarding this criterion can be assessed as weak or "1"(Table A, Appendix A).

Criterion 4: Technical efficiency

Technical efficiency could be defined as "the degree to which an actual output of a production unit approaches its maximum" (Färe and Lovell, 1978). Based on this definition, this criterion measures to which extent state forest institution is pushing toward high efficiency.

I.9 Managerial accounting: This type of accounting provides information for the internal use of the institutions' managers and it is conducted to support the decision-making process for an efficient use of resources. Tunisian state forest institutions definitely have no departments dealing with this kind of accounting. (*Interviews 13 and 17*).

I.10 Public tender harvesting: This indicator aims to define the amount of wood sold in public tenders and used by private enterprises. In fact, the efficiency of private enterprises concerning the use of wood is much higher than the state forest institutions's efficiency. For example, in 2009 private enterprises were able to harvest 84% available wood for them, while forest administration harvested only 41% in the context of forest activities (report 2009). Furthermore, the more state institutions sell wood in public tenders to private enterprises the better technical efficiency is. In 2009 and 2010, 79.3% and 78%, respectively, of the total amount of produced wood was sold in public tenders. This means that public tender harvesting is substantial.

I.11 State harvesting: This indicator measures the wood that is harvested by the forest administration. This wood is mainly cut during forestry activities (sanitary or thinning cut, etc.). In 2009 and 2010 this wood consisted respectively of 20.7% and 22% of the total wood production available for use. These amounts are not considered as substantial.

Performance judgment: Based on these indicators, orientation toward more technical efficiency is considered as moderate or "2" (Table A, Appendix A).

Criterion 5: profits from forests

The fifth criterion aims to evaluate the importance of revenue that is generated from forests. This profit can be money, as it is the case with wood and other forest products sold in public tenders, allowing private enterprises to generate revenue from these products. The other type of profit is allowing subsistence use of forest products for forest people (firewood, pastoral use for breeding, etc.) or even to allow them to generate revenue from these products. Profits from forests will be reduced if the institution has more wood that is harvested by forest people via contracts paid by the state budgets.

I.12 Profit from public tenders: As mentioned in the previous criterion, > 70% of annual wood production is sold in public auctions, which allows to consider the profit for the private sector as substantial. The transformation of non-wood products such as the extraction of essential oils from herbs (Rosemary, thyme, mastic, etc.) is valuable since these products are used in cosmetic and medical industry, and is also exported (INS, 2015). It is important to mention that industrials do not have any direct contact with state forest institutions and that there are no statistics about the exact number of industrials who transform forest wood. Forest enterprises, which can be individuals or firms, are intermediates between the administration and the industrialists (*Interview 1*).

I.13 Profit for forest people: Based on the Article 37 of the forest code, forest people can use forest products only to satisfy their own needs, and any commercial or industrial use of these products is legally forbidden. Thus, this profit is not a market revenue, but rather a subsistence use.

I.14 State harvesting activities: In the context of forestry activities, state institutions harvest a small amount of wood via employing forest people who are paid for each working day. This wood is then sold in private sales and some of the generated money is used for the functioning of the Forest Use Department, while the General Directorate of Forests does not get any revenue. The productivity of this kind of wood harvesting is low and it has more a political target of poverty alleviation by providing daily wages for forest people. Thus, this harvested wood is not substantial.

Performance judgment: The combination of these three indicators shows that profits from forest can be estimated at moderate or "2" (Table A, Appendix A).

Criterion 6: Orientation toward new forest goods

This criterion focuses on the steps made by the institutions in order to create new sources of revenue from forests.

I.15 Professional market information: The indicator is related to the information which is gathered, processed and spread in a professional way. In Tunisian state forest institutions such a professional market information does not exist and there is no marketing department within the forest administration (*Interview 13 and 3*). Furthermore, the substantial part of forest products is traditionally sold in public auctions by the Forest Use Department. The generated revenue is automatically going to the national treasury, while forest institutions in general do not have any benefits from them (except little money generated from private sales and money which contributes to the functioning budget of the Forest Use Authority as previously mentioned).

I.16 Investments into new forest goods: This indicator concerns the investment into new or transformed goods and services which are innovative for the institution. Before 2011, there was no investment into new forest goods. Annual reports of activities (2007, 2008, 2009, 2010) show the same investments of the institution. It is important to mention that even after the revolution, state forest institutions kept the same investment orientations as shown in annual reports of 2014, 2015 and 2016 for example. A substantial part of the budget is allocated to the payment of the workforce realizing forestry activities. In 2005, there was an initiative to allow concessions of forests for the private sector in order to implement some projects. However, this law had never been applied due to the existence of many constraints and requirements for getting the permission for these projects (République Tunisienne,

2011; République Tunisienne, 2016).

I.17 New external partners: This partnership could be established between state forest institutions and different firms and organizations working together to produce new forest goods and services. The main partners of the state forest institutions before the revolution were some Ministries (tourism, environment), but essentially international organizations providing funding in the frame of projects. The development projects started in 1988 with the World Bank (Project of Forest Development), after which came many other opportunities of funding with the German cooperation GIZ, the Food and Agriculture Organization of the United Nations (FAO), Japan International Cooperation Agency (JICA), etc. All these projects were focused on the development of the forest cover and the mitigation of the over-exploitation and degradation of resources as well as the environmental issues. They also supported the concept of integrated forest management to deal with the socio-economic situation of forest people. However, no new forest products that would result from these collaborations were mentioned.

Performance judgment: The performance of this institution concerning the sixth criterion can be assessed as weak or "1" (Table A, Appendix A).

Criterion 7: Advocacy for forestry

This criterion deals with the role that forest institutions play within classical political processes managing the protection and use of forests. The advocate's role means that the institution focuses on specific interests in forests without considering all interests of other actors.

I.18 Trustful cooperation with actors from the wood-based sector: The collaboration concerns wood industry actors or different sectors linked to the forest sector. Based on *Interviews 2 and 5* state forest institutions in Tunisia maintained the same main partners before and after the revolution. These partners are essentially international organizations NGOs that are active in the forestry sector, forestry research institutions, the Ministry of Environment, etc. These answers reveal that the institution cooperates the most with actors from the wood-based sector.

I.19 Aspiration toward a advocate's role: This indicator refers to the willing of the institution to represent the forest sector. This role was confirmed (*Interviews 2 and 5*) by the consideration of the institution to be strong in terms of the advocate for forestry role.

I.20 Acceptance of the advocate's role: It concerns the perception of other institutions regarding the acceptance of the forest institutions as the advocate for forestry. Indeed, they are considered as the advocate for forestry (*Interviews 4 and 7*). The strict forest protection, especially at the regional level, is perceived as their main task despite the efforts to adopt a strategy based on conciliation and a participatory approach of different actors at the central level (*Interview 4*).

Performance judgment: State forest institutions have trustful cooperation with actors from the wood-based sector. Further, it aspires to an advocate's role for forestry and it is accepted by other actors as the advocate. They can be considered as the strong advocate for forestry and their performance can be judged as strong or "3"(Table A, Appendix A).

Criterion 8: Mediation of all interests in forests

This criterion is about the ability of the institution to apply forest governance which has an innovative role in policy processes dealing with forest protection and use. The mediation role offers different stakeholders the opportunity to participate in policy processes.

I.21 Trustful cooperation with actors from all sectors: This indicator concerns the partnership of the state institutions with actors from different sectors related to forests. As shown in the previous criterion, the interviews revealed a trustful cooperation basically with actors from the wood-based sector. Additionally, there was a lack of trustful cooperation with other actors such as forest people. The permanent conflict that still exists until today between the state institutions and people living in forests is due to restrictions related to grazing since forest administration always advocates sustainable forest use by limiting the access to grazing and even prohibiting the breeding of some animals, such as goats, in certain areas for a specific period of time. This was also confirmed by other studies which described the old forest management as a police forest management (Bouju et al., 2016)

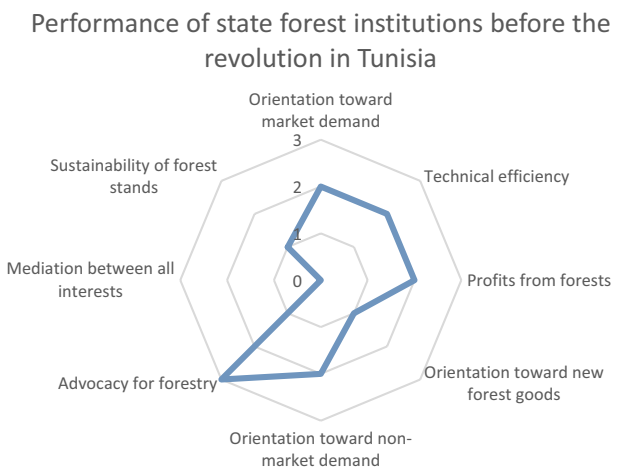

Fig. 2. Evaluation of state forest institutions' performance before the revolution in Tunisia.

I.22 Aspiration toward a mediator's role: The indicator deals with the intention of the institution to collaborate with actors from several sectors. By considering the role of forest protection played by the state institutions, its position and role of a mediator could not be completed (*Interviews 1* and *5*). In addition, the strong cooperation of the institutions with actors from the wood-based sector shows that the role of a mediator is not really aspired in practice despite some political discourses.

I.23 Acceptance of the mediator's role: It refers to the recognition of forest institutions as a mediator (between all interests). Despite claiming to play the role of a conciliator, forest directorate and its employees (especially in regions) have always been considered, before and after the revolution as rigid in terms of dealing with the forest sector in practice (*Interview 4*). The political context before the revolution was more favorable for these institutions to play the restrictive role with the domination of the state and the police regime.

Performance judgment: State forest institutions cooperate mainly with actors from the wood-based sector. Moreover, they do not aspire toward a mediator role and they are not accepted as a mediator. By combining these indicators, the result would be a zero or "0" performance (Table A, Appendix A).

To conclude, state forest institutions' performance before the revolution regarding the different evaluation criteria is moderate (orientation toward market, non-market demand, technical efficiency and profit from forests), while their performance is weak regarding orientation toward new forest goods and sustainability. The performance is strong only in the case of advocacy for forestry role. These results are summarized in Fig. 2 and Table A (Appendix A).

4.1. Postulations and assumed impacts of post-revolution policy programs

The Tunisian forest sector has been facing many challenges related to the management for several decades. After the revolution, the quick collapse of the state repressive role was one of the main factors which led to an important increase of illegal logging and a huge number of wildfires as shown in Fig. 3. It is important to precise that all data of 2011 are underestimated and do not reflect the real situation since during this year and also in 2012 forest agents were not able to record the exact number of offences and burned areas due to security threats. The state forest institutions also lost the control on forest people in terms of productivity in realizing forest activities. For example, before

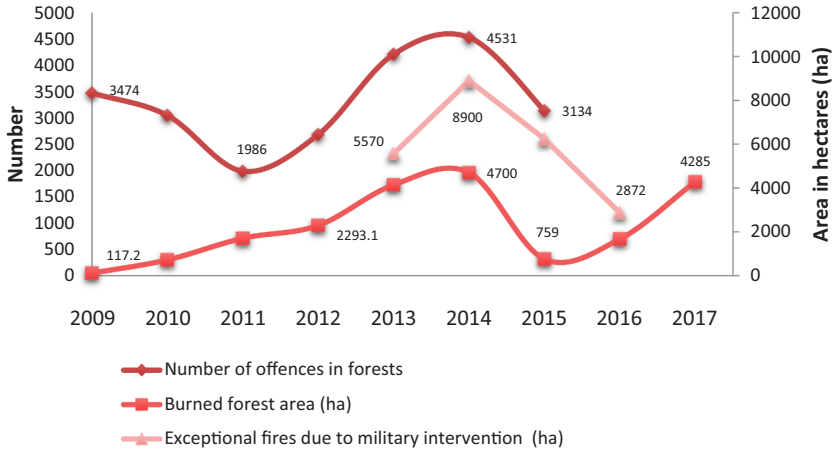

Fig. 3. Offences and burned areas' statistics in Tunisian forests between 2009 and 2017 (DGF 2016c; Dhaouadi, 2017).

2010 a worker was asked to remove cork from 30 trees per day and was paid only 4^{TND}800[1] per day. After the revolution a worker proceeds only three trees and is paid 14^{TND} per day (almost three times more) and with poor quality of products (*Interviews 3 and 15*). From an economic point of view, the increase of wages might be not very meaningful if considering the rising inflation rate, the consumer price index, the financial resources of the institutions…etc. Nevertheless, when associated with the aforementioned decline of productivity, it reflects the weakening of the state's coercion resources. In this context, studies have been realized in order to formulate new strategies and programs for the forest sector, claiming to solve forest issues and to fit to the new socio-economic situation in Tunisia.

The result of these different studies and meetings in joint collaboration between state forest institutions and international organizations consists mainly of the National Strategy for the Development and Sustainable Management of Forests and Rangelands 2015–2024 (DGF, PCFM, 2014) and the Forest Investment Program (République Tunisienne, 2016).

4.1.1. National strategy for the development and sustainable management of forests and rangelands (2015–2024)

The elaboration of this strategy was funded by the German cooperation GIZ in the frame of the regional project Silva Mediterranea-PCFM.[2] Its formulation was based on the results of the evaluation of the old forest strategy 2002–2011 and the analysis of the National Forest Program. These results were presented and discussed during two workshops, in the north and in the south of Tunisia in November 2013, gathering the steering committee of the study, regional forest administration actors and their institutional and non-institutional partners. Later a draft of the strategy and the action plan were discussed in presence of the Minister of Agriculture and key actors from the forest administration in February 2014.

4.1.2. Forest Investment Program (2016)

It is one of the three programs of the Strategic Climate Fund (SCF) which itself represents one of the funds of the Climate Investment Funds (CIF). These funds are managed by the Multilateral Development Bank (MDB) and have as main target to help developing countries to combat climate change. They support the mobilization of funds to facilitate the mitigation of emissions linked to deforestation and forest degradation. In May 2015, Tunisia was selected to be one of the pilot countries of the Forest Investment Program's second phase. Tunisia received a grant of 250,000 USD in order to elaborate its program with the support of Multilateral Development Bank and coordinated by the World Bank. The formulation of the program was under the responsibility of the Tunisian government represented by the Ministry of Agriculture and assisted by the World Bank, the African Development Bank and the European Bank for Reconstruction and Development (EBRD). A Franco-Tunisian consultancy group was designated to realize this task.

After the description of the Tunisian forest sector context, the program selected two main projects to be implemented: (i) the first project is entitled “Integrated landscape management in Tunisia's lagging regions”; (ii) the second project is called “Integration of trees in the private degraded agriculture lands.” The details concerning these two projects are summarized in Table B, Appendix B.

The documents of the Forest Strategy and Forest Investment Plan satisfy the requirements of a rational policy program (Krott, 2005) since they identify (1) specific policy issues, (2) goals and objectives, (3) intended impacts, and (4) the implementation of the program.

In the following, this content is analyzed in order to get insights into the intended impact of these programs on the state forest institutions' performance vis-à-vis the eight criteria of the 3L-model. This specific analysis provides a clearer understanding of the orientations of the post-revolution programs.

The orientation toward market will be enhanced in case the programs are implemented. Forest strategy underlines the lack of resource valorization. Only half of annual wood production is harvested in addition to non-wood products which are weakly used. The strategy has the objective to provide subsidies to young entrepreneurs. The public-private partnership (PPP) through the co-management of resources is also an important sub-program in the strategy and was one of the first projects of the law reform to be discussed in 2014 and 2015. In total, 28% of the budget allocated to the strategy was dedicated to the program of optimizing the contribution of forest sector to socio-economic development. The Forest Investment Plan considers to develop the market orientation via its first project in which there is orientation toward the privatization of forest trees´ nurseries and the public-private partnership to manage the protected areas that were totally under the state management. In addition, the project plans to support the entrepreneurship to develop different production chains by strengthening the Enterprise Support Services that collaborate with specialized consulting groups in order to guide the micro, small and medium enterprises in their business. In this context, a Fund for Productivity and Innovation will be created and financed by the project in order to stimulate the growth and competitiveness of agro- and silvo-pastoral production chains.

[1] TND: Tunisian Dinar.

[2] The full project title is: Adapting the framework for forestry policy to meet the needs of climate change in the MENA region (Middle East and North Africa). It was commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) for the period 2009–2015.

The orientation toward non-market demand will also increase based on the policy programs. Forest protection is one of the most highlighted issues in this orientation. 30% of the strategy budget will be allocated to the maintenance and the amelioration of environmental functions and services. This part of the strategy includes biodiversity protection, infrastructure improvement and provision of firefighting equipment (installing a monitoring system with a warning device). Poverty alleviation, as a non-market orientation, is also considered in both policy programs. It mainly consists of an integrated forest management and of co-management plans between the administration and forest people. This will allow them to generate revenue from forest resources and from realizing forest activities with better technical performance.

Regarding the *sustainability of forest stands,* the performance of state forest institutions will be improved based on the new policy programs. The strategy allocates nearly 40% of the total budget to the amelioration of forest and pastoral resources program. Additionally, about 20% of this budget is devoted to the elaboration, the maintenance and the revision of forest management plans. The Forest Investment Program, through its first project, considers the amelioration of the land use planning by the elaboration of many plans including (i) a new national inventory, (ii) a national plan for afforestation and reforestation, (iii) new/updated management plans for state forests, and (iv) an information and monitoring system of forest and grazing lands. This land-use planning will get about 25% of the total budget of the first project. The second project allocates around 40% of its total budget to finance forest plantations (to produce essentially non-wood products and to introduce the medicinal and aromatic plants in agriculture and pastoral lands subject to erosion threats.

Concerning *technical efficiency*, the performance will be improved by increasing the orientation toward market. By supporting public-private partnership and the co-management of resources, technical efficiency is assumed to increase. In fact, private enterprises have already a better performance in using forest products than the forest administration, as evaluated in the previous section. Improving the technical skills of forest people who are realizing different forestry activities is also one of the targets of post-revolution programs.

The *profit from forests* will be enhanced as well. The co-management plans will allow forest people to make profit, not only by using the resources to survive, but also by transforming some products and selling them legally on the market. Also, the valorization of wood which is considerably underused would increase the available wood proposed for sales in public tenders allowing private actors to make more profit.

New forest policy programs push *toward new forest goods*. Concessions and co-management could be a good opportunity for innovative projects, especially in ecotourism. It is important to mention that due to the legislative particularities of each national park creation, there are no access fees imposed by state forest institutions (*Interview 14*). Also, 30% of the first project budget of the Forest Investment Plan is allocated to agroforestry and organic agriculture.

The *advocacy for forestry* role will be the only criterion where the performance will be weakened based on policy programs. The forest strategy claims that multifunctional forest administration is no more adequate to the current situation of the country after the revolution. The legislation is also targeted by these programs in order to facilitate the access to resources. However, institutional capacity building gets limited resources with only 0.12% of the total budget of the strategy and with 3% of the total budget of the first project of the Forest Investment Plan. These 3% are not only for technical and material capacity building, but also for the reorganization of forest and pastoral administration. This means that the individual capacity building budget is even more limited. Weakening the state advocacy's role and supporting the decentralization process and the public-private partnership will contribute to strengthen the *mediation between all interests'* role played by the administration. The different assumed impacts of the post-revolution forest policy programs on state forest institutions' performance are summarized in Fig. 4.

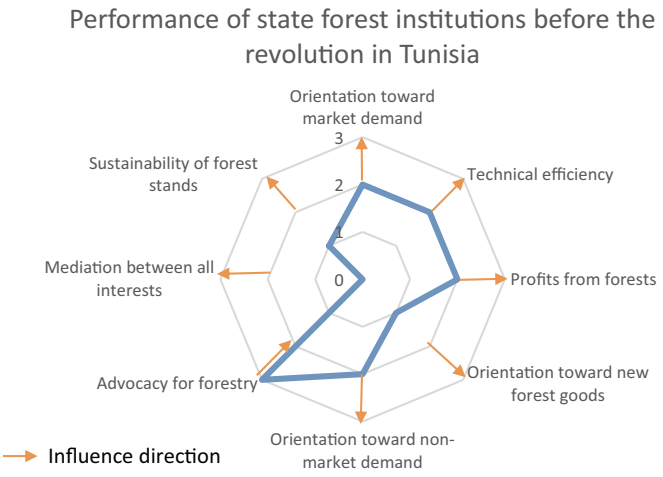

Fig. 4. The assumed impact of post-revolution forest policy programs on state forest institutions in Tunisia.

4.2. Causative factors possibly affecting the assumed performance of state forest institutions in the future

Making an evaluation based on the content of the formulated policy programs showed a positive future impact on the forest sector and the performance of state forest institutions managing > 90% of forests in Tunisia. However, this impact could be very different in practice if we consider the causative factors that are neglected in these programs. In the following, we highlight some of the potential causative factors to be considered for a better implementation process.

4.2.1. Forest management plans and national forest inventories assumed to improve sustainability and capacities

A better knowledge and planning of forestlands is assumed to contribute to the reduction of the illegal logging and to limit the conversion of forestlands into agriculture lands. While these goals could be partly implemented, other actors would probably have more interest in this information system. International organizations can use this information to define their orientations and to make decision to invest (or not invest) in a forestland based on wood or other forest resource availability. Furthermore, in the case of Argentina, the realization of new inventory assisted by the World Bank was an advantage for the agricultural sector which fights to gather information about lands that could be converted into agriculture lands (Burns and Giessen, 2015). The given definition of tree height in this inventory excluded a considerable part of lands that were previously considered as “native forests”. This gives the opportunity to agricultural policy sector to work on transforming these lands (Burns and Giessen, 2015). In Tunisia, introducing the development of agriculture lands threatened by erosion as an entire and independent project in the Forest Investment Plan (see second project) might be a sign of the importance that is getting this sector and that could lead to other future policy change in favor of agriculture, especially in the presence of weakened forest bureaucracies. Moreover, new forest policies in Tunisia allocate a negligible budget to individual and institutional capacity building compared to the importance of the role played by these institutions in charge of both authority and management tasks in forests and rangelands. These budget amounts are between 0.1% and 3% in the formulated programs. In the implementation stage of the strategy programs, there is a clear and repeated mentioning of the needed cooperation with private sector and international organizations. In other words, forest administration would not get enough technical and material staff to be able to implement these strategy programs without the support of private sector and international organizations. The lack of resources might hinder the implementation of programs in an administration where the personnel

has been decreasing since the year 2000. For example, according to the forest strategy (2015–2024), there was a loss of 18% of the personnel between 2000 and 2008 (2.3% per year), mainly because of the non-replacement of those who retired. Additionally, forest rangers who had been informing about forests in case of wildfires, illegal logging, etc., were removed by the post-revolution government arguing that these police and informing practices remind people of the old dictatorship (*Interview 16*). The lack of personnel in the field was one of the main factors causing the increase of illegal logging and wildfires. Paying more attention to the individual and institutional capacity building is a priority that can make management plans and inventories useful. This confirms the first and the second hypotheses considering that:

H1. Linking vague political programs to theory-based causative factors allows to identify the hindering elements causing implementation failures in the future.

H2. Management plans and inventories' implementation require national human capacities to have an impact in practice.

4.2.2. New forest policies neglecting the time dimension

According to Krott (2005), it is substantial to consider the time dimension since the processes of production take more time compared to the economic sector activities. From previous experiences in developing countries, new policy programs formulated in collaboration with international organizations have affected forest sustainability. Armenia is one of these cases where the World Bank formally claimed to empower sustainability in forests and informally weakened the state role. It encouraged more resource extraction and export by supporting forestland privatization and by limiting the access of forest people to resources arguing that their illegal logging is the main cause of deforestation (Burns et al., 2017). In Argentina, the intervention of the World Bank led to the creation of many laws in the forest sector aiming to ease the investment in forest plantations without owning the land. However, these laws do not mention any obligation to replant the area where the trees were cut. In other words, these lands could be changed into, for example, agriculture land (Burns and Giessen, 2015). Consequently, the implementation of these laws caused a considerable increase of private companies' investments in the forest sector and this affects the sustainability since resource exploitation is much faster than producing forest stands.

Allocating 40% of the forest strategy's budget to develop forest resources (including the production of forest management plans) appears to prioritize and increase sustainability. This sustainability improvement is assumed to be more important by additionally adopting co-management plans with forest people. In these plans people are allowed to use a certain area of forests and in return they are asked to develop and protect forest resources from wildfires, illegal logging, etc. However, by considering the time factor, sustainability goals are more difficult to achieve than assumed. In fact, co-management plans go through long procedures to be applicable in all forested area (from law approval, to pilot experiences, then to generalization) without forgetting the considerable efforts that are needed to convince forest people and build their capacities to use forest resources sustainably. This can take decades to be effectively functioning in practice. Before accomplishing this long-term goal, there will be no qualified people capable of protecting and developing new planted forest stands or to implement forest management plans, which would engender considerable natural and financial loss. This supports the third and the fourth hypotheses assuming that:

H3. Different policy goals need different periods for implementation. This means that if the implementation processes of different goals starts simultaneously, some can be immediately implemented (such as investing in agriculture, harvesting) while others will require much more time (such as forest protection or regeneration).

H4. Developing and sustaining forest stands need to get the support of forest people by integrating and considering their subsistence use of resources first.

5. Conclusion

The revolution of 2011 in Tunisia led to a transitional period during which many actors gained more power allowing them to influence policy formulation in the forest sector. Our study analyzes these forest policy documents assuming a feasible implementation of sustainability goals. Applying the 3L-model allowed to deeply understand the functioning of the old forest administration which had an overall medium performance with a strong advocate for forestry role and a restrictive management limiting the access to resources. In addition, the model criteria were used to show the new orientations of post-revolution programs assuming to improve the performance of forest institutions concerning the different criteria except the advocacy for forestry role which will be weakened. The particularity of the 3L-model is the linking of vague political programs to the theories, which reduces the complexity of these programs, but which also helps to identify the causative factors leading to a certain performance of the institution. Testing the 3L-model in a different context with specific objectives was a good opportunity to check the degree of flexibility of this relatively new model. Despite the limit of indicators' applicability, it was possible to operationalize the model by adapting these indicators to the local context. In addition, the 3L-model presents a selection of theories that can anchor the vague political terms. This implies that selecting these specific theories does not exclude the possibility to choose other theories related to the same policy goals. Based on the 3L-model, the study highlighted a selection of causative factors that might affect the implementation of the forest policy programs in the future. The time dimension is an essential factor to consider since setting too many goals simultaneously without prioritization could be not realistic enough regarding their implementation. Different goals require different implementation time. Some objectives can be achieved quickly and are implemented first, while the implementation of other goals that need more time is not prioritized. Regarding state forest institutions, the budget allocated to individual and institutional capacity building is limited. Capacity building in new forest policy programs is more focused on producing inventories and informative systems which are not necessarily a current priority for the Tunisian forest sector. The lack of forest agents in the field and the socio-economic problems are identified as the main causes of wildfires and illegal logging, especially after the revolution. Given the relative permanence of bureaucracies, they are considered as the optimal political institutions that are able to implement policies (Meier et al., 2018). The administration bodies and the officers have in general permanent positions within these institutions compared to politicians (Krott, 2005). Since the revolution, new political parties have been created, several governments have been replaced due to their failure in implementing new development policies in Tunisia. Despite this instability, the state employees remained unchanged. Capacity building within the forest administration have better chances to influence steadily the implementation of long-term forest development policies. This study leads to conclude that allocating more budget to individual and institutional capacity building is one important requirement to improve the implementation process. An efficient implementation of forest policy programs needs to take into consideration the time required for every goal to be completely implemented. In addition, the impact of forest policy programs can be improved when they are better linked to the priorities of the national forest sector.

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Conflict of interest statement

The authors certify that they have NO conflict of financial or personal interest or belief that could affect or inappropriately influence their actions concerning this research work.

Appendix A. Appendix

Table A
Performance of state forest institution with management and authority tasks.

Criterion (C)	Ordinal scale	Combination of indicators	Performance
C1: Orientation toward market demand	**3**	Supporting market revenue substantial [a] AND Professional marketing competence exists	2
	2	Supporting market revenue substantial AND Professional marketing competence does not exist	
	1	Supporting market revenue not substantial AND Professional marketing competence exists	
	0	Supporting market revenue does not exist AND Professional marketing competence does not exist	
C2: Orientation toward none-market demand	**3**	Plans for production/provision of public/merit goods exist AND financial inflow for public/merit goods production/provision substantial [b] AND auditing exists	2
	2	Plans for production/provision of public/merit goods exist AND financial inflow for public/merit good production/provision substantial AND no auditing	
	1	All other combinations	
	0	No plans for production/provision of public/merit goods AND financial inflow for public/merit good production/provision not substantial AND auditing exists OR not	
C3: Sustainability of forest stands	**3**	*alternative A*: Sustained forest stands on the whole area (cca. 3/3) — *alternative B*: (Obligation for sustaining forest stands exist) AND (forest management plans exist for the substantial [c] forest part) AND (sustained forest stand requirements fulfilled on the whole area)	1
	2	Sustained forest stands on the greater area (cca. 2/3) — (Obligation for sustaining forest stands exists OR not) AND (forest management plans exist on substantial forest part) AND (sustained forest stand requirements fulfilled on the greater area)	
	1	Sustained forest stands on the lesser area (cca. 1/3) — All other combinations	
	0	No sustained forest stands — (Obligation for sustaining forest stands does not exist) AND (no forest management plans for the substantial part of the forest) AND (sustained forest stand requirements fulfilled on whole OR greater area OR lesser area OR not fulfilled)	
C4: Technical efficiency	**3**	Managerial accounting exists AND Public tenders harvesting substantial [d] AND State administration harvesting not substantial	2
	2	Managerial accounting does not exist AND Public tenders harvesting substantial AND State administration harvesting not substantial	
	1	(Managerial accounting exists OR not) AND Public tenders harvesting not substantial AND State harvesting substantial [e]	
	0	Presence OR absence of managerial accounting AND No Public tenders harvesting AND State harvesting not substantial	
C5: Profits from forests	**3**	Profit from public tenders substantial [f] AND Profit for forest people substantial [g] AND State harvesting profits not substantial	2
	2	Profit from public tenders substantial AND Profit for forest people exists AND State harvesting profits not substantial	
	1	Profit form public tenders not substantial AND Profit for forest people exists AND State harvesting profit substantial [i]	
	0	No profit from public tenders AND No profit for forest people AND State harvesting profit not substantial	

Criterion (C)	Ordinal scale	Combination of indicators	Performance
C6: Orientation toward new forest goods	**3**	Existence of professional market information AND investments into new forest goods substantial [j] AND new external partners exist	1
	2	All other combinations	
	1	[Existence of professional market information AND no substantial investments into new forest goods AND no new external partners] OR [Absence of professional market information AND no substantial investments into new forest goods AND new external partners exist] OR [Absence of professional market information AND investments into new forest goods substantial AND no new external partners]	
	0	Absence of professional market information AND no substantial investments into new forest goods AND no new external partners	
C7: Advocacy for forestry	**3**	Trustful cooperation with actors from the wood-based sector AND advocate's role aspired AND advocate's role accepted	3
	2	Trustful cooperation with actors from the wood-based sector AND advocate's role not aspired AND advocate's role accepted	
	1	Trustful cooperation with actors from the wood-based sector AND advocate's role aspired AND advocate's role not accepted	
	0	Trustful cooperation with actors from wood-based sector AND advocate's role not aspired AND advocate's role not accepted	
C8: Mediation between all interests in forest	**3**	Trustful cooperation with actors from different sectors AND mediator's role aspired AND mediator's role accepted	0
	2	Trustful cooperation with actors from different sectors AND mediator's role not aspired AND mediator's role accepted	
	1	Trustful cooperation with actors from different sectors AND mediator's role aspired AND mediator's role not accepted	
	0	Trustful cooperation with actors from different sectors AND mediator's role not aspired AND mediator's role not accepted	

Source: Stevanov and Krott (2013), some indicators and "performance raw" modified.

Appendix B. Appendix

Table B
Forest Investment Program: projects and provisional budgets.

Project	Components	Budget (million USD)
First project: Integrated landscapes management in Tunisia's lagging regions.	Component 1: Strengthening the integrated management of landscapes	80.0
	Component 2: strengthening the agro-silvo pastoral production chains	40.0
	Component 3:Strengthening the institutional and legal framework	7.0
	Component 4: the project management	10.0
	Total project 1	137.0
Second project: Integration of trees in the private degraded agriculture lands.	Component 1: conception and implementation of a sustainable funding system	0.6
	Component 2: Support for recipients to prepare their technical and financial dossiers	2.9
	Component 3: Investment to integrate trees in private degraded lands	41.4
	Component4: the Project management and monitoring-evaluation	4.1
	Total project 2	49.0

Source: Forest Investment Program (2016).

Appendix C. Appendix

Table C
List of interviews.

Date	Interview number	Type of interview	Position of the interviewee	Institution
25/05/2016	Interview 1	Sent via email	Responsible for silvo-pastoral development	General Directorate of Forests
21/09/2016	Interview 2	questionnaire	Responsible for forest protection	General Directorate of Forests
21/09/2016	Interview 3	Face-to-face	Responsible for forest products sales	Forest Use Department
22/09/2016	Interview 4	Face-to-face	Responsible in the Environment department	Ministry of Environment
29/09/2016	Interview 5	questionnaire	Responsible for silvo-pastoral development	General Directorate of Forests
28/11/2016	Interview 6	Sent via email	Responsible for silvo-pastoral development	General Directorate of Forests
09/12/2016	Interview 7	Phone interview	Lecturer in forest science	Silvo-pastoral institute of Tabarka (Tunisia)
15/12/2016	Interview 8	Sent via email	Responsible for silvo-pastoral development	General Directorate of Forests
23/01/2017	Interview 9	Sent via email	Responsible for silvo-pastoral development	General Directorate of Forests
30/01/2017	Interview 10	Sent via email	Responsible and coordinator of projects	Northwest Silvo-pastoral Office
30/01/2017	Interview 11	Sent via email	Responsible for silvo-pastoral development	General Directorate of Forests
01/02/2017	Interview 12	Sent via email	Responsible and coordinator of projects	Northwest Silvo-pastoral Office
08/02/2017	Interview 13	Sent via email	Responsible for administrative and financial affairs	General Directorate of Forests
10/02/2017	Interview 14	Phone interview	Doctoral students working on ecotourism	National Agronomic Institute of Tunisia
27/02/2017	Interview 15	Sent via email	Responsible for silvo-pastoral development	General Directorate of Forests
05/02/2018	Interview 16	Phone interview	Responsible for silvo-pastoral development	General Directorate of Forests
23/02/2018	Interview 17	Phone interview	Responsible for silvo-pastoral development	General Directorate of Forests

References

Bernstein, S., Cashore, B., 2000. Globalization, four paths of internationalization and domestic policy change: the case of eco forestry in British Columbia. Canada. Can. J. Polit. Sci. 67–99 XXXII1I.

Bernstein, S., Cashore, B., 2010. Examination of the influences of global forest governance arrangements at the domestic level. In: Rayner, J., Buck, A., Katila, P. (Eds.), Embracing Complexity: Meeting the Challenges of International Forest Governance. International Union of Forest Research Organizations (IUFRO), Vienna, pp. 111–135.

Bernstein, S., Cashore, B., 2012. Complex global governance and domestic policies: four pathways of influence. Int. Aff. 88, 585–604.

Bouju, S., Gardin, J., Auclair, L., 2016. La politique fait-elle pousser les arbres? Essai d'interprétation des permanences et mutations de la gestion forestière en Tunisie (1881-2016). Les Cahiers d'Outre-Mer 273 (1), 221–248. https://doi.org/10.4000/com.7762.

Boussaïdi, N., 2012. Impacts de l'action anthropique sur la subéraie tunisienne: essai de projection dans le future d'un écosystème (Cas de la subéraie de de Kroumirie- Nord-ouest de la Tunisie). In: PhD Thesis, (Tunis, Tunisia).

Burns, S.L., Giessen, L., 2015. Dismantling comprehensive forest bureaucracies: direct access, the World Bank, agricultural interests, and neoliberal administrative reform of forest policy in Argentina. Soc. Nat. Resour. 29 (4), 493–508. https://doi.org/10.1080/08941920.2015.1089608.

Burns, S.L., Krott, M., Sayadyan, H., Giessen, L., 2017. The World Bank improving environmental and natural resource policies: power, deregulation, and privatization in (post-soviet) Armenia. World Dev. 92, 15–224. https://doi.org/10.1016/j.worlddev.2016.12.030.

Chudy, R., Stevanov, M., Krott, M., 2016. Strategic options for state forest institutions in Poland: evaluation by the 3L model and ways ahead. Int. Forest. Rev. 18 (4), 387–411. https://doi.org/10.1505/146554816820127532.

da Motta Bustamante, J., Stevanov, M., Krott, M., Ferreira de Carvalho, E., 2018. Brazilian state forest institutions: implementation of forestry goals evaluated by the 3L model. Land Use Policy 79, 531–546. https://doi.org/10.1016/j.landusepol.2018.09.004.

DGF, 1995. Résultats du premier inventaire forestier national en Tunisie. Direction Générale des Forêts/ Ministère de l'agriculture, République Tunisienne, Tunis, Tunisia.

DGF, PCFM, 2014. Stratégie Nationale de développement et de Gestion Durable Des forêts et Parcours et Plan d'action (2015–2024). Direction Générale Des Forêts/Ministère de l'agriculture; Projet régional Silva Mediterranea-PCFM/ GIZ-Tunis, Tunis, Tunisia.

Dhaouadi, A., 2017. Le Poumon Vert de la Tunisie à l'épreuve du Feu. Leaders. http://www.leaders.com.tn/article/23009-le-poumon-vert-de-la-tunisie-a-l-epreuve-du-feu.

Färe, R., Lovell, C.A.K., 1978. Measuring the technical efficiency of production. J. Econ. Theory 19, 150–162.

Krott, M., 2005. Forest Policy Analysis. Springerhttps://doi.org/10.1007/1-4020-3485-7.

Krott, M., Stevanov, M., 2008. Comprehensive comparison of state forest institutions by a causative benchmark-model. Allgemeine Forst-Und Jagdzeitung 57–64.

Meier, K.J., Compton, M., Polga-Hecimovich, J., Song, M., Wimpy, C., 2018. Politics, Bureaucracy, and Successful Governance: The Problem of Political Failure. American University School of Public Affairs Researchhttps://doi.org/10.2139/ssrn.3268959.

Neuman, W.L., 2014. Social Research Methods: Qualitative and Quantitative Approaches. Pearson new international edition (10.2307/3211488).

Rahman, S., Sadath, N., Giessen, L., 2016. Foreign donors driving policy change in recipient countries: three decades of development aid towards community-based forest policy in Bangladesh. Forest Policy Econ. https://doi.org/10.1016/j.forpol.2016.03.013.

République Tunisienne, 2011. Code Forestier et ses Textes d'application. Imprimerie Officielle de la République Tunisienne, Tunis, Tunisia.

République Tunisienne, 2016. Programme d'investissement Forestier en Tunisie: Plan d'investissement. République Tunisienne, Tunis, Tunisia.

Sadath, N., Krott, M., 2012. Identifying policy change — analytical program analysis: an example of two decades of forest policy in Bangladesh. Forest Policy Econ. 93–99.

Selmi, K., Tissaoui, M., Bacha, S., 2010. Résultats du deuxième Inventaire Forestier et Pastoral National. République Tunisienne, Tunis, Tunisia.

Stevanov, M., Krott, M., 2013. Measuring the success of state forest institutions through the example of Serbia and Croatia. Int. For. Rev. 15 (3), 368–386. https://doi.org/10.1505/146554813807700146.

Stevanov, M., Krott, M., Curman, M., Krajter Ostoić, S., Stojanovski, V., 2018. The (new) role of public forest administration in Western Balkans: examples from Serbia, Croatia, FYR Macedonia, and Republika Srpska. Can. J. For. Res. 48 (8), 898–912. https://doi.org/10.1139/cjfr-2017-0395.

The Carter center, 2011. Les Élections de l'assemblée Constituante en Tunisie le 23 Octobre 2011: Rapport Final. Atlanta. https://www.cartercenter.org/resources/pdfs/news/peace_publications/election_reports/tunisia-final-Oct2011-fr.pdf.

Tounsi, K., Ben Mimoun, A., 2012. Forest Population in Tunisia: Towards a National Socio-Economic Referential Framework. Direction Générale Des Forêts/ Ministère de l'agriculture; GIZ-Tunis, Tunis, Tunisia.

Empirical materials

Bouzid, A., Chennoufi, A., Daly, H., Hammami, A., Naija, M., 2005. Analyse du processus et formulation du programme forestier national (p f n) Tunisie: examen de la situation actuelle. In: Direction Générale Des Forêts/ Food and Agriculture Organization (FAO).

DGF, 2008. Rapport d'activités de l'année 2007. Direction Générale Des Forêts, Tunis, Tunisia.

DGF, 2009. Rapport d'activités de l'année 2008. Direction Générale Des Forêts, Tunis, Tunisia.

DGF, 2010. Rapport d'activités de l'année 2009. Direction Générale Des Forêts, Tunis, Tunisia.

DGF, 2011. Rapport d'activités de l'année 2010. Direction Générale Des Forêts, Tunis, Tunisia.

DGF, 2013a. Compte rendu des travaux de l'atelier de Djerba: Atelier régional de concertation et de planification participative Djerba, 28–29/11/2013. Direction Générale des Forêts, Tunis, Tunisia.

DGF, 2013b. Compte rendu des travaux de l'atelier de Tabarka: atelier régional de concertation et de planification participative Tabarka, 21–22/11/2013. Direction Générale des Forêts, Tunis, Tunisia.

DGF, 2015a. Exemple de Convention Pour la Cogestion Dans les forêts (Administration-Association). Direction Générale Des Forêts, Tunis, Tunisia.

DGF, 2015b. Projet de réforme du code forestier. Proposition pour la modification d'articles sélectionnés. Direction Générale des Forêts, Tunis, Tunisia.

DGF, 2015c. Rapport d'activités de l'année 2014. Direction Générale Des Forêts, Tunis, Tunisia.

DGF, 2016a. État Des Plans d'aménagement Des forêts en Tunisie: Septembre 2016. Direction Générale Des Forêts, Tunis, Tunisia.

DGF, 2016b. Rapport d'activités de l'année 2015. Direction Générale Des Forêts, Tunis, Tunisia.
DGF, 2016c. Superficies incendiées en Hectare Par année (2001–2015). Direction Générale Des Forêts, Tunis, Tunisia.
DGF, 2017. Rapport d'activités de l'année 2016. Direction Générale des Forêts, Tunis, Tunisia.
DGF, Banque Mondiale, 2016. Diagnostic Institutionnel et Juridique de l'administration Des forêts, Recommandations et scénarii Cible: Réformes Institutionnelles et Juridiques du Secteur Forestier. Direction Générale des Forêts; Banque Mondiale, Tunis, Tunisia.
INS, 2015. Commerce extérieur des produits forestiers. Institut National des Statistiques, Tunis, Tunisia.
REF, 2010. Rapport Annuel d'activités Pour l'année 2009. Régie d'Exploitation Forestière, Tunis, Tunisia.
REF, 2011. Rapport annuel d'activités pour l'année 2010. Régie d'Exploitation Forestière, Tunis, Tunisia.
REF, 2015. Rapport Annuel d'activités Pour l'année 2014. Régie d'Exploitation Forestière, Tunis, Tunisia.

Contesting State Authority in Forestland Use: A Power-Based Case Study Within Arab Spring Transformations in Tunisia

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Abstract

Since the sixteenth century, the land tenure system in Tunisia has been progressively centralised by state bureaucracies at the expense of local communities. However, this hegemony of the state in regulating the access to forestland resources was significantly affected by the Tunisian revolution of 2011 that occurred in the context of Arab Spring. Taking into account this political change, the aim of this paper is to scrutinise the dynamics of power between state bureaucracies and non-state actors, including local populations, in the access processes and control of forestlands in northwest Tunisia. From a methodological perspective, the paper presents an in-depth empirical analysis of two decades (2000 – 2019) of the politics of forestland access in rural Tunisia. Particular attention is paid to ruptures and continuities induced by the revolution of 2011. First-hand data used in this research was collected from April 2019 to February 2020. In addition to the qualitative approach employed (archives, face-to-face interviews, field observations, document analysis), a mapping method was used, which consisted of a quantitative and cartographic analysis of forestland cover change over the last two decades. The results show that one of the major effects of the revolution in rural Tunisia, which was the start of all the Arab Spring protest movements, was the collapse of state authority in the governance of forestland resources. The paper also reveals that the use of coercion measures was the main power element employed by state bureaucracies before the revolution. The use of this coercion before the revolution, without combining it with other power elements such as incentives, has become inefficient after the revolution. From a theoretical angle, this paper brings an important contribution to actor-centred power theory. It provides empirical evidence for the notion that the use of coercion in a post-crisis context can only be effective if the 'potentate' or powerful actor (i.e., state) is able to deal with the ability of the 'subordinate' or weak actor (i.e., local communities) to resist the potentate. This resistance can be achieved through a set of 'dominant information' items such as the use of deliberate concealment or informality in illegal logging and forestland conversion to agriculture.

Keywords: Forest governance; actor-centred power; forestland policy; Arab Spring; Tunisia

1. Introduction

State forest ownership and government-led forest management have been introduced in several colonies since the sixteenth and the seventeenth centuries (White and Martin 2002). New governments, especially in Africa, America and South East Asia, deprived native peoples of their rights and granted authority to public agencies over almost all natural forests (White and Martin 2002). Globally, forest ownership is still dominated by the state, and the proportion of private and other types of ownership is around 10% and 4%, respectively (FAO 2020; Agrawal et al. 2008). In Tunisia, almost all forests are owned and managed by the state (Chriha and Sghari 2013; Aini and Bedhief 2010). The current state of land property heritage in Tunisia results from a social and historical process that can be traced back to the sixteenth century. The local communities were autonomous and powerful until the early stages of the Ottoman empire invasion and occupation (Henia 1996). Following this invasion, the Ottoman regime aimed to bring more land under the central authority of the empire, which progressively took the form of a 'state domain'.

With the arrival of French colonisation in 1881, multiple land property regimes overlapped in Tunisia, including 'indigenous' customary right, the Arabic and Ottoman land tenure regimes. Colonial authorities used this variety of regimes to allocate the best lands (arable areas) under traditional legal status to the French settlers. After independence in 1956, the Tunisian post-colonial state started a process of bringing back the colonial expropriated lands to the new independent state property domain. This process was followed by a total nationalisation of expropriated lands in 1964. Later, this process of nationalisation was extended to the Tunisian lands that had traditional legal status in the (pre) colonial era. This allowed the post-colonial state to accumulate an important patrimony of arable lands that was approximately 800,000 ha, (Elloumi 2013; Mares and Lahmayer 2019). Between 1979 and 1982, part of state-owned arable land was transferred back to private owners. Gharbi (1998) states that, of 4.8 M ha of arable land, only 500,000 ha is state-owned, which represents nearly 10%. These lands remain underused despite being the most productive (where the French settlers were installed) (Gharbi 1998).

Before 2011, the state-owned agricultural lands were often rented in the long term by private users who were close to the old regime (Elloumi 2013). Forests covering 1.2 million ha were almost entirely controlled by the forest administration. The Tunisian forest code (2011) grants users rights to nearly 730,000 forest inhabitants living inside, or within a five-kilometre radius of, the forests. However, the law does not allow forest people to make any commercial or industrial use of forest products (Tounsi and Ben Mimoun 2012). Following social protests against the oppressive regime in Tunisia, which started late in 2010, the revolution occurred in January 2011, marking the start of a series of protests in the Arab world called "the Arab Spring". Since this revolution in 2011, the control capacity over the access to forests and agricultural lands for specific land uses in Tunisia has dropped dramatically, while forest people have gained more power. The main observations after the revolution showed that the lands, either agricultural land or forests, that were under extensive state control are considerably affected by illegal logging and fencing. This shows that these people are struggling in order to gain back their power and control over the access to lands, as it was many centuries ago. The legal frameworks that have been developed since the sixteenth century to support the state's power over the access and use of forestland resources has not stopped the increasing grassroots efforts to reclaim the access and property rights of local communities (Elloumi 2013).

By means of a case study from the northwest of Tunisia, this paper aims to (i) scrutinise the power relations between two main categories of actors: state bureaucracies in charge of forestland policy in Tunisia and non-state entities (forest people and private users), (ii) identify potential power shifts over two decades of forestland governance that may have been affected by the 2011 revolution; (iii) understand the root causes of these shifts and the related policy changes. The case study area is characterised by the existence of different overlapping land uses (e.g., forest stands, agriculture, grazing lands) resulting in competing interests regarding the use of available resources. By considering this overlap, we use the term 'forestland' in this study to address all these different categories of lands.

From a conceptual angle, the actor-centred power theory (Krott et al. 2014) was used as a core theoretical framework for this research.

2. Conceptual and theoretical framework

Land use activity, as a structural process of the relationship between humans and nature, was identified 10,000 years ago through foraging, fishing, collecting and hunting activities (Stephens et al. 2019). The notion of 'land use' can be defined as being "the arrangements, activities and inputs by people to produce, change or maintain a certain land cover type" indicating the influence of the actions of people in their environment on the dynamics of land cover (Di Gregorio and Jansen 1998). Kayden (2000) considers that land use planning is made by state officials who should comprehensively analyse and make recommendations for a sustainable future use of specific land areas. Public regulation of land use includes four main aspects: the "type, density, effect and the aesthetic impact of use" (Salsich Jr. and Tryniecki 2015). The state derives its regulatory authority from the police power (Salsich Jr. and Tryniecki 2015). The power employed by the state to regulate land use encounters resistance by other actors who want to have access to these lands and who make use of different power elements to achieve this. Having access to natural resources, whether legally or illegally, is an essential need for the livelihood of many forest-dependent people, especially in developing countries (Sunderlin et al. 2005). In other words, there are different forms of access to resources and not all of them are legally authorised by a "politico-legal institution" (Sikor and Lund 2009). The notion of 'access', with regard to natural resources governance, was briefly defined by Ribot and Peluso (2003) as "the ability to derive benefits from a thing". Access to resources is seen as consisting of specific bundles of power within webs of power that allow different actors to "gain, control and maintain" this access (Ribot and Peluso 2003). Power is perceived by Peluso and Ribot (2020) as being the result of struggles within emerging social relations. Furthermore, the attempts to gain, control and maintain access are seen to be struggles within social relations, and this allows one to consider "the bundle of powers as relational" (Peluso and Ribot 2020). In the theory of access, those who control and those who attempt to gain and maintain access have different types of relations (Peluso and Ribot 2020). These relations can comprise "competition conflict and negotiation" (Peluso and Ribot 2020). Controlling access is mediation of the access of others but also their exclusion. Gaining and maintaining access is only possible when there exist relations with those who control (Peluso and Ribot 2020).

At least since the works by Max Weber, the concept of power has been extensively scrutinised in academic literature. Despite the proliferation of works related to this concept, there is no consensual definition of power. A constellation of a multitude of proposals and interpretations regarding the concept of power exist

in the literature, depending on social context and disciplines. These definitions include those from a political science perspective (Dahl 1957; Allison and Zelikow 1971; Wight 2002), from political philosophy (Foucault 1991) and sociology (Crozier and Friedberg 1980; Scott 2010). On the one hand, some definitions of power consider it as a 'possession', which cannot be shared and which should have a specific function and place. This perception of power was supported in particular by the development of the theories of sovereignty and legitimate authority (Holeindre 2014). On the other hand, power is seen by some in contemporary societies as being a 'social relation' between actors (Revault d'Allonnes 2014). Foucault perceives power as a relation or practice in which the behaviour of an actor can be changed by another actor without any apparent coercion (Foucault 1991). Weber considers that power is not limited to the capacity but to the execution of this capacity. He defines power as the option of imposing one's will within a social relation despite resistance and regardless of the means on which this option relies (Weber 1978[1922]). In the same vein, the state, according to Weber, has the exclusive legitimacy to use coercion and force in order to enforce the law while imposing a 'general interest' over self-interest (Weber 1978[1922]).

From a more empirical angle, Krott et al. (2014) developed further the definition of power and its fundamental elements in the frame of an 'actor-centred power' approach (ACP). According to the authors, power can be empirically defined as "a social relationship in which actor A alters the behaviour of actor B without recognising B's will". In such a relationship, the relation between A and B can be summarized as follows: Actor A acts as a 'potentate' (the actor who is altering the behaviour of the other actor) who forces actor B to react as a 'subordinate'. Many power theories consider that behaviour and outcomes are both part of the essence of power. ACP considers that achieving a certain outcome in a power relationship does not only depend on the behaviour of actors but also depends on other technical and natural factors. The outcome is the objective of the actor for which he/she will struggle to enforce his position within a certain social relationship by forcing the other actor(s) to change their activities. The effective achievement of these objectives is influenced additionally by ecological, economic and social factors. It might even happen that if the potentate has a wrong understanding of ecological factors, he/she may force a behaviour that causes an outcome opposite to what he/she expected. Power is seen as an important social factor but not the only factor shaping outcomes. The three fundamental power elements defined by the ACP are: coercion, (dis)incentives and dominant information.

(a) Coercion

Coercion's aim is "altering the behaviour of a subordinate by force". The force can be linked to physical actions that are declared or anticipated. For example, this might be prohibiting the physical access to forestland resources above ground (wood, wildlife, arable land) and below ground (mining, oil) and fencing a certain area, or restricting its access through the deployment of armed forest rangers. In this case, the subordinate can try to resist by crossing/destroying the fencing, or accessing the forestland in the absence of the forest rangers. Resistance to the potentate's coercion can also include the use of violence (e.g., armed rebellion, wildlife poaching, illegal logging). In a way similar to real force, the threat of force is also considered a form of power in this kind of social relationship. These threats are often used by the forest administration to force people to comply with laws in case of disobedience and are, in the majority of cases, enough to implement a certain political process. The subordinate's belief regarding the potentate's source of power determines the extent of the threat's effect. This belief builds on the degree of visibility of the potentate's sources of force. To threaten, the potentate can make use of the subordinate's belief even

if the actual power resources are weaker in practice than are perceived. Furthermore, some of the threats are observable within public or closed discourses in the political processes. As an example, forest law contains different sanctions that comprise physical force, such as incarceration. The state has the power of sanctions, which includes physical force. Forest administrations can threaten with these sanctions to influence the behaviour of subordinates.

(b) Incentives and disincentives

The use of (dis)incentives aims at "altering the behaviour of the subordinate by means of disadvantages or advantages". An example of disadvantages are the penalties employed by state bureaucracies of forest police vis-à-vis illegal logging operators, or facilities offered to certified wood in government procurement and public markets. The potentate in this case does not follow the will of the subordinate. Instead, the latter is strongly encouraged to change his/her behaviour and comply with the rules of the potentates in order to avoid penalties or to benefit from specific advantages. Using disadvantages to alter the behaviour of the subordinate is closely linked to the coercion of the potentate in order to force the subordinate to consider the risk of losing a benefit by not changing his/her behaviour to meet the potentate's interest. Being forced to pay a penalty is coercion, whereas the amount of the penalty is a disincentive.

There are material and immaterial (dis)incentives. Material incentives can be implemented by providing money, equipment (e.g., machines, tools), or vital resources (e.g., food, water). Immaterial incentives can be implemented by offering social and psychological advantages, such as those based on moral demands, education, or healthcare. The same sources can also be used as disincentives such as cutting some subsidies or acknowledging that certain actions are disturbing the social conventions.

(c) Dominant information

Krott et al. (2014) defined dominant information use as a situation in which a powerful actor such as the potentate aims at "altering the behaviour of subordinate by means of unverified information". ACP differentiates between 'shared information', which considers the availability of a certain level of the information for the other actor and 'dominant information', which limits the capacity of the subordinate to verify it. In the latter case the potentate provides information omitting some of the facts. Based on this partial information the subordinate makes wrong decisions and behaves in a manner not in accordance to his will. The inability to verify the provided information in such a situation can be (i) unavoidable if the subordinate is obliged to accept the information as is, simply due to a lack of means of verification. For example, forest-dependent people are rarely able to check the reliability and exhaustiveness of the information provided by forest industries regarding forest management as the basis for benefit-sharing of forest revenues. It can also be (ii) voluntary when the subordinate trusts the 'good will' of the potentate and the ideologies that he represents.

Based on the theoretical framework described above, we developed three hypotheses:

H1: The major political crises, such as the revolution of 2011, can significantly change the power relations between state and non-state entities involved in the governance of specific land uses.

H2: In a post-revolutionary context, the use of coercion by state bureaucracies in regulating forestland use cannot be efficient without combining coercive measures with other core elements of power, such as incentives and dominant information.

H3: A loss of power through the use of dominant information by state bureaucracies in a post-crisis situation does not necessarily lead to a better sharing of that information among non-state actors involved in the governance of forestlands.

3. Methodology

3.1. Presentation of the study area

The selected study area is located in the northwest of Tunisia, Governorate of Jendouba in the city of Tabarka. It covers a total area of 12,437 ha[1], which includes three forest series within the forest of Mekna (Mekna I, Mekna II and Mekna III). Forest series are the units dividing the forest of Mekna and are allocated to different local forest administrations for an easier management. Every forest series has its own management plan, and is made of several parcels. Currently, these forest series have no valid management plans. The most recent plans were made in 1983 and covered the period from 1984-2007. However, these management plans are the only official source from which we can get information related to forest ownership, forest area and species.

All the area selected is under a forest regime which is defined in the forest law as being a set of specific regulations applicable to the forests, the lands suitable for forestry, national parks and natural reserves etc., to ensure the protection, conservation and sustainable use of the resources, as well as to grant the legal users' rights.

3.2. Justification of the choice of the study area

The study area has several specificities that allow the observation of different dynamics in terms of forestland access and use. In the following paragraphs we present the main motivation for the selection of the three forest series in Mekna.

(a) Forest ownership

Except for a negligible area that is mentioned in the management plans as being privately owned land, the area studied falls under the most common forestland ownership category in Tunisia: state ownership. The law defined different legal categories of state ownership, all of which are represented in the case study area. The main two categories of state ownership are: (i) State forest domain, which includes forestlands that are registered (with titles) or those which are just claimed to be state-owned (requisition), in addition to lands dedicated to reforestation activities; (ii) State private domain, which includes lands that are managed based on the law of state agricultural property management. When they are under the forest regime, the forest service intervenes only to control, but not to manage (Table A and B Annex 2). Choosing a study area that is almost entirely state-owned allows one to better analyse the state's power to regulate different types of land use, as well as any possible resistance from the forest people living in these areas.

(b) The effect of existing infrastructure

Studies have shown that the development of road networks contributes to a facilitation of the access to forests and thus to an increase deforestation, as well as to wildlife and carbon storage vulnerability

[1] Area calculated by the expert who made the maps

(Mayaux et al. 2013; Kleinschroth et al. 2019). The dense road network of the study area and its closeness to the city of Tabarka were additional factors that motivated us to focus on it. Furthermore, the creation of a water dam in 2003, on state-owned land, required a suitable solution not to affect the livelihoods of inhabitants who were living in the area and from the existing resources. This allowed the observation of more dynamics in terms of land access and use, especially with regard to the decisions concerning relocation of these people to other regions.

(c) The location

By selecting these three forest series, different ecosystems and forest functions were taken into account. They consist of (i) an area near the urban and touristic zones of Tabarka (Mekna I); (ii) a forest on the coastal line, which plays an important role in fixing the sand dunes (Mekna III) and a vulnerable cork oak ecosystem with good access to roads, expanding urbanization and agriculture (Mekna II).

3.3. Data collection and analysis

Empirical data was collected from April 2019 to February 2020. It consists mainly of (i) *document analysis* (e.g., management plans, annual reports, statistics of the local administration, forest laws and strategy) and (ii) *cartography of land use* in the study area, showing the evolution of forestland use (e.g., forest cover change, logging, forestland conversions to urbanisation and agriculture). Our diachronic analysis covered the period from 2000 to 2019 for a comprehensive overview of the land use dynamics before and after the Tunisian revolution of 2011. The initial reasoning was to elaborate the maps for the sequences of nearly five years (for the years 2000, 2005, 2009, 2014, 2019) covering equally the periods of pre and post-revolution. However, due to the poor quality of available images from the years 2005 and 2009, we chose the year 2010 instead of 2009. As a result, we made the maps of land use for the years 2000, 2010, 2014 and 2019, which allowed a more accurate calculation of the different areas. This cartography was based on Landsat images available online[2]. The selected images were taken in August for a better detection of forest landscapes. The image processing started with the atmospheric correction and the image cropping of the selected study area. Then, a supervised classification into six classes was made (forest, grassland, buildings, agriculture, bare soil/sand and water). The different polygon areas were calculated and the layers for airport, roads, rivers, wildfire (2015 and 2017), as well as the limits of the study area, were added. (iii) *Face to face, phone and email interviews* with selected experts in the governance of forestlands in Tunisia and the study area included former civil servants and researchers. These interviews allowed us to clarify and complete the missing data and aspects that were unclear, related to the forest management in the study area. In the course of the study there was a high number of phone interviews. The table in Annex 1 shows only a selection of key interviews. In addition to this first round of interviews, *80 semi-structured interviews* (Annex 1) with local 'forest people' (forest-dependent people) took place in the area where the forest services recorded the highest numbers of offences. Our empirical data reveals that the number of inhabitants in 2014 was about 9,700 inhabitants. However, this number has considerably decreased due to the construction of the water dam in the study area. Inhabitants were required to leave their houses (Interview 7).

[2] Landsat 7 for the year 2000; Landsat 5 for the year 2010 and Landsat 8 for the years 2014 and 2019 with a spatial resolution of 30 meters. All images were downloaded from the website http://earthexplorer.usgs.gov/

4. Results

As we pointed out in the conceptual and analytical framework, the qualitative power evaluation presented in the results section is based on actor-centred power theory, which defines three main categories of power elements (coercion, (dis)incentives and dominant information).

In its focus on the dynamics of forestland use change in the study area, this evaluation applies a scale of three grades:

-*strong power* (++), if a power element used by an actor is clearly mentioned in the law, identified in practice and/or clearly mentioned in documents;

-*no power* (0), if there is no evidence and no use of this power element by the actors; and

-*intermediate power* (+), between (0) and (++), if an increase or decrease in the use of power elements between the pre and post-revolution periods is identified and/or if there is little use of a certain power element by a specific category of actors. As an example, in the case of deforestation the results show that the use of dominant information by the state before the revolution was strong (++), because only the state had very good information on forest use. Since the revolution, the quality of the state's information has decreased. However, there is no data with which to measure exactly the quantity of the information. Thus, the grade assigned to describe this decrease is (+).

The two main categories of actors considered in this evaluation are state and non-state actors´ groups. In Tunisia, the Ministry of Agriculture and Water Resources manages most of the use of forests, water, and agricultural resources. Under the Ministry there are different General Directorates that manage forest, agriculture and water resources; they are represented at regional and local levels. Thus, the state actors are mainly the Ministry of Agriculture and the related directorates. Nonetheless, this does not exclude the intervention of other ministries, like the Ministry of the Interior, the Ministry of State Property and Land Affairs, the Ministry of Environment, in decision-making.

Regarding non-state actors, forest people, who comprise farmers and private logging companies/individuals, are the main actors intervening in the study area.

Table 1 shows the power relations and their changes after the revolution in the three important land use issues of deforestation, infrastructure project building, and use of state-owned agriculture lands. The following section presents the results in detail.

***Table 1**: Change in power resources of state bureaucracies and non-state actors in the governance of forestland use in Northwest-Tunisia before and after the 2011 revolution.*

Land use	**Time period**	**Regulation by power sets**				
		Actors	**Power elements**			
Deforestation			**Coercion**	**Incentives**	**Disincentives**	**Dominant information**
	Before revolution	*State	++	+	0	++
		**Non-state	+	0	+	+
	After revolution	State	+	+	0	+
		Non-state	++	0	++	++
Infrastructure projects	**Time period**	**Actors**	**Power elements**			
			Coercion	**Incentives**	**Disincentives**	**Dominant information**
	Before revolution	State	++	++	0	++
		Non-state	0	0	+	0
	After revolution	State	++	++	0	++
		Non-state	0	0	+	0
State-owned agricultural lands	**Time period**	**Actors**	**Power elements**			
			Coercion	**Incentives**	**Disincentives**	**Dominant information**
	Before revolution	State	++	+	0	++
		Non-state	+	0	+	0
	After revolution	State	+	+	0	+
		Non-state	++	0	++	0

↓ 0: no power observed; ++ strong power; +: all other intermediate power between 0 and++;

↑ Opposed actors' power; Change/ shift of power identified after the revolution

*State actors: Ministry of Agriculture (regrouping sectorial policies related to forest, agriculture, water dams and hydraulic projects); **Non-state actors (forest-dependent people, which, in addition to dwellers, can include farmers or private logging firms/individuals)

4.1. Regulating deforestation in the pre- and post-revolution periods

This section focuses on an analysis of the power of state and non-state actors related to forest protection activities. Overall, a shift in power sets has led to a change in the existing regulatory effect. The state lost the effectiveness of its coercion measures and dominant information, while non-state actors gained more power regarding both elements (Table 1).

(a) The state's regulation of forestland use

The maps (Figure 1) show the land use dynamics over almost two decades, from 2000 to 2019. A full-size version of these maps can be found in Annex 4.

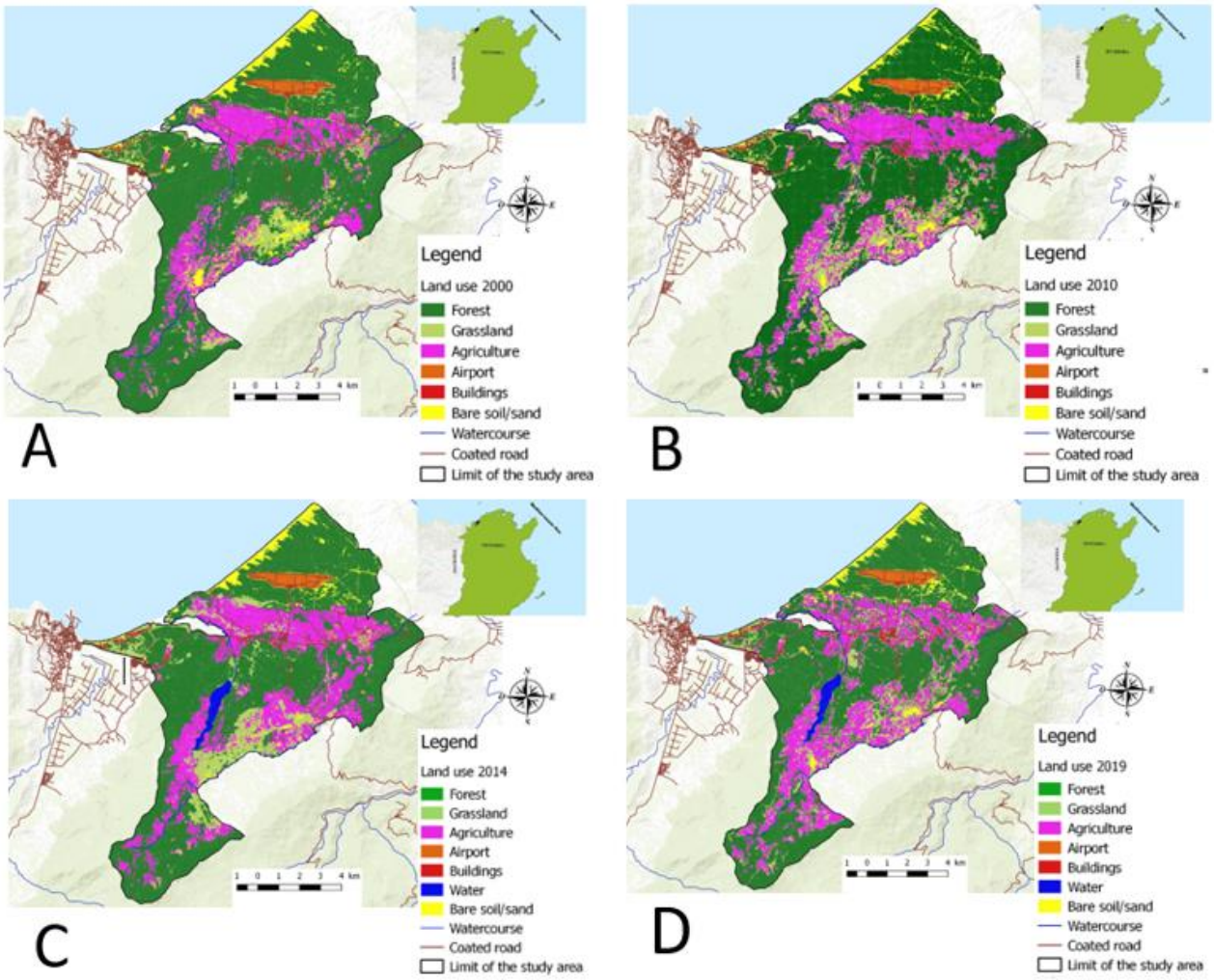


Figure 1. *Dynamics of the land uses in the study area between 2000 and 2019.*

Forest area has decreased in the study area over the selected period by nearly 1,500 ha (Figure2). However, the areas for different land uses, as estimated from the maps (Figure 2), revealed that the forest loss in the pre-revolution period (nearly 1,000 ha) was much higher than in the post-revolution period (about 500 ha). This means less forest area was lost or converted into other land uses after the revolution than was in the pre-revolution period. In turn, this raises the question of whether a more powerful state was involved in forest resource protection after the revolution.

The analysis shows that one of the driving factors behind the forest losses before the revolution was the strong investment in infrastructure projects in this town. The state-driven urbanisation development was much faster between the years 2000 (map A) and 2010 (map B), where it increased by 79 ha (from 33 ha to 112 ha) of building area, as opposed to the increase after the revolution, of only 43 ha. The pre-revolution development projects included the construction of a regional hospital (officially announced in 2007 and unveiled in 2013), two professional training centres related to tourism services (built in 2005), and the

construction of new hotels in the tourist zone of Tabarka. These constructions are located on the state-owned lands and were controlled and planned mostly by the state authorities (erecting public institution buildings, providing tourist services, and developing new housing). After the revolution, the expansion of infrastructure projects slowed down and the new drivers of deforestation were mainly illegal fires and logging.

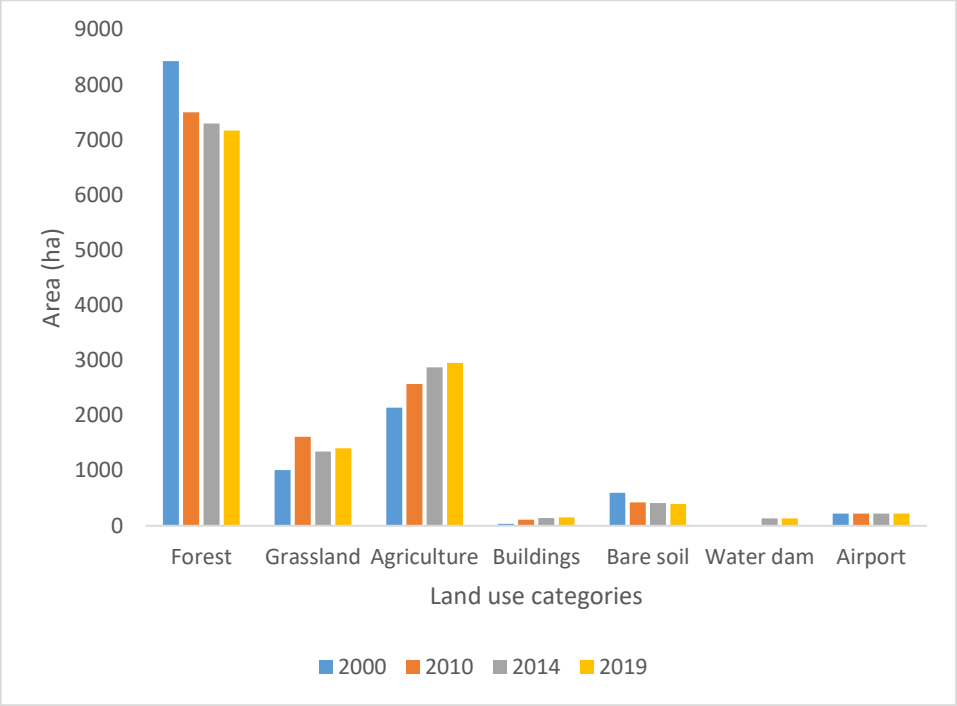


***Figure 2**. Evolution of the change in forestland use between 2000 and 2019*

In addition to the 328 ha of forests lost, due mainly to illegal logging between 2010 and 2019 (Figure 2), there were 289 ha altered by wildfire in 2015 and 2017 (Annex 3). Overall, before the revolution, forest depletion was regulated mostly by the state bureaucracies involved in planning the projects mentioned, whereas after the revolution the state lost coercion capacity, and therefore forest depletion was mostly beyond its control.

(b) How forest administration deals with illegal logging

The statistics of the local forest administration between 2000 and 2018 show that the number of recorded `illegal´ logging instances was significantly higher after the revolution of 2011 than before (Figure 3).

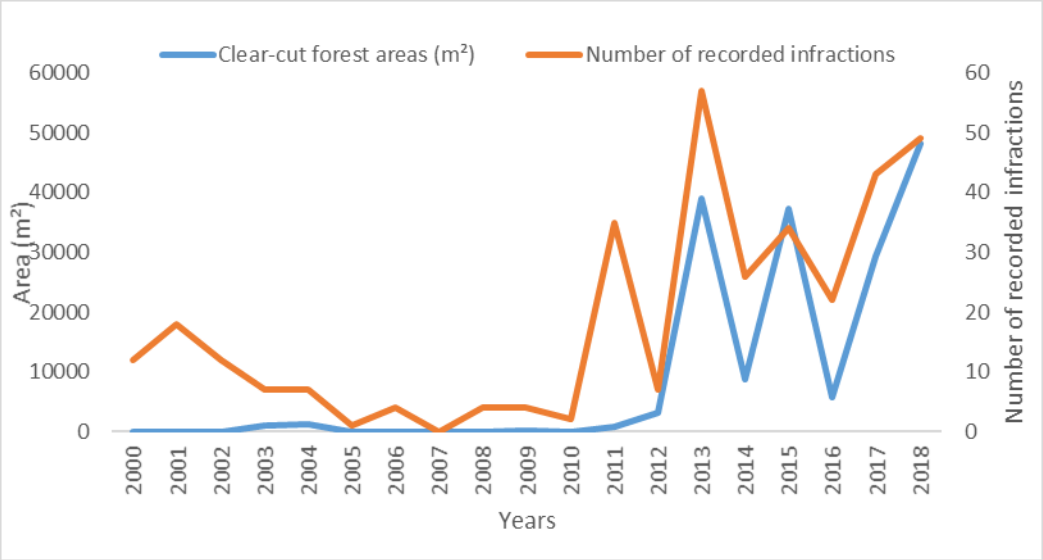


***Figure 3**. Evolution of recorded infractions in the forests and the clear-cut areas between 2000 and 2018*

The comparison of recorded infractions shows a substantial change. During the pre-revolution period, illegal logging in most cases was limited to illegal use of forest bush, exploitation of non-timber products (e.g., harvesting pine nuts) or selective cutting of a limited number of trees. In general, the pre-revolution statistics show that the quantity of forest products illegally harvested was limited to the transportation capacity of one person or a small group. After the revolution, a considerable increase in clear cutting happened. The forest area cleared in this period was between 729 ha in 2011 and 48,150 ha in 2018, which is much higher than the maximum of 1,190 ha before the revolution, achieved in 2004. These kinds of infractions in the forest were often mentioned in the administration's statistics, together with a change in land use (e.g., occupying the forest land illegally by erecting new constructions). Furthermore, different forest agents in central and local forest administrations confirmed that the recorded areas for 2011 and 2012 do not reflect forest depletion entirely, because the administration faced serious security issues during the revolution period, and this influenced agents' capacity to monitor illegal logging properly (Hasnaoui and Krott 2019).

(c) The access of forest people to forestlands

Before the revolution, the physical presence of forest people on state-owned forestlands was one of the main reasons for the forest services to tolerate some illegal harvesting or conversion of limited forest areas to agriculture, in order to enable people to survive. After the revolution, the weakened state was forced to show more tolerance, to continue providing contracts as incentives for these people, and to increase their wages despite the limited budget. In addition, the forest administration has recently implemented a project of forest law reforms, made under the pressure of international organisations, to recognise the rights of forest people to formally profit from selling forest products. However, this is only if they adhere to a structure called Agricultural Development Groups.

The use of forest products by forest people was diversified. Forest access focuses mainly on two targets (see Figure 4). The first one is peoples' survival, mainly by using firewood, grazing resources and oak acorns (also used to feed animals). The second target is to legitimise their presence in a defined area, or to demark a corresponding territory by fencing, which requires bush collection from the forest. This is their

main use of forestland resources. While fencing seems to be an important activity, forest people do not consider land property to be an important issue. Their main concern with the forest services is the confiscation of the extracted forest products. Figure 4 shows that the main goal of forest people is to have access to resources for their livelihoods. Acquiring the property of forestland does not seem to be a priority, since for many of them fencing is enough to prove their legitimacy and property rights, especially after the revolution, and it is observed most frequently within state-owned forestlands.

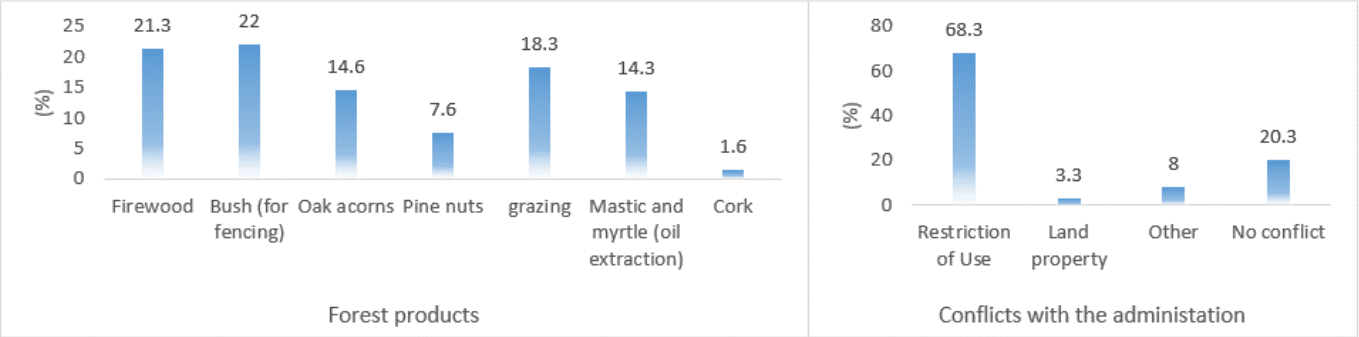


***Figure 4**. Main forms of forest use by forest people (left) and the main conflicts between forest people and the administration (right)*

Since the revolution, forest people have been playing a crucial role within the process of forest product sales, despite not benefiting directly from this commercial activity. Before the revolution forest services at national and regional levels had the capacity to limit the area and quantity of forest products to be harvested by private enterprises or individuals. Generally, the sales happen in public auctions organised by the state, and the harvesting process following the sales is controlled by the state forest agents on the field. After the revolution the state's capacity to verify and control activity on the field were weakened (especially at night or in areas with difficult access), while market actors gained more access to illegal harvesting by trespassing beyond the areas defined by the administration. To be able to successfully hide the illegal logging information, market actors were employing forest people who knew the most about the resources available and the best time to harvest in order to avoid the authorities.

These results allow to better understand the shift in actors' power (Table 1). Before the revolution, the state relied mainly on a high degree of coercion to control and regulate deforestation, including logging activities. This was done either by issuing permissions to cut or by applying sanctions, while the non-state actors, particularly forest people, exploited forests to survive. After the revolution, the state lost this capacity to sanction the illegal logging, while forest people gained more power to access the forestland resources, especially through fencing of specific areas (coercion) and their conversion into agriculture land. The state continued to provide weak incentives consisting of small contracts in order for forest people to carry out the forestry activities. Despite the increase in wages for forest people, these incentives cannot be considered to be strong, since they are limited to few weeks of work per year (Interview 1). The presence of forest people on the state-owned lands appears to be a source of power vis-a-vis the state. This physical presence of forest people forces the forest administration to take into account the risk of conflict and social movements that could emerge from a potential eviction or strict access prohibition. This power source for forest people is a disincentive for the forest administration. This motivation increased after the revolution, and the state was asked to give more freedom to these people for the use of forest products.

Through the example of illegal logging the results revealed a shift of power in terms of dominant information. In general, information was never shared between state and non-state actors. Before the revolution, the state was able to control illegal logging because forest officers were able to supervise different commercial activities, among other reasons, because they had more personnel available. This allowed the state authorities to keep the upper hand on dominant information regarding the availability, conditions of access and the use of forest products.

After the revolution, the weakened forest administration was no longer able to maintain dominant information on the quantities of forest products to use, the areas to harvest etc. At the same time, forest people profited from the context of the revolution and gained more confidence to challenge state bureaucracies or to hide their illegal logging activities. In other words, if illegal logging is successfully hidden the state will not be able to apply sanctions, even with an abundance of resources. Therefore, dominant information by land users is blocking the coercive means of the state.

4.2. Using incentives to relocate displaced inhabitants

From 2003 to 2019, a water dam (see maps C and D, Figure 1 and Appendix 4) was installed within the study area. As summarized in Table 1, the results show that the state regulated the process of the dam installation by combining strong coercion, incentives and dominant information. Since the 2011 revolution the state has been able to maintain this regulatory effect without any change.

This project started quite a long time before the revolution. Tunisian law secures the rights of citizens settled informally on state-owned land to obtain compensation (e.g., land, crop losses) if they are removed in order to install a project of general public interest[3]. In the study area 90 households were successfully resettled outside the project area, which was a state-owned land surrounded by forest stands. There is currently an ongoing process of compensation for 25 additional households affected by landslides in the same area (Interview 3).

Before the start of the dam construction, the Ministry of Agriculture, in collaboration with other bureaucracies involved, decided to compensate these people by providing new agricultural lands with property titles and/or financial resources. Those who had agriculture lands exceeding two hectares, or those who were living in poor social conditions and had agricultural land covering 0.5 to 1.9 hectares, were all compensated with a property grant of land in better location, and with better access to different facilities. Regarding the dwellers' buildings and other property (e.g., trees) state experts evaluated the damage and the state provided money and land for construction. Households perceived this deal positively, and the Ministry of Agriculture was able to implement the construction of the dam easily, without facing claims (Interviews 2 and 3).

The state authorities mentioned above made use of strong coercion supported by the land ownership. These authorities were able to physically force inhabitants to move from a specific area to another in order to implement a public-interest project, which is a legal action. However, when relocating these inhabitants,

[3] http://www.mehat.gov.tn/fileadmin/user_upload/Communiques_et_Avis/RevueCPRduPMR2vers21032018corrigee22Juin.pdf

the state provided many incentives, which allowed it to avoid local resistance and conflicts. At the same time, the state, through the Ministry of Agriculture, has strong dominant information, based on the technical expertise of its sectoral bureaucracies, to evaluate the compensations and also to justify the choice of the project's area.

For non-state actors, the power sources related to these kinds of project are quite limited as compared to the sources for state actors. Only their physical presence is a disincentive for the state. As an example, this disincentive compels the forest administration to explore regularly alternative solutions for local communities when planning infrastructural projects, which cannot be implemented without land expropriation, and displacements and relocation of forest-dependent people. While forest protection activities show a considerable shift in the balance of power sets between state and non-state actors, this infrastructure project, which is clearly planned and based on compensation, has not revealed any change in terms of actors' power since the revolution.

4.3. Access and control of state-owned agricultural lands

Results show a weakening of the state's coercion and dominant information, while the non-state actors gained a reinforcement of their coercion and disincentive power (Table 1). Thus, the regulation has been disturbed since the revolution. The forestland areas that were changed to agricultural use increased since the early 2000s, from 2,143 ha to 2,955 ha in 2019 (Figure 2). However, in this time interval there were two different forestland cover changes: (i) agriculture in the south replaced grassland in most cases. (ii) the fragmentation of agricultural lands in the north, which were invaded by forest and grassland (Annex 5). This northern agricultural land has been a state-owned farm for a long time. It was owned by French settlers before the independence of Tunisia (Interview 5). This farm covers a total area of 352 ha and today it is facing management issues and is almost abandoned (Interviews 4, 5 and 7). After the revolution the situation of this land remained unclear. Currently it is managed by limited number of staff, with poor capacity of control over the whole farm (Interviews 4 and 7). The abandoned land offers a good opportunity for people living around this farm to access some parts of it, by fencing selected areas for private agricultural use. The weak management and lack of maintenance has led to the growth of grasslands and forest vegetation inside the farm. The fragmentation seen on the maps (Annexes 4 and 5) is a consequence of surrendering and mismanaging this land, which facilitated the access for other, new actors, and of the growth of new forested areas and grasslands where there was no more activity. In February 2020 it was announced that this state-owned farm would be allocated to a specific type of private agriculture structures called "companies of agricultural valorisation and development"[4].

The only power shift related to agriculture in this land use happened in terms of coercion (Table 1). Before the revolution the state was able to limit the access to these agricultural lands. After the revolution the weakened state became unable to limit physical access, while local inhabitants started informally fencing small areas for their private interests. This explains the described increase of coercion through the increase in fencing activities. The state bureaucracies also lost their capacity to govern through the use of dominant information regarding these areas. Since the farm was abandoned, the limited number of workers precludes control both of productivity and the of the actual situation regarding the progress of informal fencing. Nevertheless, it has not led to an increase in the dominant information of local inhabitants, since they are

[4] http://www.apia.com.tn/actualites/detail/112

not able to hide from the state authorities the physical fencing, their activities and information about the farm's productivity or situation.

Regardless of the efficiency of the state management, the land property substantially supports the state's incentive power. The large share of forests and agriculture lands owned by the state allows different authorities to keep their power to provide incentives, like compensations before and after the revolution, in order to regulate the different forms of land use. However, this incentive power cannot be considered to be strong. With the exception of projects of public interest that require relocating inhabitants, the state has no clear strategy for the use of these agricultural lands to support local communities.

5. Discussion and conclusions

The results allow us to test the hypotheses. The first hypothesis, that "*The major political crises such as the revolution of 2011 can significantly change the power relations between state and non-state entities*" was analysed regarding the three land use issues. It was confirmed only in the case two of these land uses (deforestation and agriculture) but not in the case of the infrastructure project. One of the main causes of power stability regarding the infrastructure project is the sufficiency of state-owned land and resources kept by the state after the revolution, which can be used for compensations. In addition, the state maintained expertise and the legal basis for coercion. In the other two land uses (agriculture and deforestation), and despite the unchanged legal bases, the effect of the threat of implementing the law to affect people decreased considerably after the revolution. In addition, people gained coercion by means of active use and land fencing. Furthermore, in the context of the revolution, the costs caused by the forest people's resistance increased for the state (e.g., worsening the state's image, protests to increase wages).

The case of the effective regulation of infrastructure project confirms the second hypothesis, that "*In a post-revolutionary context, the use of coercion by state bureaucracies in regulating forestland use cannot be efficient without combining coercive measures with other core elements of power".* The issue of the infrastructure project clearly shows that efficient regulation is built on strong coercion combined with incentives and dominant information. In the other two land uses, there were no strong state incentives and no dominant state information that could strengthen weak coercion.

The third hypothesis states that "*in a post-crisis situation, a loss of power through dominant information by state bureaucracies does not necessarily lead to a better sharing of that information among non-state actors"*. In the issue of state-owned agriculture land, the state has lost its dominant information since the revolution. Nevertheless, the non-state actors have not gained more shared information. The issue of deforestation also shows a loss of dominant information by the state, while the non-state actors gained dominant information by hiding their illegal access to forest products.

Based on the actor-centred power, this research allowed us better to explain the actor's power behind the access to forestland resources in a post-revolutionary context using a case study from Northwest Tunisia. The actor-centred power approach differentiates clearly between the power of potentates and subordinates. Potentates are actors who are able to alter the behaviour of the subordinates within a social relationship (Krott et al. 2014).

In contrast with the existing empirical cases, our case study made visible the power elements of the potentate and those of the subordinate, and compared the possible changes. By using this approach, we were able to identify power losses for the state and to differentiate them from power gains for non-state actors. The governance effect is a sum of the state's power and the resisting power of non-state actors. The advantage of our approach is that we were able to show the substantive power gains of non-state actors after the revolution, based on coercion, as well as disincentives and dominant information.

Regarding actors' categorisation, Maryudi and Sahide (2017) focused on differentiating between state actors. Within the same bureaucracy there are conflicting interests. Considering them as a single unit might lead to imprecise power relation analyses. Furthermore, inaccurate categorisation might result in ignoring powerful actors in the analysis (Maryudi and Sahide 2017). In our study we approached the actors' identification according to the actor-centred power concept of potentate and subordinate, and we examined additional factors. Within this social relationship between state and non-state actors, we consider that each actor makes use of its own power set. We selected a specific area as an empirical case study and we identified different dynamics of land use through different data sources (e.g., maps, interviews, field observations, document analysis). This approach allowed us to identify and focus on the main intervening actors, and we regrouped them into two main categories: state and non-state actors. State bureaucracies seek to dominate the non-state actors, like the local population, while these non-state actors attempt to resist this domination. The observations related to the access forms selected showed that different state institutions at national and local levels have the same main objective of controlling access, while the non-state actors, mainly forest people and private users, have been struggling to gain more access to forestlands and to maintain it.

Prabowo et al. (2016) consider that the interests and power of actors may change over time. To capture these dynamics and possible shift of power balance, it is important to consider a long time period to apply the actor-centred power approach. Covering the period from 2000 to 2019 provided sufficient hindsight about a power shift related to the revolution of 2011. According to our observations, the main power shift that happened in the course of the revolution was due to the state's loss of coercion power and to non-state actors' specific gains in power

5.1. Shared information and dominant information in relation to the use of coercion

Coercion, as defined in actor-centred power theory (Krott et al. 2014), builds on the use of force as a source of power. This theory endorses Max Weber's perception of the state, through its different administrations, as the main actor dominating the use of political force. In addition, the rights of control and sanctions provided to the state by the law are considered to be a support for the coercion power element. Based on the results of this study, the main requirement to properly use coercive power is the existence of shared information among the potentate and the subordinates. In other words, state coercion works only properly as long as state and non-state actors have the same knowledge about (i) the existing resources, (ii) how much of this can be used, when and where (iii) the possible sanctions that the non-state actors risk when they commit infractions such as illegal logging. Once non-state actors acquire the power of dominant information, the sharing of information between the two categories ceases to exist, which affects the coercive capacities of the state despite the existence of a legal framework supporting the use of coercion. Below, we explain these interactions between shared information, dominant information and coercion through the example of hidden illegal logging, which we consider to be dominant information power.

Krott et al. (2014) defined dominant information as being a source of power for an actor A (potentate) when it is not verified by an actor B (subordinate), who might additionally trust the provided information and makes use of it without checking its validity. This can be voluntary if the subordinate forfeits verification and criticises his own ideologies, or if the subordinates trust the 'good will' of the actor providing the information. Subordinates can also be forced to accept information and not verify it because of a lack of means or specific methods. The actor-cantered power theory illustrates these different types of dominant information through examples that focus mainly on expertise, knowledge and ideologies. The same theory categorises hidden illegal logging as a form of coercion. By hiding illegal logging the subordinates are hindering the coercive capacity of forest authorities (guards) to stop it physically. In contrast, the current study observes that hidden illegal logging encompasses the use of dominant information in addition to coercion. For example, the collaboration between the private forest users and forest people detailed in the results' section increases the knowledge and the possibility for more access to resources, but also the possibility of hiding information from the state. On the other hand, the lack of personnel in the administration, needed to control all the activities in the field, reduces the access of the state to information about harvested quantities, which in turn forces the authorities to accept the information provided. Additionally, the state has no other choice but to accept the illegal logging happening at night or in areas they cannot reach, because of limited means of control. We consider this example to be empirical evidence of the relevance of considering hidden illegal logging to be a source of dominant information employed by forest users, in addition to coercion. Furthermore, a better regulation of illegal logging, or any other forest-related activity, by coercion works only if the state associates coercion with either shared information or its own dominant information. If a non-state actor becomes able to hide information about illegal logging, this equal sharing of information is extinguished and instead turns into dominant information used as power source. In this case, the state regulation is lost due to a loss of information. Overall, dominant information destroys shared information that supports the coercive power of the state.

5.2. Ways to keep stable power sets: associating coercion with incentives

The state-owned agriculture and forests in Tunisia are a major advantage for the state. In addition to the forests, the state owns currently around 500,000 ha of agricultural land[5] and is unable to manage them efficiently due to a lack of resources. Nevertheless, this land ownership has been one of the main supports for the state's power of coercion since its independence. The use of force by the state has been associated with the power of financial sanctions (disincentives) for any illegal physical access to the state-owned resources. This power set, used by the state before the revolution to implement different policies, has shown its limits. This orientation of the Tunisian state resulted in an unstable balance of power and in permanent resistance from forest users, who wait for any unusual event that may destabilise the authorities, such as the revolution, to gain more access to resources. In another example, in Indonesia, the weakened capacity of the state to enforce law and to provide incentives formed a main factor that contributed to an empowerment of farmers in terms of access to forestlands (Maryudi et al. 2016).

The example of the relocation of households away from the dam site is an example of how the state can use incentives as an alternative power element that can be much more efficient in implementing the relocation decision. Instead of forcing people to move or simply expropriating their assets, allocating

[5] http://www.onagri.tn/uploads/lettre/lettre28-12-2016-5.pdf

compensation lands with better access to the city was enough motivation for them to move from the project area without challenging the state authorities. Using incentives instead of the exclusive use of sanctions can ease the existing conflicts between the administration and forest users, especially if based on a clear legal framework that regulates the provision of this kind of incentives. It can also encourage the citizens to have a more caring relation in regard to natural resources. Implementing the law while providing incentives proved that it can bring more stability into the power balance.

To conclude, the use of an empirical, actor-centred power approach (Krott et al. 2014) in a post-revolution political context, allowed us to identify possible interactions between the defined power elements in regard to an effective regulation of conflicts. The actors make use of different power sets that vary according to the land use case. The main contribution of this paper consists of showing that coercion, which is considered to be the main power source for the state, cannot be effectively used without the existence of shared information or without monopolising the use of dominant information. Furthermore, by observing the power sets' evolution over time in the pre- and post-revolution periods, we noticed that the main shifts of power from the state to non-state actors occurred when the state relied on its coercive capacities before the revolution. In the case study scrutinised in this paper, combining coercion with incentives resulted in a stronger effect on the regulation of conflicts by state bureaucracies. In the same vein, this research also shows the importance of considering the actors' power in the studies of land use change in areas of limited statehood.

References

Agrawal, Arun; Chhatre, Ashwini; Hardin, Rebecca (2008): Changing governance of the world's forests. In *Science (New York, N.Y.)* 320 (5882), pp. 1460–1462. DOI: 10.1126/science.1155369.

Aini, Rafik; Bedhief, Sahbi (2010): Evaluation des ressources forestières mondiales 2010. Rapport National Tunisie. FAO. Rome.

Allison, G. T.; Zelikow, P. (1971): Essence of decision: Explaining the Cuban missile crisis: Boston: Little, Brown (327. No. 729.1).

Chriha, Salem; Sghari, Abdeljalil (2013): Les incendies de forêt en Tunisie. Séquelles irréversibles de la révolution de 2011. In *Méditerranée*, pp. 87–93. DOI: 10.4000/mediterranee.6910.

Crozier, M.; Friedberg, E. (1980): Actors and systems: The politics of collective action: University of Chicago Press.

Dahl, R. A. (1957): The concept of power. In *Behavioral science* 2 (3), pp. 201–215.

Di Gregorio, Antonio; Jansen, J. LouisaM. (1998): Land cover Classification System (LCCS): Classification concepts and user manual. FAO. Rome.

Elloumi, Mohamed (2013): Les terres domaniales en Tunisie. Histoire d'une appropriation par les pouvoirs publics. In *Études rurales* (192), pp. 43–60. DOI: 10.4000/etudesrurales.9888.

FAO (2020): Global Forest Resources Assessment 2020. Key findings.

Foucault, M. (1991): On Governmentality, Lecture at the College de France (1978). In Graham Burchell, C. Gordon, Peter Miller (Eds.): The Foucault Effect. Studies in governmentality. with two lectures by and an interview with Michel Foucault. USA: The university of Chicago Press, pp. 87–104.

Gharbi, Mohamed (1998): Terres privées, collectives et domaniales en Tunisie. In P. Groppo (Ed.): Land reform. Land settlement and cooperatives: FAO.

Hasnaoui, Ameni; Krott, Max (2019): Forest governance and the Arab spring: A case study of state forests in Tunisia. In *Forest Policy and Economics* 105, pp. 99–111. DOI: 10.1016/j.forpol.2019.04.016.

Henia, Abdelhamid (1996): Les terres mortes de la Tunisie utile et les nouvelles stratégies foncières à l'époque moderne. In *Revue du monde musulman et de la Méditerranée* 79 (1), pp. 127–142. DOI: 10.3406/remmm.1996.1740.

Holeindre, Jean-Vincent (Ed.) (2014): Le Pouvoir. Concepts, Lieux, Dynamiques. Auxerre: Sciences Humaines Éditions.

Kayden, Jerold S. (2000): National land use planning in Amercia: something whose time has never come. In *Washington University Journal of Law and Policy* 3, pp. 445–472.

Kleinschroth, Fritz; Laporte, Nadine; Laurance, William F.; Goetz, Scott J.; Ghazoul, Jaboury (2019): Road expansion and persistence in forests of the Congo Basin. In *Nat Sustain* 2 (7), pp. 628–634. DOI: 10.1038/s41893-019-0310-6.

Krott, Max; Bader, Axel; Schusser, Carsten; Devkota, Rosan; Maryudi, Ahmad; Giessen, Lukas; Aurenhammer, Helene (2014): Actor-centred power: The driving force in decentralised community based forest governance. In *Forest Policy and Economics* 49, pp. 34–42. DOI: 10.1016/j.forpol.2013.04.012.

Mares, Hamdi; Lahmayer, Imen (2019): Analyse de la situation foncière en vue de la préparation de la stratégie REDD+ en Tunisie. FAO. Rome.

Maryudi, Ahmad; Citraningtyas, Erlita R.; Purwanto, Ris H.; Sadono, Ronggo; Suryanto, Priyono; Riyanto, Slamet; Siswoko, Bowo D. (2016): The emerging power of peasant farmers in the tenurial conflicts over the uses of state forestland in Central Java, Indonesia. In *Forest Policy and Economics* 67, pp. 70–75. DOI: 10.1016/j.forpol.2015.09.005.

Maryudi, Ahmad; Sahide, Muhammad A.K. (2017): Research trend: Power analyses in polycentric and multi-level forest governance. In *Forest Policy and Economics* 81, pp. 65–68. DOI: 10.1016/j.forpol.2017.05.003.

Mayaux, Philippe; Pekel, Jean-François; Desclée, Baudouin; Donnay, François; Lupi, Andrea; Achard, Frédéric et al. (2013): State and evolution of the African rainforests between 1990 and 2010. In *Royal Society* 368 (1625), p. 20120300. DOI: 10.1098/rstb.2012.0300.

Peluso, Nancy; Ribot, Jesse (2020): Postscript: A Theory of Access Revisited. In *Society & Natural Resources* 33 (2), pp. 300–306. DOI: 10.1080/08941920.2019.1709929.

Prabowo, Doni; Maryudi, Ahmad; Imron, Muhammad A.; Senawi (2016): Enhancing the application of Krott et al.'s (2014) Actor-Centred Power (ACP): The importance of understanding the effect of changes in polity for the measurement of power dynamics over time. In *Forest Policy and Economics* 62, pp. 184–186. DOI: 10.1016/j.forpol.2015.10.006.

République Tunisienne (2011): Code forestier et ses textes d'application. Tunis, Tunisia: Imprimerie Officielle de la République Tunisienne.

Revault d'Allonnes, Myriam (2014): Le pouvoir existe-t-il? In Jean-Vincent Holeindre (Ed.): Le Pouvoir. Concepts, Lieux, Dynamiques. Auxerre: Sciences Humaines Éditions, pp. 37–45.

Ribot, Jesse C.; Peluso, Nancy (2003): A Theory of Access. In *Rural Sociology* 68 (2), pp. 153–181.

Salsich Jr., Peter W.; Tryniecki, Timoty J. (2015): Land use regulation: Third edition. A legal analysis and practical pallication od land use law: American Bar Association.

Scott, J. C. (2010): The art of not being governed: An anarchist history of upland Southeast Asia: Nus Press.

Sikor, Thomas; Lund, Christian (2009): Access and Property: A Question of Power and Authority. In *Development and Change* 40(1), pp. 1–22.

Stephens, Lucas; Fuller, Dorian; Boivin, Nicole; Rick, Torben; Gauthier, Nicolas; Kay, Andrea et al. (2019): Archaeological assessment reveals Earth's early transformation through land use. In *Science (New York, N.Y.)* 365 (6456), pp. 897–902. DOI: 10.1126/science.aax1192.

Sunderlin, W. D.; Angelsen, A.; Belcher, B.; Burgers, P.; Nasi, R.; Santoso, L.; Wunder, S. (2005): Livelihoods, forests, and conservation in developing countries: an overview. In *World development* 33 (9), 1383-1402.

Tounsi, K.; Ben Mimoun, A. (2012): Forest Population in Tunisia: Towards a National Socio-economic Referential Framework. Tunis, Tunisia: Direction Générale des Forêts/ Ministère de l'agriculture; GIZ-Tunis.

Weber, Max (1978[1922]): Economy and Society. USA: University of California Press.

White, Andy; Martin, Alejandra (2002): Who owns the world's forests? Forest tenure and public forests in transition. Center for International Environmental Law. Washington, DC.

Wight, Martin (2002): Power politics. London: Royal Institute of International Affairs.

ANNEX 1

Table A. Main interviews revealing key information for the study

Date	Interview number	Type of interview	Position of the interviewee	Institution
15.01.2020	Interview 1	Phone	Retired civil servant	General directorate of forests
12.02.2020	Interview 2	Phone	Responsible for implementation of the water dam in the study area	Ministry of Agriculture
14.02.2020	Interview 3	Email	Responsible for implementation of the water dam in the study area	Ministry of Agriculture
24.02.2020	Interview 4	Phone	Lecturer of forest ecology	Silvo-Pastoral Institute of Tabarka (Tunisia)
24.02.2020	Interview 5	Email	Lecturer of forest ecology	Silvo-Pastoral Institute of Tabarka (Tunisia)
25.02.2020	Interview 6	Phone	Retired civil servant	General directorate of forests
26.02.2020	Interview 7	Phone	Local inhabitant	-
28.02.2020	Interview 8	Phone	State representative at the locality level	Delegation of Tabarka

Table B. Interviews with forest people

Forest series	Dates of interviews	Type of interview	Number of interviewed persons
Mekna 1	27.04.2019	Face to face	28
	29.04.2019		
Mekna 2	22-04.2019	Face to face	30
	24-04-2019		
	03.05.2019		
Mekna 3	06.05.2019	Face to face	23
	07.05.2019		

ANNEX 2

Table A. Different forms of state ownership of forests

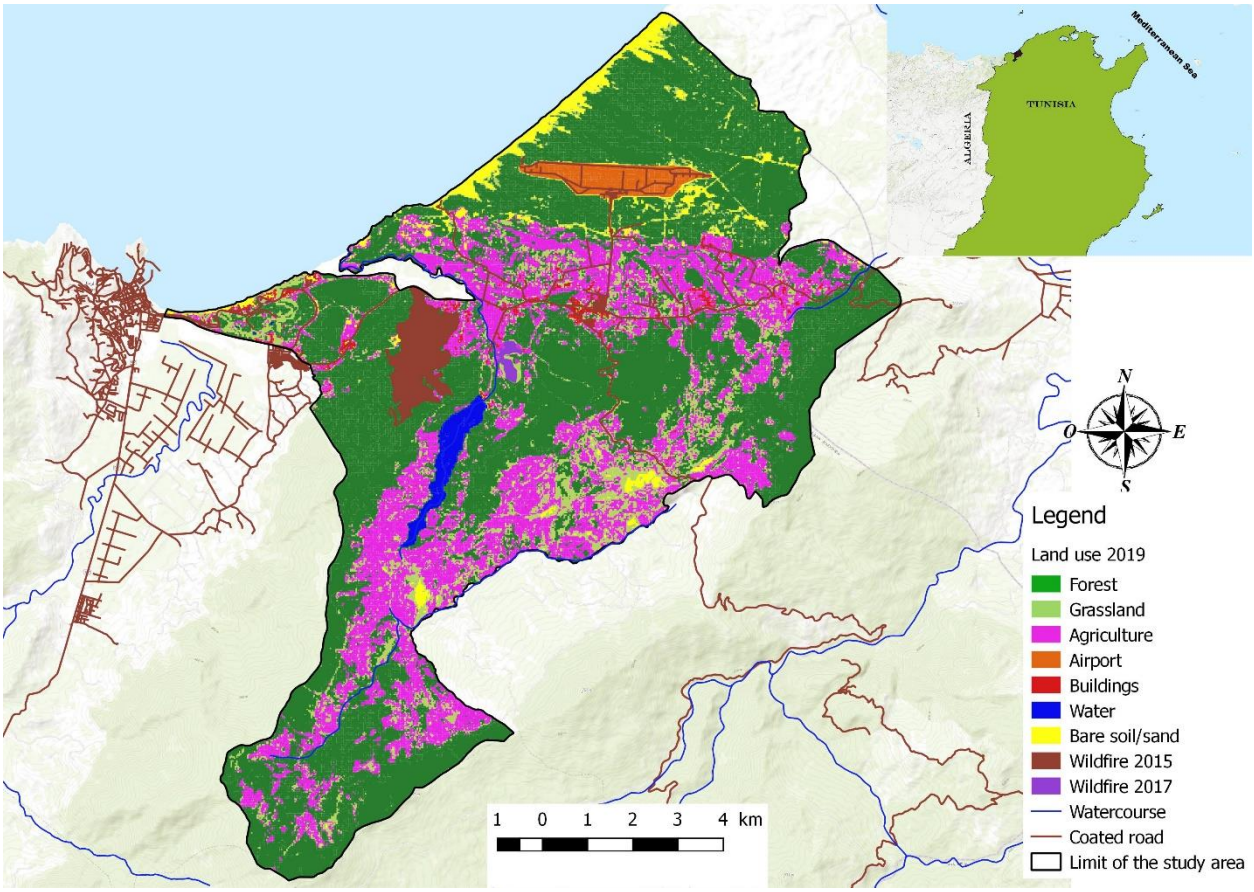
State ownership Category	Explanation/included sub-categories
State forest domain	- The forestlands registered as state forest domain - Forestlands or lands dedicated to be reforested (acquired by agreement with owner or by expropriation decisions) - Forestlands that are not registered but are claimed/presumed to be state-owned **(requisition)**
State private domain	- Includes forests that are registered under the Private state domain and not forest state domain They are considered as agriculture lands and are under the law of state agricultural property management Certain parts can be rented to private users for agricultural use. When these lands are under forest regime, the forest service intervenes in the control but not the management.

Table B. Different forms of state ownership of forests in the study area

Forest series	**Existing Categories of state forest ownership**	**Available details in the management plans**
Forest series Mekna I	State forest domain (Requisition) State private domain	Requisition (around 85%) Private state domain (about 15%)
Forest series Mekna II	State forest domain (Requisition) State private domain State forest domain (registered)	Old management card shows that the dominant categories of ownership are Requisition and state forest domain
Forest series Mekna III	State Private domain	100% of the of the forest area

ANNEX 3

Map of the study area showing the wildfires of 2015 and 2017 (land use 2019)



ANNEX 4

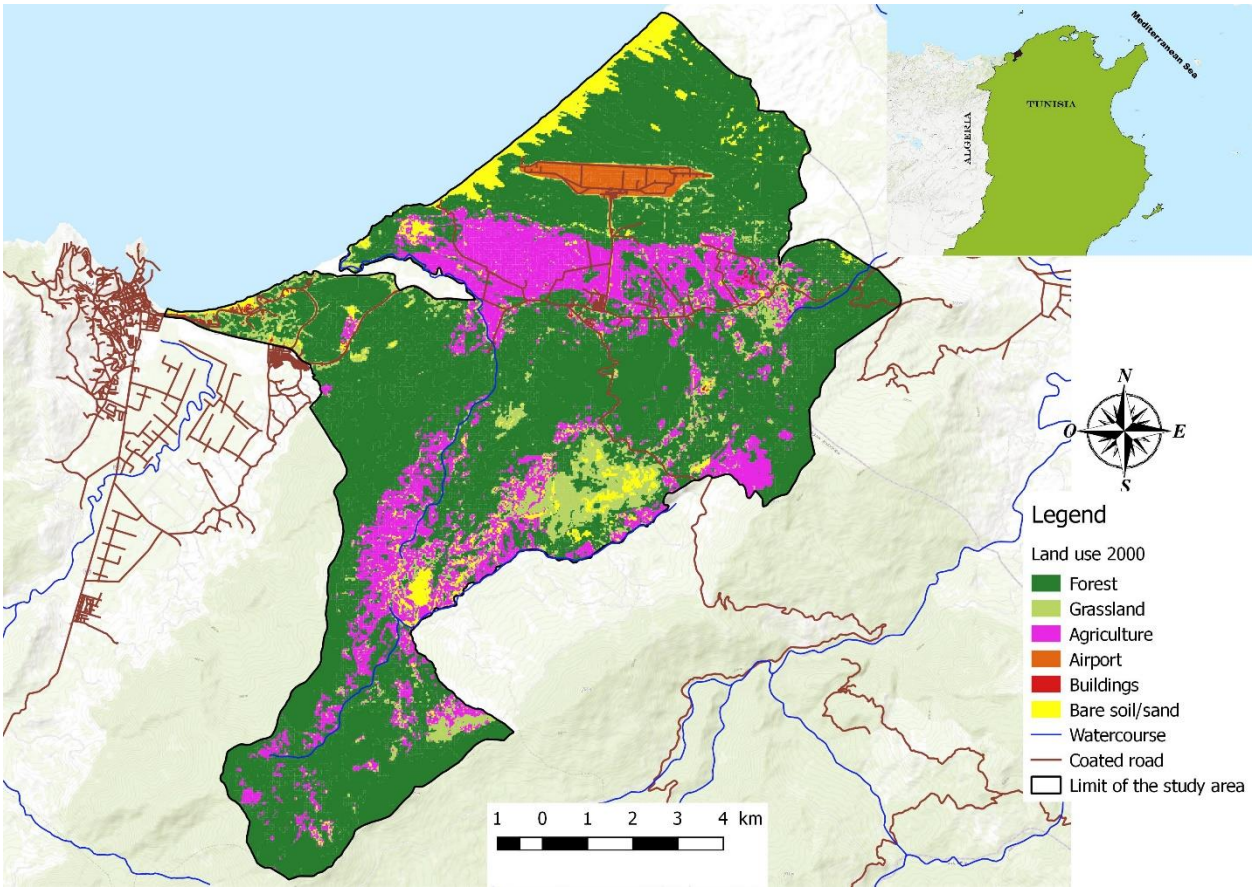


Figure A. Land use in the study area in 2000

ANNEX 4

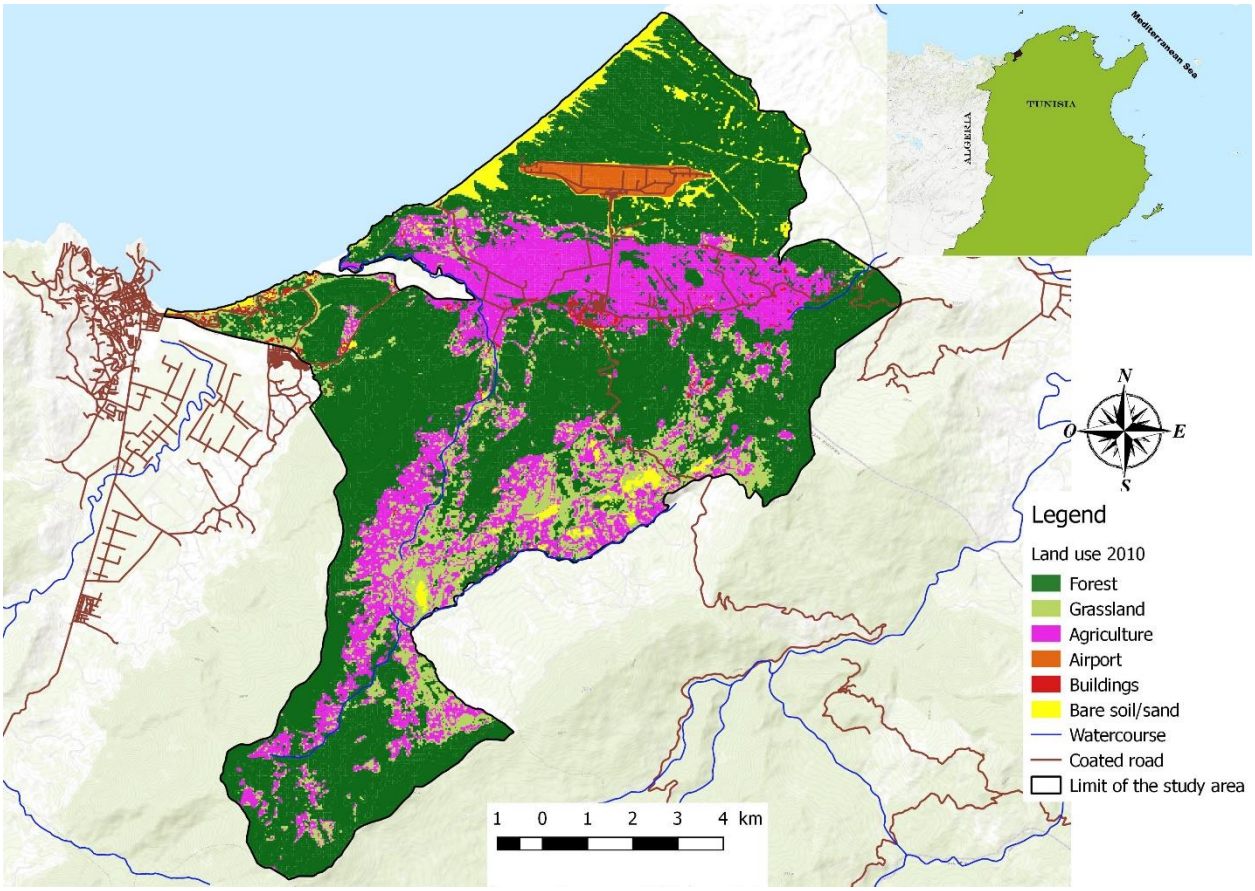


Figure B. Land use in the study area in 2010

ANNEX 4

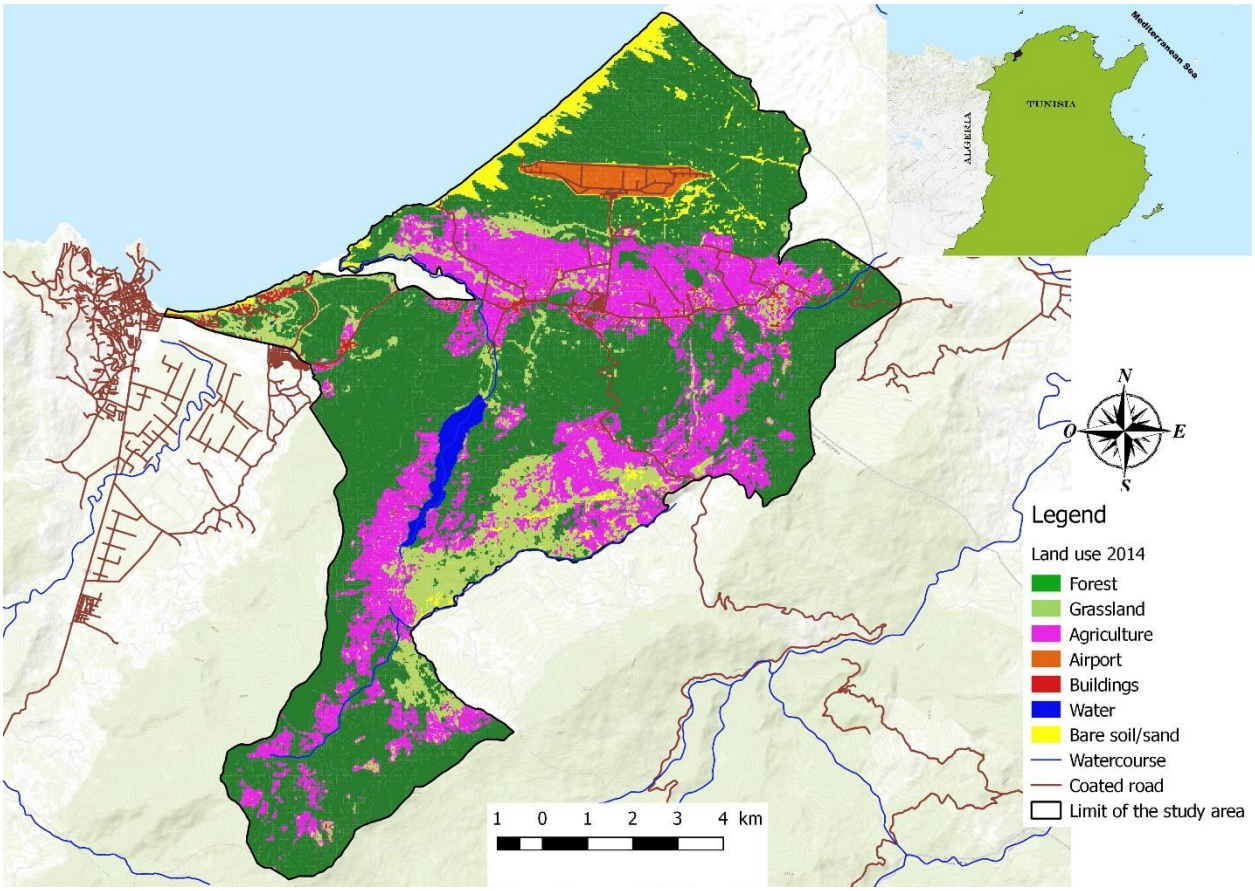


Figure C. Land use in the study area in 2014

ANNEX 4

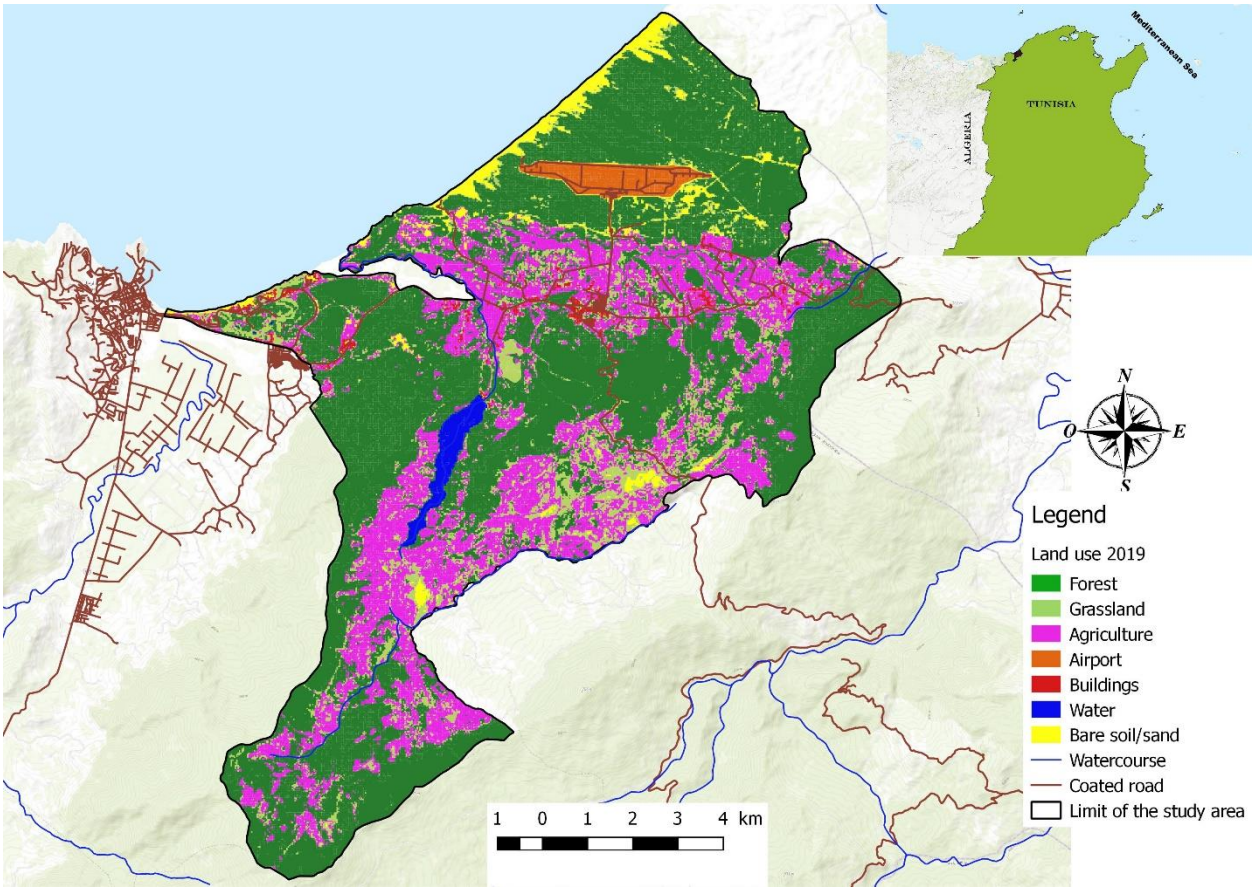


Figure D. Land use in the study area in 2019

ANNEX 5

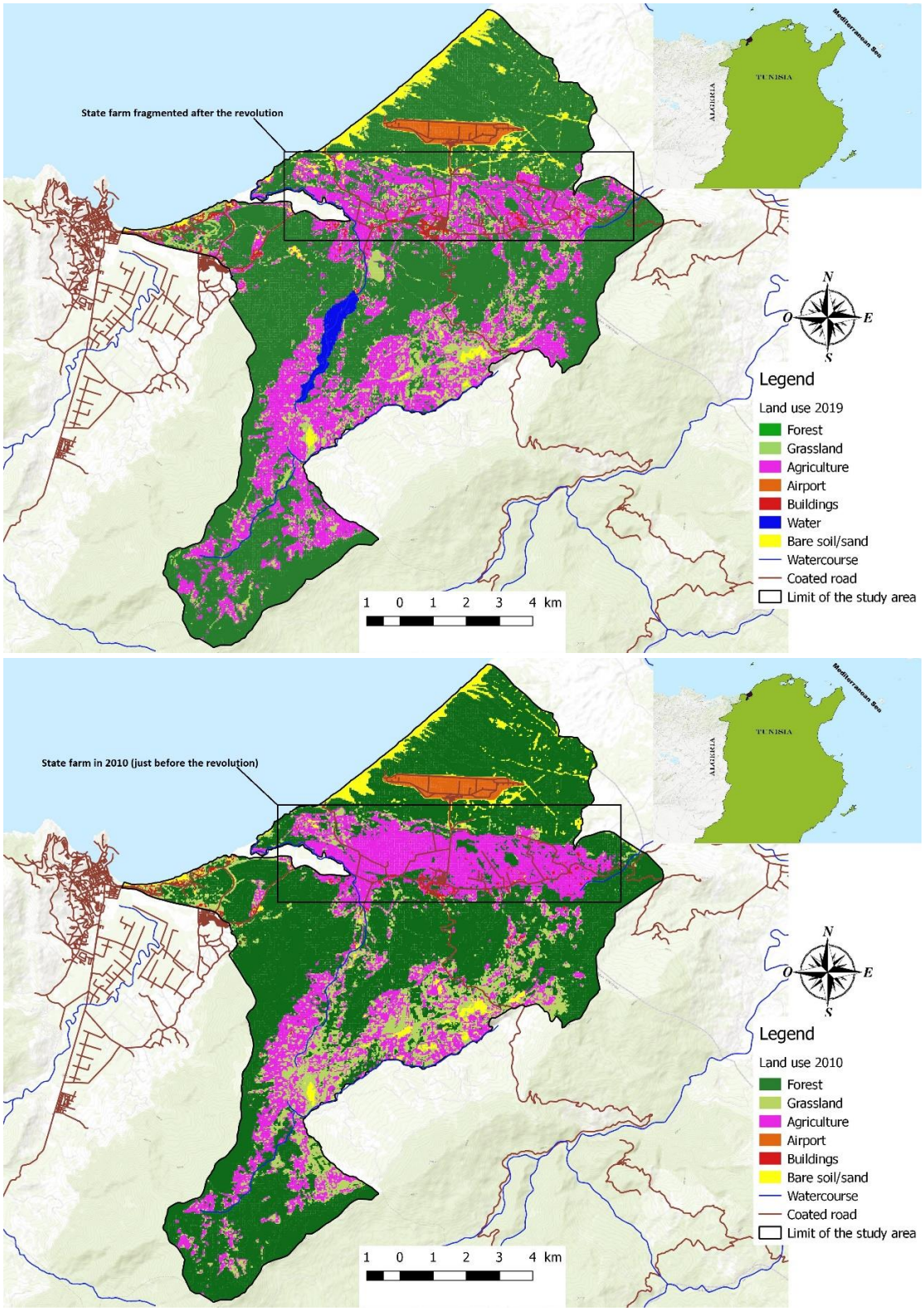


Figure A. State farm before and after the revolution