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LAND MASTERY, MAJOR ISSUE FOR WETLANDS CONSERVATION IN RURAL AREAS Case of Macta in northwestern Algerian.

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ABSTRACT

Context and background

The Macta wetland is a coveted and fragile area with a biodiversity hot-spot on the Algerian western coast and the southern shore of the Mediterranean. This rural area is affected by the increase of human activity linking, mainly, agricultural and pastoral practices. In the context of put into nature reserve for this wetland, the land mastery has become a major issue that currently represents a determining factor in the relationship between man and nature, on the one hand, and in the competition between interest groups for the exploitation of land and natural resources, on the other.

Goal and Objectives:

This study aims to analyze the influence of agricultural development policies and those of land on the implications of the actor's active in the field and their interference with the initiatives to protect the Macta wetland.

The objective was to identify the land and ecological issues at stake in putting into reserve this fragile rural space in order to establish a territorial development more adapted to the socio-economic and environmental conditions.

Methodology:

The working method adopted is based on the mapping of land using Geographic Information Systems with a diachronic approach covering the different stages of agrarian reform from the colonial period until today. The work was completed by field observations and interviews with actors active in the area

Results:

Frequent changes in the policy of the agricultural sector have led to the appearance of over 9400 ha of surplus land, or 50% of the area studied (municipality of Moctadou), in which the interventions of the management authorities for the setting in nature reserve overlap with an agricultural development action by the locals. This has led to a number of problems represented by difficulties in the mastery of land use and land management, as well as conflicts between actors. These constraints have impacted all attempts to make the wetland a heritage site.

Keywords:

Wetlands, actors' strategies, agricultural policy, land ownership, social relations

1. INTRODUCTION

Wetlands cover about 6% of the earth's surface (Graversgaard et al., 2021) and are useful to people (Zedler & Kercher, 2005 ; Mitsch et al., 2015) by storing carbon, purify water (Kingsford et al., 2016 ; Chen et al., 2014 ; Zhu et al., 2021), conserve biodiversity, control flooding (Kumari et al., 2020 ; He et al., 2017 ; Meng et al., 2020), provide food security, protect the environment (Vélez et al., 2018), restore ecosystems and provide habitat for flora and fauna (Ranjan, 2021). They are at the heart of several initiatives such as the United Nations Framework Convention on Climate Change (1992), the Ramsar Convention on Wetlands (1971) and the Convention on Biological Diversity (1992). These conventions are tools for the preservation of wetlands in their different geographical forms.

Wetlands are being degraded faster than any other terrestrial ecosystem due to human activities (Shen et al., 2019 ; Li et al., 2021) particularly agriculture and overgrazing (Swain et al., 2007 ; Zhu et al., 2021 ; Mao et al., 2018 ; Beuel et al., 2016 ; Finlayson et al., 2018) which degrade ecosystems, negatively affect biodiversity, decrease water quantity and quality, increase carbon dioxide emissions (Mao et al., 2018) and alter soil nutrient dynamics (Ho et al., 2018 ; Swain et al., 2007).

Because of the multiple resources that wetlands contain, their management often comes up against sectoral and sometimes contradictory political decisions whose governance generates, over time, conflicts of interest with compromises difficult to manage (Roux et al., 2008 ; Apostolopoulou & Pantis, 2009).

Successful wetland management dynamics must be based on the implementation of an effective political ecology (Matzek et al., 2014). This approach must be operational, legitimate (Jeanmougin et al., 2017 ; Meinard, 2017) and manages the mechanisms of land appropriation (Büscher et al., 2012 ; Corson et al., 2013 ; Igoe & Brockington, 2007 ; Holmes, 2014 ; Zoomers, 2010).

Its success depends on the ability and willingness of the different actors to collaborate (RadojčićRedovniković et al., 2016) because the absence or lack of adaptation leads to a situation of conflict due to overlapping regimes and ownership between opposing interest groups (Adger & Luttrell, 2000).

Therefore, successful wetland conservation is fundamentally linked to the institutions and property rights (the land) associated with resource management decisions (Adger & Luttrell, 2000) as is the case in developing countries (Ahmed et al., 2008).

Studies on land, a central element of wetland control, are few and far between despite the countless debates on the subject at Mediterranean and global levels (Cizel, O. & GHZH, 2010). The majority of them, like Adger & Luttrell (2000) and Ahmed et al. (2008), have only focused on the type of property and its relation to wetland protection decisions without considering the historical and other factors that influence these areas. This is essential for any future planning for sustainable wetland conservation.

Algeria, with the ratification of the Ramsar Convention, has classified since 1980 to date, 50 sites of international importance. In its Strategic Plan 2009-2015, this convention establishes that each of the contracting parties must put in place by 2015 strategies, national policies or equivalent

instruments for wetlands, in parallel with other strategic and planning processes (Directorate-General for Forestry, 2017).

In this context, the promulgation of several legal texts on the preservation of biodiversity and sustainable development (additional references) has created a general awareness for the preservation of wetlands. Finally, all the initiatives culminated in 2017 with the approval of a national strategy for the management of wetland ecosystems, the objective of which is to update the cartography of wetlands on a regional scale, identify their potential, classify them and, finally, propose a series of protective actions.

The application of these tools in the field has been confronted with numerous constraints, including the problem of land and the mastery of its management.

In the Algerian wetlands, some of which are located far from urban centers, rural activities are constantly developing, particularly in the context of the agrarian reform adopted by Algeria after independence. This reform was mainly carried out through land reorganization, which started with the nationalization of large agricultural estates and ended with the allocation of concessions of limited areas to the local population.

Among the Algerian wetlands is the so-called Macta wetland. It is located in the northwest of Algeria and is coastal to the Mediterranean Sea.

In the Macta wetland, the changes have led to the appearance of surplus land in which the interventions of active actors overlap, in this case all persons, structures or administrations involved in the area. These overlaps have led to conflict over the management and use of these plots and to the exodus of new actors (nomads), which has complicated the situation of the wetland and amplified these constraints.

In addition, the uncoordinated management between administrative services with divergent interests and the lack of synchronization between the partners in the area have generated strategies of circumvention and resistance, particularly with regard to the boundaries suggested by the Macta wetland management plan, which represent a point of contention between the stakeholders in the area.

On the other hand, the frequent changes of Walis have contributed to the adoption of contradictory proposals concerning the delimitation of the wetland.

The management of this area (the Macta), which has a high ecological potential, is affected by the disconnection between the different actions carried out, the low participation of the real actors, the rigidity of the ecological discourse as well as the absence of a vision integrating all the socio-ecological parameters in the long term.

Therefore, in the context of Macta, it is imperative to determine the relationship between land tenure, agricultural activity and the protection of the Macta wetland. This work is relevant in our opinion because it is little addressed by the literature on the Mediterranean basin in general and Algeria in particular. Thus, the major concern that has been raised from which some questions have emerged is described below: - What is the impact of land tenure in achieving a balance between wetland preservation (natural areas) and agricultural and pastoral operations? This issue leads us to

formulate the following questions: - What is the impact of land to achieve the balance between wetland preservation (natural areas) and agricultural and pastoral activities? This problematic leads us to formulate the following questions: What are the most important historical changes in the Algerian agricultural policy and its impacts on the Macta wetland? How has the agricultural land of the Macta wetland been structured and what are the repercussions on the initiatives of its protection, in particular, its delimitation, its exploitation and the power relations between the actors? Is it possible to find compromises between the different actors for a better management of this coveted and fragile area? And, finally, what solutions can be proposed?

2. METHODOLOGY

2.1 Study area

The Macta wetland, is a rural area where agricultural activity occupies more than half of its total area of 44,500 hectares. Due to its coastal location in contact with the Mediterranean Sea downstream of a large watershed, the Macta is a relevant study case for analyzing the strategies of actors in the context of conservation actions in a territory with high ecological potential characterized by unstable land use (Ghodhani & Amokrane, 2013).

It is the only wetland in contact with the sea on the west coast of Algeria. The rest of the wetlands are endoreic and much saltier with more or less developed agricultural activity.

The Macta marshes are located 50 km east of Oran and 40 km west of Mostaganem. Most of it is located in the province of Mascara, the rest of the wetland territory is shared between the provinces of Mostaganem and Oran (Figure 1). It is delimited by a network of roads linking the main urban areas of the northwestern region of Algeria; Oran, Mostaganem, Mascara, Sig, Mohammedia (Belgherbi & Benabdeli, 2011).

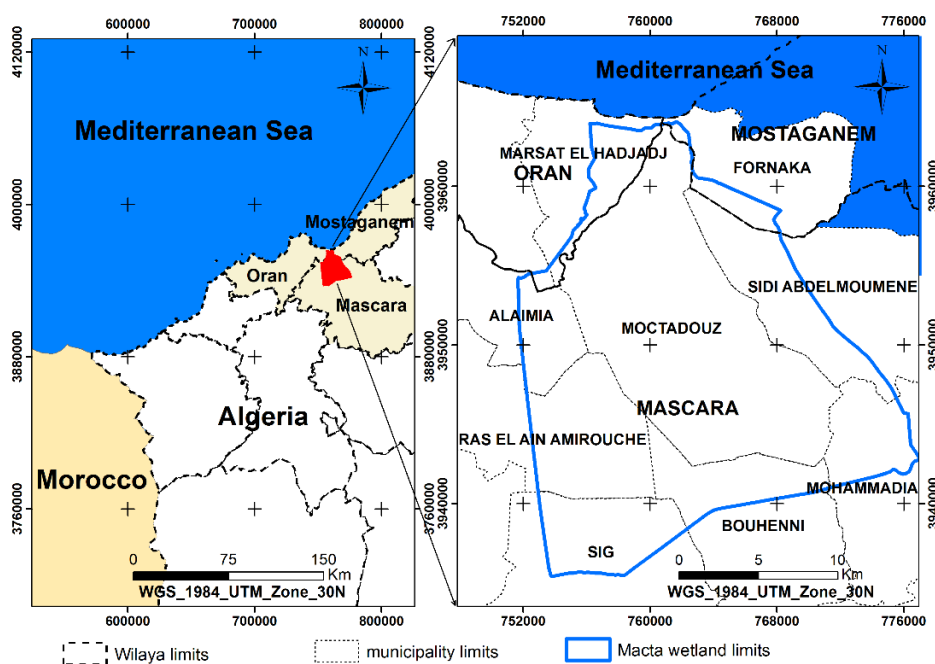


Fig. 1. Geographic location of Macta.

In 2003, the Macta marshes were classified as a wetland to be protected by the Coastal Development Plan within the framework of the so-called "Coastal Law". These marshes, in contact with the

Mediterranean Sea, represent the outlet of a semi-arid hydrographic network crossing three fertile plains: Habra to the east, Sig to the south-west and Macta to the north (Agence de Bassin, 2009).

The Macta depression is fed by the Sig, Habra and Tinnwadis, especially during the rainy period from November to April, in addition to infiltration from the Mediterranean Sea.

From a hydrological point of view, the Macta marshes contain three types of zones:

- Delta, mouth of the rivers flowing into the sea at the level of the Gulf of Arzew.
- Coastal marshes or lagoons, deposits of sediment a few hundred metres from the sea which act as arms on this area
- Floodplain, space of maximum expansion of the river and floods (Belgherbi & Benabdeli 2010 ; Ngo, 2014).

From a hydro-ecological point of view, the Macta wetland is divided into three large homogeneous zones: the marshy zone in the north (10,000 ha), the natural vegetation zone in the middle and the cultivated zone in the south and south-west (Sitayeb & Benabdeli, 2008).

Four geological formations are present: the marine Pliocene, the continental Pliocene, the Calabrian and the continental Quaternary. The evaporation of water from the Habra Plain lagoon after the collapse of the Thyrene and the pre-Flandrian transgression that refilled anew the Great Depression with seawater (Tinthoin, 1948) is the source of the relative salinization of the region.

Thus, the marshes of Macta shelter a diversified flora represented by groups of annual salsolas considered by Quezel & Santa (1963) as rare in North Africa. According to the same authors, *Salicorniaeuropea*, which is extremely rare in North Africa in general and in Algeria in particular, *Spergulariadoumerguaei*, which is endemic to the coastal Oranese region, and *Sueadamaritima* rarely form such large populations.

The ornithological richness is the major element of the originality of the Macta marshes and the main factor for classification under the Ramsar Convention (Ghodbani & Amokrane, 2013). The hivernal international census of water bird carried out in 2016 by the region's forestry services counted 32 species, including 14 protected species and 16 game species, including rare species such as the marbled teal (*Marmaronettaangustirostris*).

The human population of the Macta wetland is 241,300 inhabitants in 2008 and 257,500 in 2018, with an annual increase of about 1,500 inhabitants/year. This population is concentrated in the communes' towns with a total of 157,800 inhabitants, a rate of 64%. The rest is generally found in scattered areas and agricultural villages (Belgherbi, 2011).

The dominant activities in the Macta wetland are mainly agriculture and animal husbandry, the latter being practised by local residents and nomads, particularly in times of drought due to the presence of halophilic species much sought after by sheep breeders.

2.2 Method of data collection and analysis

The approach adopted in the present work consists in analyzing the influence of land tenure policies on the implications of institutional actors on the ground and their interference with the protection initiatives of the Macta wetland. This will involve a diachronic approach covering the colonial period

up to the present day, coupled with a multi-scalar analysis with the integration of several scales of observation; marsh, wetland, Oranese region, national territory, Mediterranean.

In a first step, topographic maps and aerial photographs were prepared for use in site recognition (toponymy) and geo-referencing.

Five topographic maps from 1983 (scale 1/25,000), provided by the National Institute of Cartography and Remote Sensing of Oran (INCT) (Table 1), were geo-referenced using cartographic techniques. A series of 14 aerial photographs from 1983 (scale 1/40,000), covering the study area (Table 1), were corrected and geo-referenced using benchmarks obtained from the previous five topographic maps.

In a second phase, cartographic work on the aspect of land ownership is started. It is divided into two phases, before independence and after independence:

1. For the first phase, four cadastral plans (Senatus Consult) were retrieved from the Archives Centre of the Regional Directorate of the Cadastre of Oran. These plans are in raster format, 2 at 1:20,000 scale, drawn up in 1916, and 2 at 1:10,000 scale dating from 1887 (Table 1).

Each plan was geo-referenced with the topographic maps and the aerial photographs of the same coverage using known landmarks (valley, road intersection...etc).

The parcel layouts, as shown on the cadastral plans (Senatus Consult), as well as the information recorded in the cadastral matrix (owner, area, legal nature, etc.) were digitized. The cadastral matrix was obtained from the Archives Centre of the Regional Directorate of the Cadastre of Oran (Table 1).

Each parcel was assigned a property status according to the following nomenclature: colonial farms, state land, communal land and private land. The latter were organized in the form of map layers.

2. The second phase was divided into three periods. The first two periods presented a lack of data, which was compensated for by the use of the "participatory mapping" technique carried out in collaboration with the officials of the Directorate of Agriculture, local farmers and the president of the farmers' union. This approach allowed us to identify, with the help of a Global Positioning System (GPS), the official boundaries of the Autonomous Domains (first period) and the Socialist Agricultural Domains (SAD) (second period) of the municipality of Moctadouz. These data, based on the experience of our collaborators and field verifications, were organized in the form of a map layer. The third period was studied by the paper cadastral plan of 2014, obtained from the Directorate of Cadastre of the Province of Mascara (Table 1). The cadastral plan was geo-referenced and incorporated into it the cadastral matrix.

The cadastral matrix, obtained from the Directorate of Cadastre of the Province of Mascara (Table 1), contains several columns, including the column "types of use", which contains information useful for the rest of this work (collective agricultural exploitations (CAE), individual agricultural exploitations (IAE), etc.). The latter has been organized in the form of a map layer.

It should be noted that the mapping of the different periods revealed the appearance of surplus land, theoretically agricultural but not yet allocated.

All the boundaries (Ramsar 2002, Forest Conservation 2005, design offices 2014) (Table 1). of the core area were geo-referenced and overlaid on the third period map layer.

The cartographic processing (georeferencing, correction, digitisation, etc.) was carried out with cartographic techniques using the free software Qgis 2.18 and applying the projected coordinate system WGS 1984 UTM ZONE 30N.

The mapping work was complemented by qualitative research techniques represented by (participant) observations and (non-directive and semi-directive) interviews with active actors.

These actors were selected on the basis of previous studies of the Macta wetland (Ziad, 2002; Ghodbani & Amokrane, 2013), the various study reports carried out, as well as Algerian legislation relating to wetland management and those defining the tasks of these actors.

Table 1. Summary of baseline data

Data	Format	Date of completion	Scale	Number of documents	Sources
Cadastral plans (Senatus Consult)	Image	1916	1/20 000	2	Archives Centre of the Regional Directorate of the Cadastre of Oran
		1897	1/10 000	2	
Cadastral plans	Paper	1862-1924	-----	4	Directorate of Cadastre of the Wilaya of Mascara
Cadastral plan		2014	-----	1	
Cadastral matrices		2014	-----	25	
Topographic maps	Image	1983	1/25 000	5	Institut National de la Cartographie et de la Télédétection d'Oran (INCT)
Aerial photographs		1983	1/40 000	14	
Central zone limit (Ramsar)		2002	-----	1	Sub-direction of agricultural services (Bouhenni)
Central zone limit (established by the Forest Conservation)		2005	1/20 000	1	Forest Conservation of Mascara wilaya
Central zone limit (optimal scenario established by the design offices)		2014		1	Report (design offices)
Central zone limit (intermediate scenario established by the design offices)				1	
Central zone limit (trend scenario established by the design offices)				1	

The list of actors includes the actors present on the site (farmers, herders), the administrators of the province of Mascara represented by the officials of the province, the Agricultural Services, the Forest Conservation, the Environmental Department, the Hydraulic Services, the mayors of the communes sharing the wetland.

The final selection of actors was made, according to Harrison and Quershi's suggestion in 2000, by an iterative approach through discussion with pre-identified actors that reveal other previously unknown actors (Herath, 2004).

During the interviews and observations, the list of actors was extended by adding nomads (actors present on the site), associations for the protection of the environment, the farmers' union and the National Agricultural Land Office (ONTA).

The administrative actors have been represented by executives with knowledge of the wetland; two executives for each directorate. While the environmental protection associations and the farmers' union are represented by their presidents.

The interviews focused on the evolution of the different agricultural land structures launched by the state, their consequences on the spatial organization, the future of the wetland, the role of each actor in the protection of the wetland as well as the evaluation of the proposals (initiatives) for its preservation (Table 4).

For the actors present on the site (farmers, herders & nomads) we conducted non-directive and semi-directive interviews with a representative random sample of 45, 20 and 20 people respectively, distributed according to the existing forms of land ownership (CAE, IAE and surplus land I and II).

The exchanges with the stakeholders present on the site also made it possible to address the issue of practices relating to the use of natural resources and the vision of these same users on the issue of the protection of the Macta wetland (Table 4).

During the realization of this work, some methodological constraints related to the collection of cadastral data on the Macta wetland were encountered due to the opacity exercised by the administration on the cadastral data, sometimes non-existent, and the size of the study area, of 44,500 ha, extending over three provinces Mascara, Oran and Mostaganem, implying the distribution of the information on several separate administrative offices, which forced us to:

1. Limit this study to the part for which the cadastral data are available. This is the municipality of Moctadouz covering about 18,600 ha, i.e., 41.80% of the wetland. The choice of the Moctadouz municipality is appropriate because its territory covers the three types of landscape characterising the wetland; the entire marsh zone in the north, almost the entire relay zone, the median zone, and a large part of the agricultural zone in the south. It is, in a way, the spatial unit most representative of the problem of preserving the balance between the land status and the evolution of agricultural uses. Herders and nomads are concentrated in this municipality and share a large area of surplus land that characterizes the area.
2. Focus the monitoring of the different zoning of the Macta wetland only on the core zone. The latter is considered the most important because it is from its delimitation that the buffer zone and the peripheral zone will be delimited. In addition, it is the zone whose identification has caused the most problems for the Macta wetland actors.

3. RESULT

3.1 Implementation of agrarian policy in the commune of Moctadouz before independence (1863 to 1962)

During this so-called colonial period, the (Figure 2), designed on the old land ownership in Moctadouz, shows the existence of four types of property; colonial farms, state land, communal land and private land.

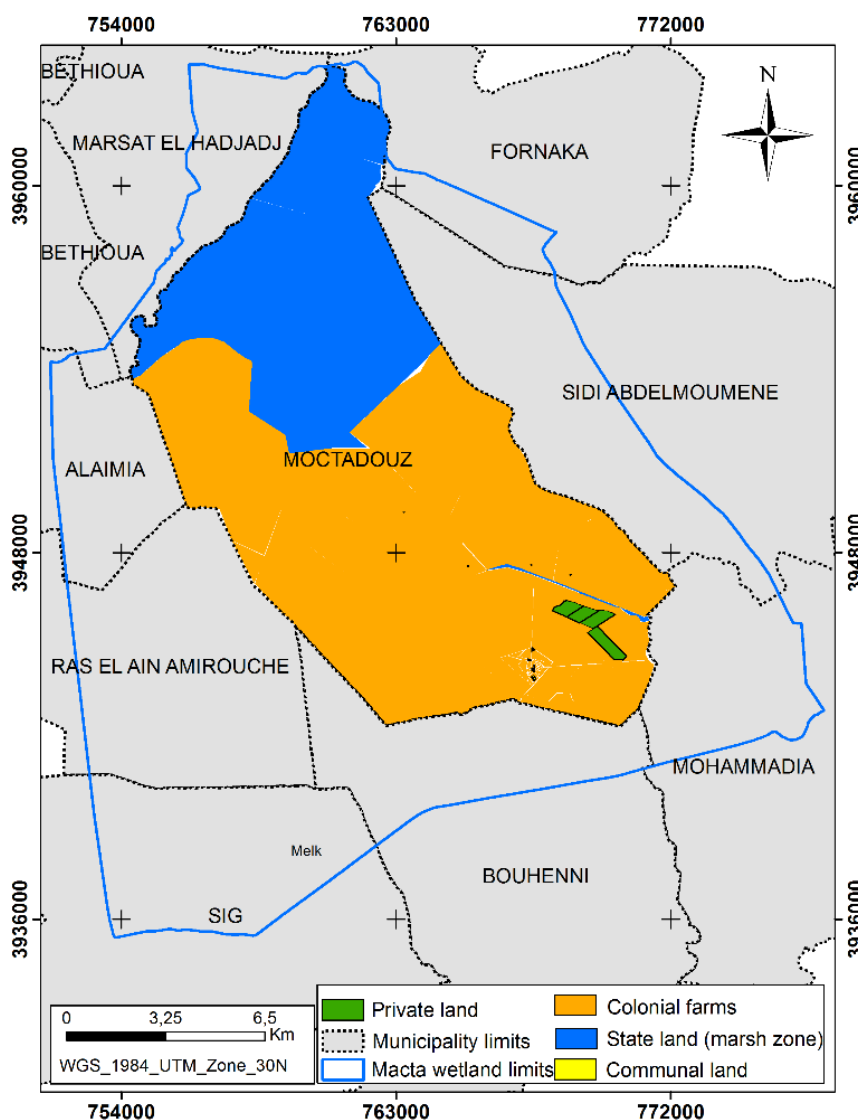


Fig. 2. Land ownership in Moctadouz during the colonial period.

The colonial farms represent about 12374 ha or about 66% of the total area studied (Table 2). Generally speaking, these farms covered both the cleared southern parts and the relay zones in the middle, which remained in a natural state due to the lack of resources and the risk of flooding generated by the extension of the marsh water body during rainy periods.

The second type identified, represented by the state land, covers an area of about 33% of the study area (Table 2). This land is located in the northern part covering the marsh zone. According to old cadastral data, this area was subjected to the forestry regime (water and forestry service) by the colonial decree of 22-07-1960.

The last two types of landholdings, private land and communal land, occupy small areas of 143.5 ha and 3.72 ha respectively (Table 2).

3.2 Implementation of agrarian policy in the commune of Moctadouz post-independence

This period, after 1962, comprises three phases according to the agrarian policy in force: phase I (1962 to 1981), phase II (1981 to 1987) and phase III (after 1987). Each phase saw changes in the status of land ownership over time.

3.2.1 Phase I: Implementation of the agrarian policy in the commune of Moctadouz period (1962-1981)

During this period, almost the entire area of the commune came under state property (national domain). It consists of a marsh zone, equivalent to that of the state land, without any change in management or surface area. While the remaining part, previously affiliated to the colonial farm, was divided into self-managed domains (7077 ha) and surplus land (5426 ha) (Table 2, Figure 3).

The self-managed domains (Table 3), of which there are eight, underwent major restructuring during Phases II and III. While the surplus land was the seat of conflict between different actors (Table 4).

Another type of land ownership is to be noted; the built-up lands that occupy a small area and cover the habitations of the Moctadouz agglomeration (Table 2, Figure 3).

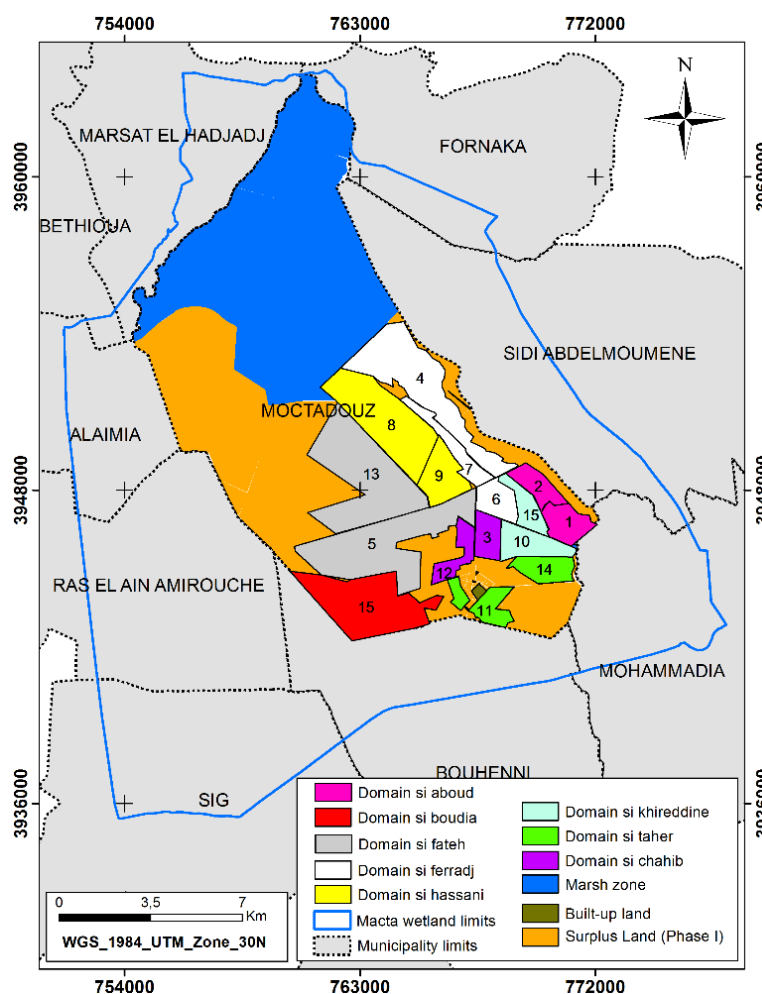


Fig. 3. Boundaries of self-managed domains and socialist agricultural domains (SAD) in the commune of Moctadouz, the sub-direction of agricultural services (Bouhenni)

3.2.2 Phase II: Implementation of the agrarian policy in the commune of Moctadouz)

During the period (1981-1987), the status of land ownership remained unchanged, except for the 8 self-managed domains which became 15 (DAS) with an average area of 442 ha for a total area equal to that of the self-managed domains (Figure 3, Table 3).

3.2.3 Phase III: Implementation of the agrarian policy in the commune of Moctadouz

After 1987, the 15 DAS were divided into 130 CAEs and 27 IAEs with an average area of 19 ha and 7 ha respectively. The total surface area of these CAEs and IAEs is 2681.83 ha, i.e., approximately 14% of the surface area studied (commune of Moctadouz). The area of surplus land, on the other hand, has become 9403.89 ha, i.e., 50% of the area studied (Figure 4, Table 2).

The last two types of land ownership, private lands and built-up lands, occupy small areas (respectively 406 ha and 29.28 ha Table 2).

It should be noted that private land appeared as landed property during Phase III (Figure 4, Table 2).

From 1990 onwards, the national domains (state property) of the commune of Moctadouz all became private state property (PRDS).

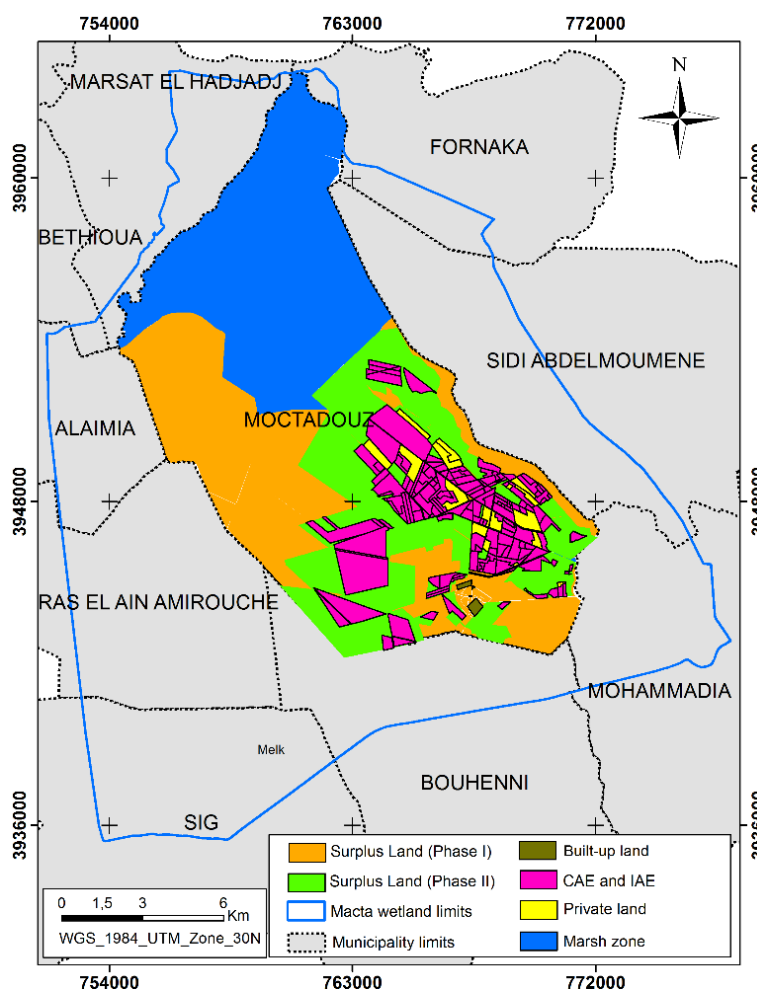


Fig. 4. CAEs-IAEs boundaries at Moctadouz municipality.

Table 2: Area and percentage of each type of property in relation to the municipality of Moctadouz for all periods of agrarian implementation

Periods	Land ownership	Area (ha)	Percentage
-----	Municipality of Moctadouz	18600	100
Before independence (Colonial period 1863-1962)	Colonial farms	12374	66,5
	State lands	6079	33
	Private lands	143,5	0,77
	Communal lands	3,72	0,02

After independence	1962-1981	National domains	Marsh zone (State lands Before 1962)	6079	33
			self-managed domains	7077	38
			Surplus lands (phase I)	5426	29
		Built-up lands	18	0,1	
	1981-1987	National domains	Marsh zone (State lands Before 1962)	6079	33
			SAD	7077	38
			Surplus lands (phase I)	5426	29
		Built-up lands	18	0,1	
	After 1987	National domains PRDS (after 1990)	Marsh zone (State lands Before 1962)	6079	32,68
			(CAEs-IAEs)	2681,83	14,41
			Surplus lands (phase I)	9403,89	50,55
			Surplus lands (phase III)		
		Private lands	406	2,18	
		Built-up lands	29,28	0,1	

Table 3. Fragmentation of agricultural land area through the stages of agrarian reform.

Names of self-managed domains	Area (ha)	Names of SADs	Area (ha)
Domain si taher	420,8	Si mebarek	215,88
		Si taher	204,92
Domain si fateh	2197,77	Si fateh	1081,77
		Si snouci	1116
Domain si ferraj	1338	Si ferraj	210,83
		Si demmou	932,19
		Si fellah	195
Domain si hassani	1131,38	Si hassani	299,54
		Si zeroual	831,84
Domain si aboud	388,57	Si aboud	175,79
		Si abdelmoutaleb	212,78
Domain si kheireddine	429,93	Si kheireddine	261,32
		Si zaim	168,61
Domain si chahib	330,67	Si chahib	164,97
		Si salaheddine	165,7
Domain si boudia	839,68	Si boudia	839,68
Total	7077	-----	7077
Average surface area (ha)	713.87	-----	442

The previous mapping study allowed us to know the different changes in agricultural lands through the stages of agrarian implementation (self-managed domains, SAD, CAE-IAE) which caused the decrease in the surface of the agricultural unit and the increase in the number of these units as well as the appearance of surplus lands.

Following the mapping work, we undertook interviews with different stakeholders to find out their reactions to the different changes imposed by the agrarian reform, to find out the role of each stakeholder in the protection of the wetland, and to assess proposals for its preservation (Table 4). The table is made up of two columns, the first for the stakeholders and the second summarizing the results of the survey. Some results will be presented in the discussion.

Table 4. Results of the survey with various actors in the Macta wetland, actors present on the site (farmers, herders and nomads)

Actors (province of Mascara)	Survey results
Actors on site (farmers, herders & nomads)	<p>Farmers and herders:</p> <ul style="list-style-type: none"> • The farmers: have been living on the land of the estates or on their own land for a long time, where they practice agriculture and livestock, sometimes both in parallel, and are registered by the communal services. They are respectful of the legislation (limiting grazing and clearing) and of the space managed by the forestry services. In addition, herders graze livestock either on uncultivated land or on rangelands in the steppe formations of the wetland. • Nomads (external breeders): After 1990, groups of nomads from the steppe regions of the south (Wilayas of Laghouat, Djelfa, El Bayadh and Tiaret), practising sheep farming, settled in the interior of the surplus land not far from the marsh zone. The number of these nomads, which is constantly increasing, varies according to the season and the year, with increasingly long stays, to the point where some have even settled permanently in tents. These breeders are the ones who affect the wetland the most by their intensive clearing even on the zone that are not intended for this purpose.
Agricultural Services	<p>The local farmers and nomads form alliances with well-defined roles and benefits for each of them.</p> <p>The agricultural services of the wilaya of Mascara are grouped within the wilaya directorate and the agricultural subdivisions throughout the different daïras where they are represented by several sub directorates at the local level (sub directorates of Sig, Mohammadia, Bouhenni as well as Moctadouz affiliated to the sub direction of Bouhenni).</p> <p>These subdivisions ensure statistics and vaccination of livestock for farmers and herders respectively.</p>
Forests Conservation	<p>They have a good knowledge of the temporary and permanent assets of the Macta wetland.</p> <p>These services, which must ensure that surplus land near the marsh zone is not exploited, do not react against land clearing practices and are in favor of their redistribution to young unemployed local farmers.</p> <p>The integration of environmental issues into development actions by these services remains fragile in the face of coalitions between local farmers and nomads.</p> <p>Since 1980, the Forest Conservation has been responsible for protecting the Macta wetland.</p>
	<p>The actions carried out in the Macta wetland are essentially divided into two points:</p> <ol style="list-style-type: none"> 1. Reflections on the field study: As a result of these reflections, several works have been carried out. The first, dating from the 1980s, was for the file submitted to the Ramsar Convention. The second, in 2002, was aimed at proposing the delimitation of the area and the demarcation of the boundaries in the field. The third, in 2004, concerned the study for the preservation of the wetland. The fourth, called winter census, concerns the annual counting of migratory birds. 2. Police action in the field: this resulted in the issuing of fines against illegal clearing and grazing in areas considered as zones to be protected. The forestry officers have made several attempts to prevent the livestock activity carried out by nomads in the surplus land. They have faced several problems that have

Actors (province of Mascara)	Survey results
Environment Directorate	ended up in court, as legal proceedings against the nomads are not successful, as they have no fixed address. Conflicts have arisen with agricultural services due to the overlap in the management of surplus lands. The Environment Directorate has never had a significant role in the management of the wetland, although it is designated to monitor and study the design of a management plan for the zone.
Hydraulic Services	The main role of these services is to protect people living on the periphery of the wetland from flooding.
Mayors of Communes sharing the Macta wetland	The elected representatives remain convinced that the exploitation of the zone will promote the economic development of their rural communities in the short term. The latter have not been consulted or involved in any decision concerning the management of the area. Some of them also expressed their dissatisfaction with the fact that their communes are entirely located within the boundaries of the wetland (the communes of Bouhenni and Moctadouz). This, according to them, has prevented them from implementing several income-generating projects for their isolated agricultural communes.
Associations for environmental protection	They are often absent from the management and protection of the Macta wetland, and their role has been limited to some awareness-raising activities on the occasion of International Wetlands Day.
Farmers' union of Moctadouz municipality	Defending farmers' rights. Distrustful of Forest Conservation as biased in favour of ranchers at the expense of farmers.

4. DISCUSSION

Before 1860, the wetlands of the Macta were considered as unhealthy areas lacking advantages for human activity and could become a source of problems.

Following the revalorization policy from 1863, works were initiated such as the launching of drainage and damming of wadis accompanied by hydro-agricultural works of filling and clearing, dam construction, installation of irrigated perimeters and drainage systems (Meddi et al., 2009).

This work was carried out in the absence of any environmental vision in the exploitation of natural resources for economic development.

As a result, large areas of natural vegetation have been lost, notably the tamarix species (*Tamarix africana*) (Quézel & Simoneau, 1960).

According to Tafer (1996), at the time of development, the dejection cones of the wadis Sig and Habra were occupied by large stands of tamarix. For example, in 1856, the areas of the Habra and Sig forests were estimated at 789 ha and 665 ha respectively. In 1960, these areas had become 200 ha and zero ha respectively (Quézel & Simoneau, 1960). This led to the domination of colonial farms. According to cadastral data, the origins of farms' ownership date back to the period between 1863 and 1924 (Ziad, 2002).

After independence, the implementation of the agrarian policy had a positive impact on the ecological environment of the wetland (Macta); thus, the selected agrarian area shrank from 12374 ha to 2681.83 ha (Phase III) (Table 2). The reasons for this are multiple, including lack of water, high salinity, lack of agricultural know-how and poor management in general.

Hydraulic works were less and less numerous and projects to drain certain marshes did not come to fruition due to lack of funds. This led to some regeneration of ponds in the surplus land (phase I and III) (Table 2).

This new mineralogical composition of the soil (salinity) led to the return of halophilic vegetation, including *Atriplex* and *Salsola* (Quézel & Simoneau, 1960).

The results showed that state ownership (PRDS) is more important than private land (Table 2) as well as the area of agricultural units decreased during the agrarian implementation (Table 3).

Some studies (Ahmed, 2008 ; Ando & Getzner, 2006) on wetlands have demonstrated the relevance of state ownership to private ownership for any protection initiative as private landowners exert political pressure against decisions to include their land in the nature reserve.

According to the theory of Stigler (1971), Peltzman (1976) and Becker (1983) who suggest that large landowners would be more effective in opposing land protection than small landowners, as a fragmented group of small landowners may suffer from relatively large coordination problems (Ando & Getzner, 2006). From this point of view, agrarian implementation can be seen as a positive success factor for the protection of the Macta wetland.

The Ramsar Convention recognizes the importance and considerable benefits of wetlands for the environment as well as for the economy of today's societies. Algeria, a signatory to this convention, like other countries, is interested in protecting these areas, including the Macta wetland. As a result, the Forestry Department has been charged with the protection of the Macta wetland since 1980.

Surveys conducted with wetland actors showed an overlap in the management of surplus land between the different active administrative bodies (Directorate of Agriculture, Forestry Conservation). This has caused problems in the management of the zone.

The Forest Conservation Administration has made considerable efforts since 1980 to protect the land in the marsh zone as well as the surplus land in the PRDS from illegal agricultural activities and overgrazing. This involves a reframing of the existing grazing by the local population; the livestock population held until the 1980s was around 20,000 head, comprising cattle, sheep and goats. This animal population has not exceeded the self-regenerative capacity of the vegetation cover (Ghodbani & Amokrane, 2013).

After 1990, there was an exodus of nomadic populations from the southern regions (Laghouat, Djelfa, Tiaret, El Bayadh, in particular), in search of new pasture, to the Macta wetland. This fact has made the situation in the area more difficult for the Forest Conservation service to manage.

The initiative done by the forestry conservation to control the situation was to resort to the courts. This did not produce any results because these nomads are homeless.

5.1. Putting in reserve of the Macta wetland, new strategies according to the land

The setting in nature reserve of the Macta wetland by the authorities, from the year 2000 onwards, went through different stages based either on ecological indicators or on the land.

5.1.1. Putting in reserve without integration of the land

The setting in nature reserve was decided in 2002 by the central authorities in the framework of the Ramsar Convention. Several criteria were taken into account in the classification procedures, the most important of which are the birds themselves. A series of procedures were undertaken to implement this heritage project, the most important being the delimitation by law of three zones with different degrees of preservation; integral zone, buffer zone and peripheral zone.

The present work focuses only on the central zone.

The zoning of the wetland (Ramsar 2002), the central zone, was purely ecological without taking into account the limits of the role and power of local actors (Agricultural Services, Forestry Conservation). Its delimitation includes the land of the marsh zone, the surplus land and the land of the CAE-IAE (Figure 5). It remains under the stewardship of the Forestry Commission.

This zoning cannot be realized because it has introduced, in its delimitation, CAE-IAE land that cannot be reclaimed. The adoption of this zoning only amplifies the pre-existing problems between the Agricultural Services and the Forestry Conservation.

5.1.2. Putting in reserve with little integration of the land

The land factor is partially considered, i.e., the consideration of the scope of intervention of the active actors (the Agricultural Services and the Forestry Conservation) and the failure to solve the problem of the allocation of surplus lands.

In 2004, the cadastral services of the three provinces (Oran, Mostaganem and Mascara) sharing the Macta wetland were mobilized to update the cadastral plans.

This land operation identified a vast PRDS within the wetland, including the marshy area to the north, part of the agricultural area to the south (CAE-IAE) and the median area of natural vegetation (phase I and phase III surplus land) straddling the two areas (General Directorate of Forestry, 2005).

The Conservation of the Forest of the province of Mascara, in charge of applying the protection measures, started another physical delimitation of the first zone (central zone) in 2005 in a climate of tension. The operation resulted in the installation of 14 cement bollards 50 cm high (General Directorate of Forestry, 2005). This demarcation (Figure 5) should, in theory, facilitate the control of the marsh zone considered the most fragile, in order to protect it from overgrazing, clearing and poaching. In reality, the marking of the integral zone is a strategy that has served two purposes; the first is to concentrate, in the face of limited means, control efforts on the most environmentally fragile part. The second objective is to avoid conflicts with Agricultural Services over surplus lands (Ghodbani & Amokrane, 2013).

A large part of the surplus land, theoretically agricultural but not yet allocated, is not affected by this delimitation, which places it outside the control of the forestry services. The consequences are the intensification of illicit agricultural practices and overgrazing, with the number of sheep reaching 50,000, held by a nomadic population (around 200 people) (Directorate of Agriculture, 2009). This situation has been favoured by the drought that has affected the region. According to Belgherbi & Benabdeli 2010, the annual rainfall has decreased by 30% between the periods 1950-1983 and 1983-2007.

5.2. Relationship between the land action and the new Macta wetland management plan

In 2014, without any coordination with the active actors (Forest Conservation and Agricultural Services), a new study, under the supervision of the province of Mascara, for the design of a management plan for the Macta wetland was launched by the environmental department. It reveals the fragmentation of public action between the state services in the management of the wetland.

The study carried out by two consultancies, appointed by the Directorate of the Environment (AgriproAmbienteConsultores, SA and MATH), resulted in the proposal of three scenarios for the delimitation of the wetland; optimal scenario, intermediate scenario and trend scenario. Each scenario includes three zones; the central one, the buffer one and the peripheral one. The focus of this study is always the central zone.

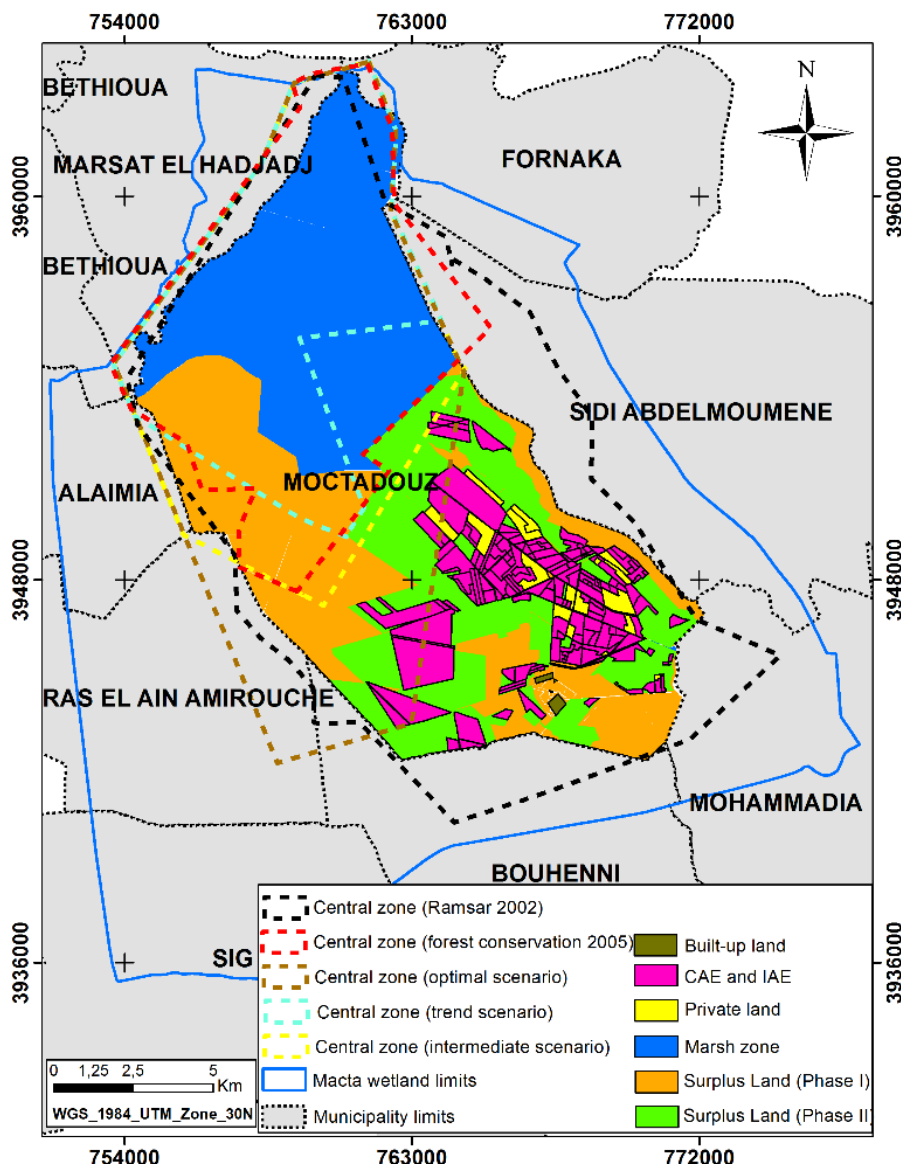


Fig. 5. Central zone delimitations (2002, 2005 and 2014).

- The optimal scenario: this represents a high ambition for conservation and rehabilitation of the Macta wetland ecosystem. According to stakeholders, it is far from being feasible because the delimitation of the core area includes a large area of agricultural land (CAE-IAE) (Figure 05) that cannot be restored to its natural state due to the state's policy to promote agricultural activity.

This contradicts the definition of the core zone as an area containing unique resources, where only activities related to scientific research are allowed.

- The intermediate scenario: this is the balance between ecosystem conservation and economic development of the region (Figure 05).
- The trend scenario: represents a continuation of the current development and a lower conservation ambition for the Macta wetland. This scenario favors the maintenance of the agricultural vocation of the region, as opposed to the Agricultural Services, so that the most important agricultural area is not integrated into the central zone. The delineation of the core area in this scenario leaves a considerable gap between the central zone and the CAE-IAE, thus expanding the surplus land (Figure 05). This may lead to the conversion of this land area into agricultural land.

The Agricultural Services and management authorities, as part of the implementation of agricultural activity, have been redistributing land for young local farmers who are unemployed.

In 2017, on the basis of Ministerial Order No. 1344 of 01 November 2012 of the Ministry of Agriculture and Rural Development setting the modalities of application and selection of candidates for the concession of agricultural land and superficial goods belonging to the private domain of the State and the interministerial circular No. 1809 of 05 December 2017 of the Ministry of Agriculture and Rural Development and Fisheries relating to the procedures for the implementation of the right of concession on agricultural land belonging to the private domain of the State the managing authorities proceeded to the sharing of agricultural land by granting individual concession titles to new local agricultural investors. The sharing operations concern surplus land (phase I and phase III) and part of the marsh zone.

The expected benefits, following this sharing, is the coverage of the private domain of the State and the limitation of the illegal use of soils while preserving a social peace, by answering the claims expressed by the local population for the officialization of the right to exploitation.

According to an executive of the Agricultural Services, the attribution of these new concessions was following the approval of the trend scenario approved by the province of Mascara under the authority of Mr Wali in the presence of representatives of Agricultural Services, Forest Conservation, Cadaster, State Property, Hydraulics and ONTA). The two engineering offices were absent.

It should be noted that the latter provisions were decided by the new Wali.

According to this framework, the area subject to allocation is subdivided into two parts:

- First part; surplus land located between the CAE-IAE and in their southern periphery: 74 concessions, far from the zoning considered in the central zone (Figure 05), were allocated with a total area of 1090 ha.
- Second part: 78 new concessions were assigned with a total area of 1676 ha. These include the surplus land between CAE-IAE (upper boundary) and the southern part of the trend scenario encompassing part of the marsh zone and transgressing the Forest Conservation boundary (Figure 05).

In order to delimit the central zone and to frame the preservation actions, the study offices have opted for the intermediate scenario. They seek to achieve a balance between the best preserved and heterogeneous areas in the north and the main anthropic pressures in the south.

A large portion of the second part (the new concessions) belongs to the central zone boundary. This leads in order to return to a non-conflictual situation, to the revision of this operation for the application of this scenario.

This proposal was adopted during the meeting organized by the Wali of the province of Mascara in the presence of representatives of the Agricultural Services, Forest Conservation, Cadaster, State Property, Hydraulic Services and ONTA, as well as the two design offices.

It should be noted that these latest arrangements were decided by the new Wali.

The elected representatives of the rural communes sharing this area support this idea and are in most cases convinced that the exploitation of the natural resources of the Macta will promote the economic development of their rural communes in the short term. The integration of environmental issues into development actions by managers (elected officials and institutional actors) remains fragile in the face of electoral politics dominated by coalitions between local farmers and nomads.

One of the engineers involved in the design of the management plan stated that 'the debates on the choice of boundaries took place in the absence of associations and mayors and with a lack of interest from partners. Integrated management cannot take effect without the participation of all actors.

Finally, the conviction of the actors is that the preservation of the Macta wetland is a matter for the state. This view is a constraint to their involvement in a sustainable development debate on the preservation of natural resources.

Some mayors, particularly those in the south, have a very negative view of the setting of Macta as a nature reserve, denouncing the passage of the boundary of the peripheral zone over their territory. The mayor of the commune of Bouhenni, after having seen his project for an industrial zone for extracting materials blocked by the reserve, told us that: "The reservation penalizes us. We are far from the marshes and our rural municipality needs to increase its budgetary income". Thus, the rigidity of the ecological discourse without financial compensation is at the very origin of the forms of resistance to the state's environmental initiatives.

New mechanisms must be adopted to reach compromises that are in the interest of all users in the short, medium and long term.

5. CONCLUSION

In this paper, we have discussed the impact of the mastery of Land on the success of the Macta wetland protection initiatives, in the light of the evolution of the agricultural policy in Algeria.

Concerning the historical changes in Algerian agricultural policy, the latter has undergone important evolutions visible through the different modifications in the distribution and use of agricultural land from the colonial period (colonial farms) to the period of nationalization (after independence) through the implementation of agrarian reform. Thus, the colonial farms became self-managed domains, which were later divided into SADs and then, the latter, into CAEs and IAEs.

As regards the repercussions of the structure of agricultural land on the initiatives to protect the Macta wetland, the changes have had two effects: a shrinking of agricultural areas, which is beneficial for the protection of this area because it facilitates the control of activities carried out. The second effect, a negative one, has led to the appearance of large areas of surplus land, the surface area of which is estimated at 50% (9400 ha) of that of the municipality of Moctadouz (18600 ha). The surplus land has led to an overlap in its management between the various active administrative bodies (Agricultural Services, Forestry Conservation), which has led to a dysfunction in the management of this area, causing an exodus of new actors (the nomads). This has amplified the difficulties in managing the area, which has hampered all initiatives for its protection, despite the existence of legislative texts and international agreements.

These difficulties relate to disagreements between the Agricultural Services and the Forestry Conservation during the delimitation of the area, the lack of coordination between the delimitation initiatives, the non-participation of some active actors in the delimitation debates, and the frequent change of the executive.

In terms of finding compromises between the different actors, some are convinced that the preservation of the Macta wetland is a matter for the state. This view needs to be changed because it is a constraint on their involvement in the sustainable development debate for the preservation of natural resources.

We recommend an urgent and thorough discussion about the surplus land, including the agreement of a model for delimiting the area and its official reservation. This will only be possible, in our opinion, by involving all active actors, establishing a balance between the protection of the area and the economic activities of the local inhabitants; i.e., achieving a balance between the ecological indicator and the agricultural land to delimit the area, in addition to the installation of a multi-stakeholder committee to constitute a management platform with all the material and human means.

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8. CONFLICT OF INTEREST

The authors have declared that no competing interests exist.

9. AUTHORS' CONTRIBUTION

- ISMAIL GUEBBABI: Conceptualization (lead); Execution of the investigation (lead); Data analysis and interpretation (lead); Methodology (lead); Project administration (lead); maps establishment (lead); redaction (lead).
- TARIK GHODBANI: Conceptualization (lead); Data analysis and interpretation (supporting); Methodology (supporting); Redaction (supporting).

- ABDELDJALIL BOUGHERIRA: Maps establishment (supporting).
- ABDELAZIZ KOUTI: Execution of the investigation (supporting).
- BILAL BELLOULOU: Maps establishment (supporting).
- DJILALI MEKHATRIA: Redaction (supporting).
- MILOUD SALLAY: Data analysis and interpretation (supporting).

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11. ADDITIONAL REFERENCES

The legal texts on the preservation of biodiversity and sustainable development:

- Presidential decree n° 95-163 of 06 June 1995: protection of biological diversity.
- Law n° 03-10 of 19 July 2003: defines the rules of environmental protection in the framework of sustainable development.
- Presidential decree n° 05-108 of 31 March 2005: Convention on the conservation of migratory species of wild animals.
- Presidential decree n° 06-405 of 14 November 2006: Protocol of protected areas and biodiversity.
- Law n° 11-02 of 17 February 2011: specific to wetlands: delimits the 3 zones: the water body, the flood plain and the watershed.

SAD: Economically viable and manageable production units created under Law No. 27 of 1984 (JORA, No. 27, 1984) following the division of self-managed domains into socialist agricultural estates (SAD) (Baci, 1999 ; Laoubi & Yamao, 2012).

CAE: Collective type farms created within the framework of law n° 87-19 of 8 December 1987 (JORA, n°50, 1987) following the division of the (DAS) into collective agricultural exploitations (CAE) and individual agricultural exploitations (IAE) (Bouchaib, 2010).

IAE: Individual type farms created within the framework of law n° 87-19 of 8 December 1987 (JORA, n°50, 1987) following the division of the (DAS) into collective agricultural exploitations (CAE) and individual agricultural exploitations (IAE) (Bouchaib, 2010).

ONTA: A public establishment of an industrial and commercial nature, an instrument of the State acting on its behalf and by delegation, its main mission is to implement the national agricultural land policy (Ali, 2011).

Self-managed domains: After the annexation of vacant colonial lands to state ownership following a series of texts (Journal Officiel de la République Algérienne, No. 15, 1963; JORA, No. 17, 1963), the legislator applied the system of self-management to these vacant lands (Bousbiat, 2007). This is a two-headed system inspired by the Yugoslav experience; but in reality, this model was very managing and totally under the control of the state (Bouchaib, 2010).

PRDS: Article 18 of Law No. 90-30 of 1 December 1990 (JORA No. 90-30, 1990) states that 'the national domain includes the public and private domains of the State, the Province and the Commune' (Belhimer, 2015). According to Article 12 of this law, the public domain includes the rights and movable and immovable property that serve for the use of all and that are available to the public user, either directly or through a public service. The public domain cannot be subject to private appropriation or property rights. The private domain, on the other hand, includes buildings and furniture not classified in the public domain.

Wali: The Wali in Algeria is the government representative at the head of the province (territorial and administrative unit grouping several communes). In the case of Macta, he is the first person responsible for institutional preservation action in accordance with law n°11-02 of 17 February 2011 on protected areas in the framework of sustainable development (JORA n°13 2018).

12. KEY TERMS AND DEFINITIONS

Wetland: According to the Ramsar Convention on Wetlands (www.ramsar.org), wetlands comprise, in a general sense, practically all ecosystems where water is present during at least part of the year, except for seas and oceans deeper than 6 m.

Land mastery: Actions that establish and reinforce forms of access, claim and exclusion for a given period of time. Such as briefings, location and legislation, as well as force and violence.

Land: Any part of a specific area on Earth with well-defined boundaries and assigned to an eligible occupation.