New Notion of « Sustainable Littoral » in Morocco: A Case of the Rabat-Sale-Kenitra Region

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Abstract

The Moroccan littoral constitutes of a particularly sensitive and complex geographic space, which is undergoing various and increasing pressures. Through its diversity and its ecological potential, it requires more attention in terms of its protection. Due to the significant importance of this space, it is coveted for many activities and forms of development but the process of managing the space remains difficult and calls for question. This paper aims to provide an overview of the degradation of the Moroccan littoral, particularly in the region of Rabat-Sale-Kenitra. It also provides some management measures more suited for the intrinsic characteristics of this space that can be taken into account to guarantee a sustainable littoral.

Keywords: Moroccan littoral, Rabat-Sale-kenitra region, Pressure, Degradation, Sustainable.

Introduction

With a littoral of around 3,500 km, developing on two Atlantic and Mediterranean maritime facades, the Moroccan littoral occupies a very important place at the level of the entire coastline of the African continent (Hannou, 2003). Thus, its importance in our environment and its sensitivity to the various interventions which can take place calls for the need to protect and manage it effectively (Tlili & Ayari, 2006). This is because the hypersensitive coastal environment shelters more than half of the Moroccan population (MEMDD, 2019).

The concept of sustainable development is a widely recognized benchmark today, and Moroccan laws and public policies tend to conform to its principles. The coastal zones are physically and ecologically very sensitive to the various projects, carries a socio-economic stakes, difficult to harmonize, and their development is inspired by a particular concept known as Integrated Coastal Zone Management (ICZM). As a result, Morocco adopted on October 15, 2015, Law No. 81-12 on the littoral, which will help to structure the integrated management of these areas in Morocco. The

purpose of this law is to define the principles and rules for the protection and sustainable development of the littoral (Aouich, 2016).

As in all Mediterranean countries, the Moroccan littoral tends to become an area that is over-occupied and over-used due to urbanization, industries, ports, fishing, and leisure activities. Although it is often excessive, this occupation leads to the degradation of the physical environment and in mortgaging any possibility of better management of coastal and marine space in the future (Laouina, 2006). This is particularly the case for the littoral of the Rabat-Sale-Kenitra region, which is a vulnerable space and leads to significant forms of both natural and anthropogenic pressure.

Hence, this paper aims to provide answers to the following question: What is the sustainability for the littoral of the Rabat-Salé-Kenitra region as a fragile environment intensely occupied by human?

To achieve this objective, it is first necessary to establish a diagnosis of the littoral state of the region of Rabat-Sale-Kenitra through an inventory and an evaluation of the degradation process as well as the damage that it suffered. After then, a management strategy should be drawn up which will be adopted by the actors present. Thus, it is likely to be inserted in an orientation not only ecological but socially sustainable.

Study Methodology

The methodology used in this study is based on documentary bibliography and the "DPSIR" model (Figure 1) which was used to assess the health of this coastal ecosystem.

The DPSIR model, advocated by the Organization for Economic Cooperation and Development (OECD), is one of the frameworks which are based on the concept of causal chains for data synthesis. Thus, it links environmental information using indicators of different categories (driving forces, pressure, state, impacts and responses) (Saddik et al., 2017). Tonneau et al. (2009) opined that one of the greatest advantages of the DPSIR model is that it allows indicators of different kinds to be linked without resorting to an aggregation system or without having perfect knowledge of causalities. The DPSIR model organizes the following sequence: human activities - economic sectors, demography, etc. which constitutes the driving forces of the system represented.

These activities put pressure on the environment in particular, and the state is therefore affected. Impacts are linked to ecosystems and human health due to changes in the state. Putting into consideration the profile of these different categories, particularly impacts, corrective responses from society are developed and implemented. Whether regulatory, economic or voluntary, they in turn influence the configuration of the system.

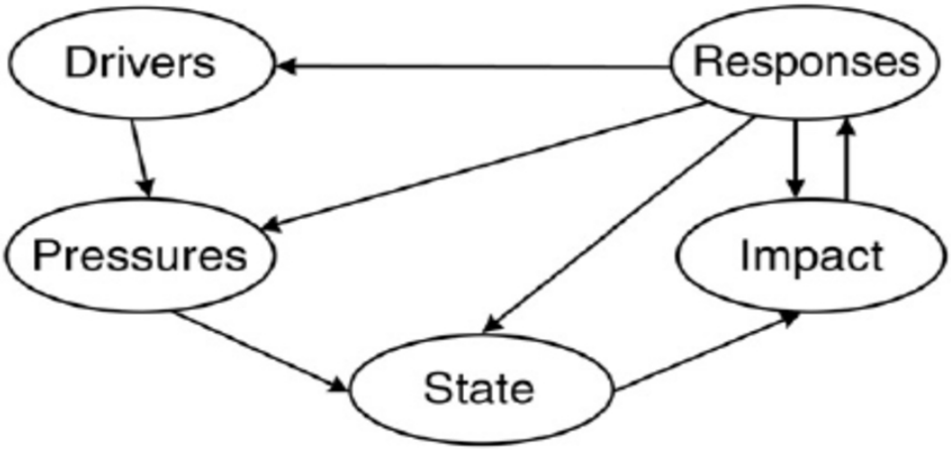

Figure 1. The DSPIR model (Saddik et al., 2017)

The Littoral of the Rabat-Salé-Kenitra Region: A Fragile and Threatened Natural Milieu

Potential and Strategic Natural Resources

The littoral of the Rabat-Sale-Kenitra region stretches for about 165 km (Snoussi, 2020). Its geographical position on the North Atlantic littoral of Morocco, its geological and topographic structure, and its water resources, in addition to its favorable regional economic context, represent major strengths and the factor that triggered the lusts and interests of public and private economic actors.

The region's littoral has a Mediterranean climate with a maritime influence. It is mild, moderate, and rainy during the winter, while it is humid and temperate during the summer with Chergui days. However, it is distinguished by an apparent variability (minimum temperature of 4 °C and maximum of 40 °C). As for the annual rainfall, it varies between 900 mm and 300 mm (Snoussi, 2020). The average rainfall in the coastal area (Kenitra) is 537 mm / year (Motib, 2019). Favored by the proximity and the influence of the disturbances of the North Atlantic, this part of the space has enormous underground and surface water resources (El Kehal, 2014).

The littoral conceals an invaluable wealth of natural ecosystems (wetlands, forest ecosystems, littoral cliffs, dune areas, etc.). Furthermore, strong tourist potential and in particular a strong attractiveness of littoral areas can offer a tourist development centered on nature and culture products.

The region's littoral has significant hydraulic potential and significant water mobilization infrastructure, especially dams. It contains two basin agencies: the Sebou Hydraulic Basin Agency and that of Bouregreg and

Chaouia which centralizes the assessment, planning, management, and protection of water resources at the scale of the two basins.

A Spatially Limited Mid Generally Experiences a High Usage Pressure A Densely Populated Littoral

The Rabat-Sale-Kenitra region has become, in the space of a few decades, a territory with strong attraction, especially based on its littoral area. It comprises of majority of the demographic, economic, administrative, and cultural flows of the Kingdom of Morocco. This development is mainly due to the administrative weight of the city of Rabat, as the capital of Morocco, to its university vocation and to its role as a communication node (Matnuhpv, 2019).

The population of the littoral of the region of Rabat -Sale- Kenitra has not ceased increasing ever since the middle of the last century. According to the latest general population census (RGPH, 2014), the Rabat-Sale-Kenitra region has 4,581 million inhabitants, or 13.53% of the country's total population. Hence, this ranks it 2nd place after the Casablanca-Settat region (Boui, 2018). The littoral (Province of Kenitra and Prefectures of Rabat, Salé and Skhirat Témara) alone comprises of 3.2 million inhabitants, which represents 70% of the region's population (HCP, 2016) (Figure 2).

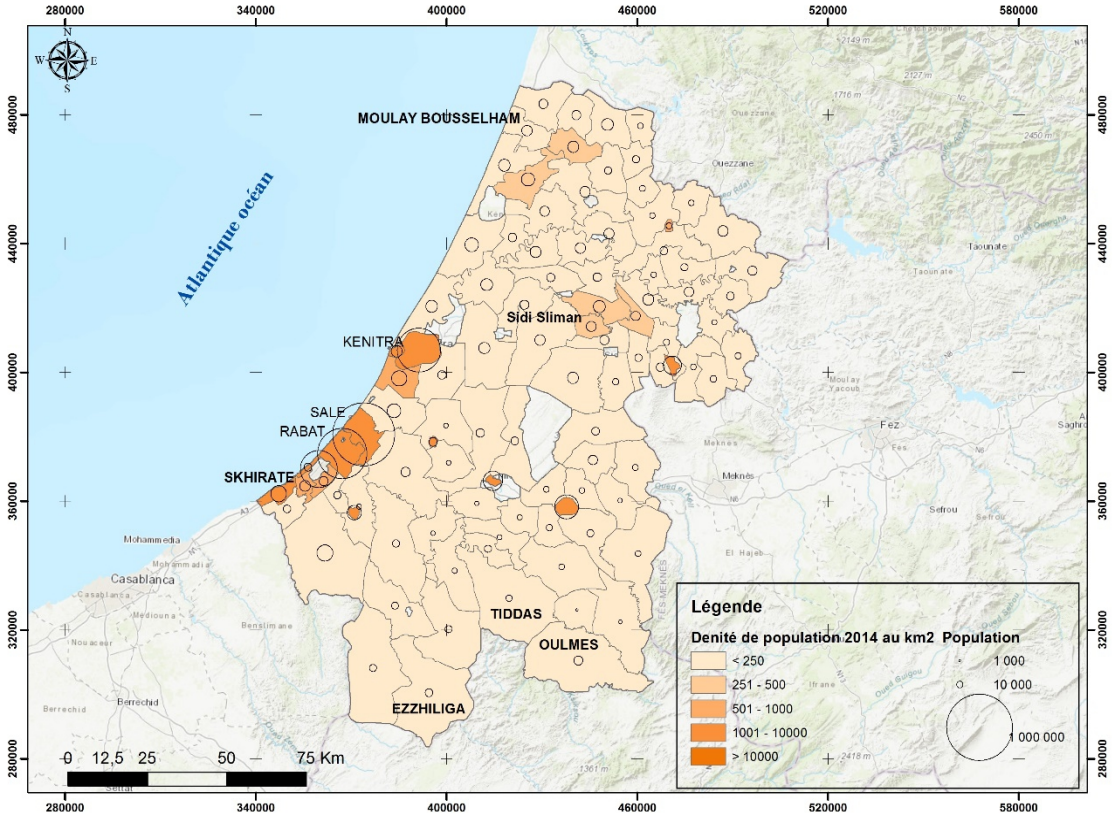

Figure 2. Population by municipality and densities (Source: general population and habitat census 2014, HCP)

The region's average annual growth rate over the 2004-2014 period is 1.31%, which is very close to that recorded at the national level (1.25%). However, this regional average hides quite significant disparities between the provinces and the prefectures of the region, but especially between a highly populated and urbanized coastal strip and a rural and less densely populated hinterland (Snoussi, 2020).

A Highly Urbanized Littoral which results, in particular, to an Anarchic Urbanization

The Rabat-Sale-Kenitra region is also one of the most urbanized regions in the country with a rate of 73.6% (3rd of the 12 regions) (HCP, 2016). At the littoral level, the urban network is characterized by a large grouping, which largely dominates the urban framework of the region, i.e., the Kenitra-Témara axis which comprises of more than 70% of the urban

population of the region. The municipality of Rabat is fully urbanized, the municipalities of Sale and Skhirate-Témara are also almost entirely urbanized (respectively 93.2% and 93.1%), and the province of Kenitra has experienced a significant increase in its urbanization rate (+8.7 points between 2004 and 2014) to reach 57.2% in 2014 (Figure 3).

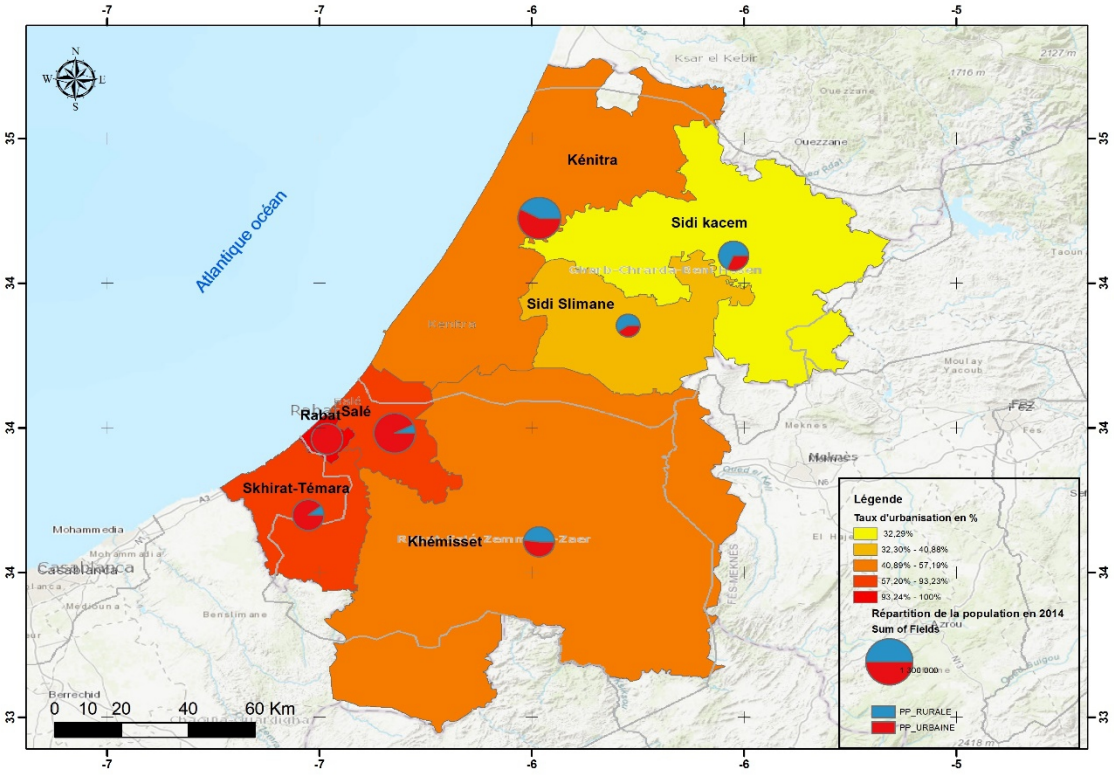

Figure 3. Rate of urbanization in the Rabat-Salé-Kénitra region (Source: General population and habitat census 2014, HCP)

In 2014, the urban population represented 69.8% of the regional population with an average annual growth rate of 2.1% during the intercensal period 2004-2014. This increase occurred at the expense of the rural population, which rose from 11% in 2004 to 10.3% in 2014. In addition to the natural demographic increase, this dynamic is explained by the rural exodus, the creation of new urban centers, and the extension of the urban perimeters of coastal cities.

The main problem posed by the urbanization of the study area concerns the encroachment on sensitive areas, in particular forests, dune areas, areas at risk of flooding and agricultural land, which resulted in the anarchic proliferation of non-regulatory habitat dispersed over all of the region's littoral communities. Thus, this has led to a loss of local potential and consequently the loss of economic value, and it also threatens the security of populations and the balance environment (Motib, 2019).

Concentration of Industrial and Tourist Activities

The littoral constitutes the majority of large-scale industrial and economic activities (Nakkli, 2010). This is particularly the case for the littoral of the Rabat-Sale-Kenitra region which is part of the structuring Atlantic axis of the Moroccan economy. Also, it extends from Kenitra to Safi and includes more than three-quarters of industrial activities and 80% of investments of the sector (such as the food industry, parachemistry, metallurgy, etc.). It should be noted that the region experiences wide disparities between the littoral and the hinterland in terms of industrial activities. Indeed, the world is witnessing a strong polarization of industry along the Skhirate-Témara-Rabat-Sale-Kenitra littoral axis (DGCL, 2015).

Heavy industrial activities are especially linked to the activity of sugar mills, oil mills, paper mills, and cellulose and agro-food units. Most of these industries causes pollution and are preferentially located on the coast itself: either within the ports or in the immediate vicinity of Rabat-Sale-Kenitra. The other components of the industrial fabric are scattered throughout the urban fabric in the littoral zone. Hence, these are units that discharge their pollutants directly into the natural mid (Motib, 2019).

In addition, the region of Rabat-Sale-Kenitra has a very important tourist potential placing it in 6th position of Moroccan tourist destination, behind Marrakech, Agadir, Casablanca, Fez, and Tangier. This is with a predominant part of the city of Rabat, which totals almost 80% of the tourist offer in the region (DGCL, 2015).

It is emphasized that the littoral hosts a large mass tourist seaside activity, generally unstructured. The number of summer visitors to beaches in the region is estimated to be at around 618,500 per season with Mehdia, Rabat, Sale, the Nations and Moulay Bouselham having the highest number (Snoussi, 2020).

Multiple Environmental Pressures

The littoral of the Rabat-Sale-Kenitra region has a natural environment and quite exceptional beauty. However, environmental problems linked to population growth, the extension of urban spaces, and the action of man on nature arises acutely and could compromise the sustainable

development of this coastal mid. Indeed, these environmental pressures can lead to disasters endangering collective security and causing direct or indirect damage to populations, property, infrastructure, natural ecosystems, and the economy.

The Littoral: A space Threatened by the Uncontrolled Extraction of Coastal Sand

The littoral of the Rabat-Sale-Kenitra region also suffers from a major problem, which are the degradation of the dunes and the erosion of beaches. Basically, this is mainly due to an ever-increasing demand for construction materials, in particular for sand for the building sector. This increasing demand for sand as a building material has forced users in the construction industry to seek other sources of supply to alleviate the shortage, particularly in the northern part of the country. Subsequently, there has been an improvement from the use of crushing sand to the use of seabed dredging sand (Benmohammadi et al., 2011). Indeed, the high demand, due to the "boom" that construction is experiencing, carries the risk of seriously disrupting littoral ecosystems and those of continental waters.

This demand, estimated at nearly 13 million tonnes, is largely met by levies, often illegal and inexpensive, from beaches and coastal dunes. As a result, many beaches are depleted in sand (Chafik, 2014). For example, the quantity of sand extracted annually in Mehdia beach (the littoral of kenitra) is approximately 460,000 m^3. For this reason, Mehdia Beach has witnessed a decline in the northern littoral between 1997 and 2007 by four meters. The littoral of the Corniche retreated by 0.7 meters, and this decrease corresponds to a sediment deficit of 180,000 cubic meters of sand which is equivalent to 13,000 cubic meters annually (Sogreah, 2011). To take care of the physical stability of the coastline and protect marine ecosystems from the danger of dredging, several precautions should be taken (Hakkou et al., 2016).

Figure 4. Line recoil of coastline (Mehdia-kenitra) (Source: Soghreh (2011))
Figure 5. Line recoil of coastline (Mehdia-kenitra) (Source: Soghreh (2011))

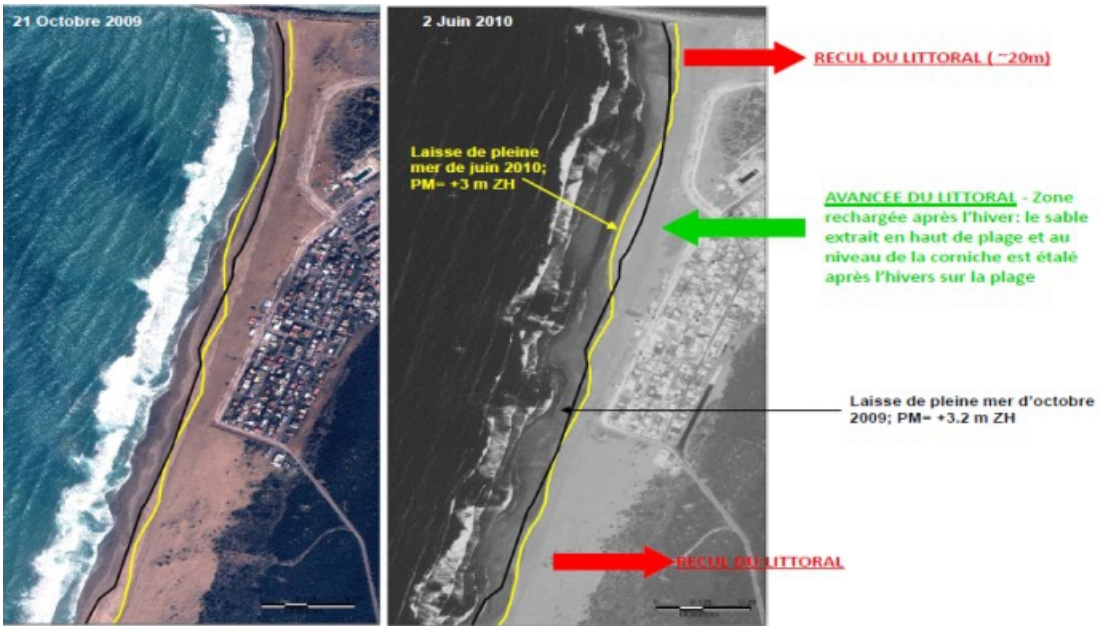

Figure 4. Line recoil of coastline (Mehdia-kenitra) (Source: Soghreh (2011))

Pollution and Erosive Phenomena

Environmental pollution has become a legitimate concern in recent years. The littoral fringe undergoes liquid and solid emission of various origins. Domestic pollution constitutes a major problem of the littoral environment. Thus, the territory has shortcomings in terms of connection to the public sewerage network. With the exception of the agglomeration of Rabat Sale and the city of Kenitra where connection rates exceed 90%, the rest of the region has much lower rates. The unconnected centers discharge their wastewater pollutants into the natural environment (Oued Bouregreg, Oued Beht, the coast) (Snoussi, 2020). In particular, the mouth of the Sebou wadi drains all domestic, industrial, and agricultural discharges of the cities of Fez, Meknes, Sidi Kacem, Sidi Slimane, and Kenitra. Oued Sebou and its tributaries are today considered to be among the most polluted wadis in Morocco (Nakhli, 2010).

In addition, agricultural activity, fairly developed in the Gharb plain, induces pollution of groundwater, which manifests itself in particular by the increase in the nitrate content, posing health risks. Hence, the strong agricultural intensification of this plain, based on irrigation and the massive supply of chemical inputs, in particular nitrogen fertilizers, are at the origin of the continuous deterioration of littoral aquifers (Motib, 2019).

The marine environment directly receives industrial liquid discharges and urban domestic discharges from littoral agglomerations. The Kenitra Safi axis comprises of more than 60% of urban discharges and more than 80% of industrial discharges from Morocco (Sofa, 2005). In fact, almost all industries discharge their effluents heavily loaded with polluting products in the open sea without any prior treatment. In the RSK region, discharges of wastewater into Sebou wade pose a threat to the quality of bathing water at Mehdia beach, located not far from the mouth of Sebou wade. Maritime and in particular port activity also contributes to water pollution (Motib, 2019).

On the other hand, the sandy coasts of the region are highly exposed to erosion. The only studies that have attempted to assess the evolution of the littoral of the region mainly focus on the beaches on either side of the mouth of the Sebou. They showed that between 1963 and 1993, a different development on both sides of the mouth of Oued Sebou was observed. Chlihat beach located north of the mouth showed general accretion while the southern sector, with its two beaches Mehdia and Sidi Boughaba, were faced with erosion. The importance of the progradation in the North of Sebou and the decline in the South can be explained by the association of many factors, especially the installation of dams on the watershed of Sebou, the extension of the mouth of the Sebou by two dikes to depths of -7m ZH, exploitation dredging works at the mouth of the mouth, and wind transit estimated at 20 m / ml / year which further strengthens the weight loss of Mehdia beach (Snoussi, 2020).

Towards a New Image of a More Sustainable Littoral

Picture 1. Sand erosion Mehdia beach 28 February 2018, source : Motib,2019

The ever-increasing deterioration of the environmental conditions of the littoral is having a hard time being felt. This is not only at the level of ecological balance but, also and above all, at the socio-economic level, particularly on the quality of life of local populations. Sustainability therefore appears to be linked to our ability to manage ecosystems from a long-term perspective. It is necessary, first, to adopt the decree of law relating to the littoral. After then, the region must undertake local actions, which will allow the protection of the coast and the preservation of coastal natural resources. The objectives assigned to this axis of sustainable littoral management are summarized as follows:

Reinforcement of Littoral Protection through the Approval of New Law No. 81-12 Relating to Littoral

The protection of the littoral in Morocco has remained governed by a plurality of fragmentary texts, which is often very old, non-dissuasive, and applied in a non-coordinated manner by the institutions in charge (Menioui, 2007). Faced with these legal insufficiencies, it seems essential for our country to have a legislative text devoted specifically to the littoral. This is with the aim of reconciling the fundamental imperatives of its protection. In a bid to achieve this objective and ensure the sustainable development of the littoral, the kingdom of Morocco adopted Bill 81-12 on the littoral on June 23, 2015 (MEME, 2015).

Consequently, to achieve this objective and ensure the sustainable development of the littoral, the law on the littoral adopts the basic principles

and rules of an integrated management of the coastal zones resulting from international recommendations. Examples include United Nations Conferences on Environment and Development of Rio 1992 and Rio + 20, the 2002 Johannesburg World Summit on Sustainable Development, and regional protocol relating to the Integrated Coastal Zones Management (ICZM) in the Mediterranean, ratified by our country on September 21, 2012. Thus, this entered into force effective October 21, 2012 (MEME, 2015).

In addition, this law which appears among the legislative texts of the legislative program 2012-2016 of the government fits perfectly within the framework of the objectives of the Framework Law on the National Charter for the Environment and Sustainable Development. It sets the fundamental principles of integrated coastal management as a transversal management process involving the simultaneous consideration of different interests in the coast including in particular the systematic consideration of the environment for all decisions affecting this fragile territory. Thus, this law aims to achieve the following objectives:

1. Preserving biological and ecological balances, natural and cultural heritage, historic and archaeological sites, natural landscapes and combating coastal erosion;
2. Preventing the struggle, reducing pollution and degradation of the coastline, and rehabilitation of polluted or deteriorated areas and sites;
3. Planning, in particular, through a national coastal plan and regional coastal plans that are compatible and in perfect harmony with land use planning documents;
4. The involvement of associations, the private sector and the local authorities, concerned in making decisions relating to coastal management;
5. The promotion of a research and innovation policy in order to enhance the coast and its resources

In addition, and in order to achieve the objectives of protection, enhancement and conservation of the coastline to guarantee the balance and sustainability of its multiple functions, the law establishes a national commission and regional commissions with a unifying nature and mobilizer. Thus, this brings together all the national and regional components.

In regard to protection and conservation measures, the law establishes the principle of prohibition to harm the natural state of the seashore. In addition, the law establishes a non-constructible zone, adjacent to the coastline of a width of 100m, calculated from the land limit of this coastline as well as a zone for withdrawal from transport infrastructure with a width of 2000m.

In terms of pollution struggle, the law on the littoral prohibits any discharge causing pollution of the coast and subject to authorization the spill

of liquid discharges, which do not exceed the limit values subject to the payment of a fee. Similarly, the law guarantees free access to the shore by establishing an easement along the shore over 3 m in width, as well as a transverse access easement.

National Strategy for Integrated Coastal Zone Management « ICZM » RSK

Morocco with the support of the World Bank launched the Integrated Coastal Zone Management (ICZM) project to ensure the sustainable and coherent development of the coastline of the Rabat-Sale-Kenitra region (Dref, 2018).

The ICZM RSK project aims to capitalize, consolidate, and pursue the initiatives carried out at the level of this region within the framework of regional planning and integrated management of coastal zones. More particularly, this concerns the project relating to the contribution towards the development of a management plan. Integrated coastal zone, carried out within the framework of the "European Support Mechanism for Integrated and Sustainable Water Management and the Horizon 2020 Initiative (SWIM-H2020)", enables the development of a diagnosis of coastal areas of the region as well as a common vision for the integrated management of its coastal areas. It also helps to ensure sustainable and coherent development of the region's coastline, to integrate the risks of climate change (rising waters, biodiversity and natural environments, natural resources), and to list and sequence the coastline by suitable vocations. In addition, a dozen of sustainable development projects should be integrated into the management of the littoral.

The Rabat-Sale-Kenitra region is home to 10% of sites of biological and environmental interest (SIBE) on a national scale. The territorial planning of the region takes into account the coastal fringe. In fact, the regional development program (RDP) in July 2017 provides for integrated management of the coastal zone, and the amount of resources allocated to the ICZM program is 15 MDH. The PDR also plans other projects which also concern the coast, namely the development of a reference framework for the management and development of major ecological continuities, agricultural land, and forest resources. It also involves the development of a protection plan for the enhancement of sites of biological interest, as well as the promotion and support of exemplary sustainable development projects and finally support for flood protection projects.

Planning Tools

- **The Development of the Bouregreg Valley**

It covers a total area of 6,000 ha from the Bouregreg estuary to the "Sidi Mohammed Ben Abdellah" dam upstream over a length of 17 km. Among its objectives include:

-depollution of the valley and regional planning with a view of making it “a place of prestige and social cohesion, capable of creating wealth and initiating a policy of sustainable development”;

- facilitate trade between Rabat and Sale with two tram lines, a new bridge and a 1.5 km tunnel under the walls of the Oudayas;

- The project called “BabAl Bahr” corresponds to a city of 35 ha comprising residences, hotels, shops, etc. (Bogaert, 2012).

- **Corniche of Rabat: Saphira Project**

This project aims to contribute to the improvement and enhancement of the Atlantic coast of Rabat. Therefore, the expectations of this project can be summed up in contribution to the resorption of unsanitary housing in the Yacoub Al Mansour and Akkariet neighborhoods. This boosts the local economy by generating jobs in the tourism and hotel sectors. Investment on this steep coast is subject to the completion of major work to reinforce the cliff and sanitation of the coast (Mouloudi, 2009).

- **The Kenitra-Atlantic Port and the Kenitra Free Zone**

The port will be located 24 km north of the mouth of Sebou wadi. The traffic forecast for this port project is 6 million tonnes on the horizon 2020 and 7.6 million tonnes in 2030, according to forecasts by the Ministry of Equipment (Snoussi, 2018).

- **Liquid Sanitation**

The region has 10 WWTPs. The connection rate at the end of 2015 was 91%, This is with a depollution rate of 34% with outfall and 8% without outfall. The new wastewater pre-treatment stations are important link in the coastal depollution system. Those carried out by Redala (Rabat and Skrirat or in the process of being carried out (Sale)) will make it possible to eliminate all direct wastewater discharges and thus to depollute the Atlantic coast and the Bouregreg valley for the agglomerations of Rabat, Sale, Témara, and Harhouraet Ain Attiq.

Conclusion

The littoral of the Rabat-Sale-Kenitra region is characterized by a great diversity of environments (beaches, dune, cliffs, lagoons, estuaries, etc.). This environment, which offers many ecosystem services (natural resources, recreation and tourism, climate regulation, protection against storm surges, etc.), is very fragile because it is subject to the impact of human activities which are constantly increasing (urbanization, development,

etc.). It is in fact the subject of strong land speculation and linear and anarchic urbanization, the installation of tourist and industrial infrastructure, and a more traditional function of the coastal domain which relates to the port and fisheries. It is also exposed to the inevitable effects of climate change (rise in sea level, modification of the swell regime, flooding, erosion, intrusion Marine…).

A coveted space, the littoral, is therefore a vulnerable space that experiences significant forms of pressure, both natural and anthropogenic, causing degradation and pollution that reduce its resilience to climate change. This situation requires Morocco to find the conditions for a more "sustainable" development. Therefore, this requires the harmonization of all activities and all uses of the coast in the interest of the environment and the population. As a result, it is necessary to consolidate the participatory approach in order to involve the populations concerned. Also, it is necessary to consolidate scientific research as stipulated in the littoral law and to ensure the application of laws and regulations.

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