



Sustainable Water Integrated Management (SWIM) - Support Mechanism

Project funded by the European Union

ALGERIA

COST OF DEGRADATION OF THE SEYBOUSE BASIN WATER RESOURCES

Summary



SUMMARY

With a population of 38.4 million inhabitants and a Gross Domestic Product (GDP) of 16.1 trillion dinars in 2012, Algeria, which still faces an estimated water endowment 450-500 m³ / year / capita is among the countries under water stress. In fact, Algeria lies below the 1000 m³/year/inhabitant scarcity threshold adopted by the World Bank compared to a regional average of 1,100 m³/year/inhabitant in 2011 and a world average of 6,600 m³/year/inhabitant, in 2011. The climate is typified by irregular rainfalls –both space and time wise - and by persistent drought. Drought during the previous decades has particularly affected agriculture, which in turn made it necessary to impose rationing as of the use of water in agriculture.

Already in the 80s, Algeria had implemented a development system based on the intensification of the exploitation of its natural resources, especially in the field of hydrocarbons and mining, which enabled the improvement of living conditions of its citizens whilst reversing the ecological imbalances, thanks to environmental sustainability policies. Despite that, the ecological fragility remains. Since 2002, Algeria has been engaged in a balanced policy inducing the mobilization and diversification of its water resources, within a context of rapid population growth in urban centers that significantly increased the needs in water of the country as a whole. Currently, Algeria disposes of seventy dams of a storage capacity of 7.3 billion m³ (said capacity will increase to 8.9 billion m³ in 2014 with 84 dams) and a modulable volume of 5.2 billion m³ with siltation rates ranging from 0.035% at the Keddara dam in the country's center (50,000 m³/year for an initial capacity of 143 million m³) and 1.1% in the Gargar dam, in the west (4.5 million m³/year for an initial capacity of 358 million m³). Similarly, nine seawater desalination plants have been in operation, with a capacity of 1.4 million m³/day whereas another two nearing completion, the whole meant to bring the production capacity of desalinated water up to a total 2.1 million m³/day. Significant achievements in the field of water resources mobilization helped to significantly increase the average rate of connection to the water network that reaches according to official sources 95% nationally, and an allocation of 175 liters / day / capita. The rate of connection to the sewerage system is 87%. For cons, the data published by UNICEF provide different connection rates with 83% for improved drinking water and 95% for improved sanitation in 2010.

It is within such general context that ascribes the regional study of the cost of degradation of water resources at the water catchment level, with the support of the SWIM-SM regional program funded by a 7.0 million €. grant from the European Union. One of the five components of this project is the improvement of water governance and the integration of water issues in sectoral policies such as policies of agriculture, industry, tourism, etc., in a way such as for the water to become an important element in national policies and development strategies. Assessed though the problems of water and their impact on the economy have been at the national level, the situation is different when it comes to catchment areas, as there has been no precise identification of problems and no assessment associated with degradation costs undertaken as yet. However, decisions must be taken at the basin level as regards the management and protection of water resources. This would allow local institutions to further look for those tools necessary to a debate on the policies needed to reduce these costs, at national and regional level, and on the basis of numeral cost values.



Through its national focal point, Algeria requested the assistance of SWIM-SM to estimate the cost of degradation of water resources in the Seybouse Catchment Basin . The choice of this basin relied on the following criteria:

- Seybouse is the second most important stream of Algeria, running through the country's north-east region and boasting of a length of 240 km. The formation of this waterway is happens near Guelma, through Oued Cherf and Oued Bouhamdane. Its basin, an area of 6,471 km², is the largest in Algeria and its land is more fertile. Seybouse flows into the Mediterranean sea, near Annaba.
- Seybouse mainly flows through the Wilayas of Guelma, Annaba and El Tarf, principally which consisting in land used for agricultural and industrial purposes.
- The Seybouse basin comprises two storage dams, namely the Oued Cherf dam of a capacity of 152,700,000 m³ and the Hammam Debbagh dam on the Oued Bou Hamdan, of a capacity of 184.3 million m³, both of which which are used for irrigation and drinking water.
- This basin is considered to be typical for a thorough of costs-and-benefits analysis associated with the degradation and restoration of water resources in Algeria, including aspects related to agricultural - municipal and industrial – pollution.
- The Seybouse basin has not been systematically documented; where available, data relevant to the Seybouse catchment areas are at best diffuse whilst there is no specific monograph on water resources at the catchment area level. Moreover, the economic dimension of degradation in the basin as well as in 16 other catchment areas Algeria has never been dealt with a view to tackle such to overcome degradation.

The main objective of this study is to evaluate the cost of degradation of water resources in the catchment area of the Seybouse basin, to help decision makers at national and local level to identify and prioritize specific actions to improve management of the basin through potential funding for projects related to environmental benefits and an alleviation of external effects. The Outcomes pursued are: (a) an overview of the economic aspects of management problems of the Seybouse catchment area; (B) an assessment of the cost of degradation of water resources; (c) an economic analysis of certain alternatives and (d) specific recommendations to integrate the advantages that benefit the environment and improve the management of the basin.

The costs of environmental degradation of Seybouse run up to 28.4 billion DA in 2012 with a variation from 20.7 to 34.8 billion DA equivalent on average to 4.2% of GDP in the region of the Seybouse Basin and as well as to 0.2% of Algeria's current national GDP (2012). The costs attributable to human health were of DA 7.9 billion in 2012 or 27.7% of the cost of degradation of the Seybouse basin with 6 billion dinars for waterborne diseases; 1.9 billion dinars concerned respiratory diseases in the Annaba region (Table 1 and Graph1).



Table 1 : Seybouse degradation cost, 2012- in millions of DA

Categories	Seybouse			
	Cost of Degradation		Infimum	Supremum
	In millions of DA	%	Millions of DA	Millions of DA
	20.755	73%	14.298	25.582
Waste	2.208	8%	1.741	2.621
Air (Annaba)	2.081	7%	1.947	2.634
Biodiversity	72	0%	57	86
Natural disasters – Global Environment	3.281	12%	2.645	3.917
Total	28.397	100%	20.689	34.840
% GDP Seybouse	4,2%		3,1%	5,2%
% GDP Algeria	0,2%			

Note: Infimum and supremum figures are meant to accommodate the uncertainties associated with degradation cost calculations.

Broken down by category, degradation of water resources is the largest in the Seybouse, by relative values, namely 73.1% of the overall cost for 2012. Natural disasters and the global environment including floods and forest fires having occurred in the region of the Seybouse Basin in 2012 come second, at 11.6%. The waste comes in third position with 7.8% followed by air in Annaba, at 7.3% and finally biodiversity comes last, at 0.3%.

Regarding the Water (20.8 billion dinars in 2012), the “Water Quantity” subcategory accounts for the majority of cost items relevant to the Seybouse Basin (11.0 billion DA) followed by water-borne diseases (6.0 billion DA) and finally the quality of water (3.7 billion dinars). This category impacts upon the global environment (carbon dioxide sequestration) although the costs could not be calculated.

Regarding the “Waste” category (2.2 billion dinars in 2012), the “Collection” sub-category represents the majority of the costs relevant to the Seybouse Basin (1.5 billion dinars), followed by “Waste Processing” (526 million DA), burial (174 million dinars) and finally the “Global Environment” (44 million dinars).

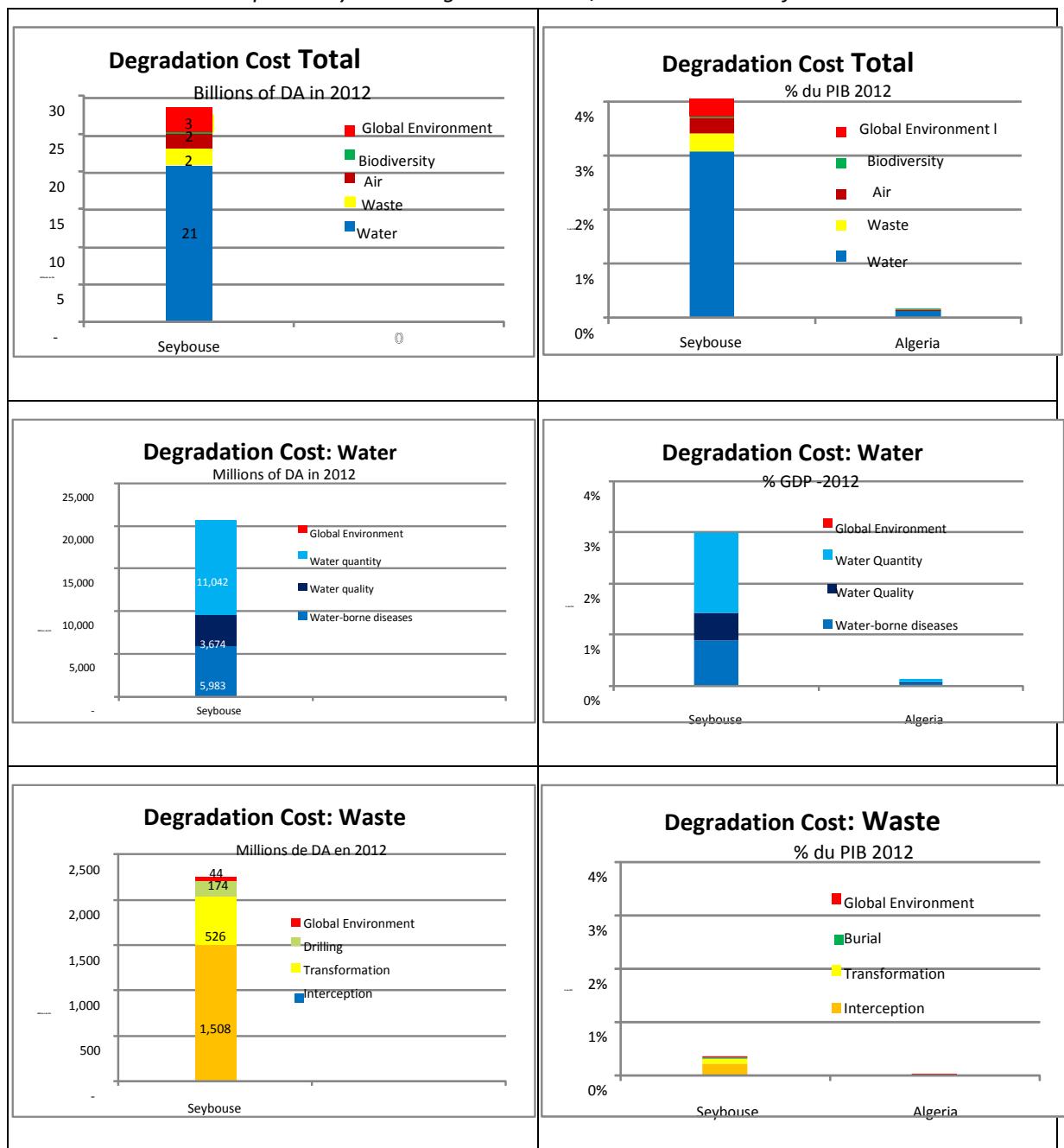
Regarding the “Air” category (2.1 billion dinars in 2012), the damage is mainly related to health (1.9 billion dinars) whereas there is damage resulting in the deterioration of agricultural productivity (125 million dinars) infrastructure and façades (84 million dinars), while the impact on the flora and fauna (eg. acid rain) has not been calculated. Moreover, the cost associated with lead in air has not been assessed, due to lack of reliable data.



The detailed analysis of the “Natural Disaster” and “Global Environment” categories (3.3 billion dinars in 2012) indicates that the damage is most particularly due to floods, forest fires and carbon emissions due to waste and forests fires.

Under the “Biodiversity” category (72 million dinars in 2012), the damage is due in particular to the reduction of wetlands as well as to the loss of biodiversity as a result of fires.

Graph 1 : Seybouse degradation cost, 2012- in billions of DA



Source : The Authors.



The cost estimates relevant to the degradation of water resources has identified the following conclusions:

- Efficiency losses in the drinking water and irrigation supply networks (28.5% of the total degradation) within the Seybouse Basin are by far the highest, namely causing damage by 36% higher than the damage due to lack of access to safe drinking water and improved sewerage (22% of the total cost of degradation). Furthermore, the actual cost of water was used in the calculations, instead of the production cost, hence an expansion of this particular subcategory by of 33%.
- Damage due to lack of access to safe drinking water and improved sewerage (6 billion DA) in the Seybouse Basin sanitation is by 39% higher than the damage resulting from the quality of the resources (2.9 billion DA).
- Poor collection and a lack of waste treatment (2.2 billion DA) constitute an important damage, eventually accounting for nearly a third of the damages caused by a lack of access to water and improved sewerage.
- Erosion contributes to the siltation of dams which in turn affects the amount of water (166 million dinars), which may further mean that the silting of dams can be caused by sediments in catchment areas and not necessarily by land erosion the sediments of which do not necessarily reach the dam reservoirs.
- Natural disasters are underestimated, their cost reaching some 2.9 billion DA, accounting for 11% of the total cost of degradation, including floods that significantly contribute to erosion.

Based on these findings, four priorities emerge in the short and medium term, the first three of which have been valued, namely:

- Reducing losses in irrigation networks;
- Drinking water and sewerage in rural areas;
- The collection and treatment of waste; and
- The effectiveness of land planning aimed at limiting erosion, siltation of dams and the harmful effects of flooding. Interventions related to land planning to the purpose of limiting erosion and siltation of dams were not considered due to lack of studies which would have allowed the establishment of a causal link between land planning and the reduction of siltation as well as an economic evaluation.

The most efficient scenarios were selected and are shown on Table 2 and Graph 2. Only one scenario was considered, relevant to the effectiveness of large-scale irrigation: Improved yields of vegetable and tree crops with productivity gains expected. The efficiency and effectiveness of large-scale irrigation is by no means challenged, all the more since it could have a positive return on investment within only 4 years. Regarding water and sewerage in rural areas, three scenarios are profitable: (i) drinking water supply exists whilst there is no connection to the sewer system; (ii) there is neither drinking water supply nor any connection to the sewer system; and (iii) the first two scenarios are considered collectively. As far as waste is concerned, there have been three scenarios considered: (i) ensuring a transfer station, a segregation station of a 15% recycling and 15% composting capacity in each of the Wilayas, also featuring the burial of



residual volume in a landfill; (ii) ensuring a transfer station, a segregation station of a 10% recycling and 10% composting 10% capacity, in each of the Wilayas, also featuring the burial of residual volume in a landfill; and (iii) endowing each of the Wilayas with a transfer station and an improved landfill, allowing for the construction of cells to produce electricity. The everything-dumped-in-the-landfill alternative coupled with the generation of electricity through the generation in cells is by itself profitable. The same may not be said about the alternatives relying on segregation and recycling, since such solutions are too expensive. Thus, to overcome this shortcoming, a multi-criteria analysis could be considered for decision making where C/A analysis would be weighed as much as job creation, the reduction of poverty, etc.. (See Appendix VI for calculations details).

Cost analysis of restoration of three categories analyzed and based on the net present value (NPV) of the investment over 20 years with a discount rate of 10% and the internal rate of return (IRR), has helped identify the most effective and efficient investments as being:

- a) As far as irrigation is concerned: investment, which is indicatively expected to save 200 million m³, to be further utilized to increase the yield of irrigated areas. The analysis shows a positive NPV of 2.1 billion dinars, an IRR of over 10% and A / C Ratio VA above 1.
- b) Sewerage is profitable for all 3 scenarios, at 2.3 billion dinars, an IRR above 10% and A / C Ratio VA above 1 for the third scenario, warranting a coverage rate of 100% for both drinking water and sewerage, over the period from 2013 to 2031.
- c) The transfer and disposal of municipal waste is only profitable when each Wilaya, a transfer station and landfill are established in each Wilaya, with electricity produced through methane emissions. This investment is of am NPV of 23 million dinars, an IRR of 11% and a A / C Ratio VA at 1.2.
- d) The evaluation of the reduction of water erosion could not be completed because of the unavailability of reliable data.

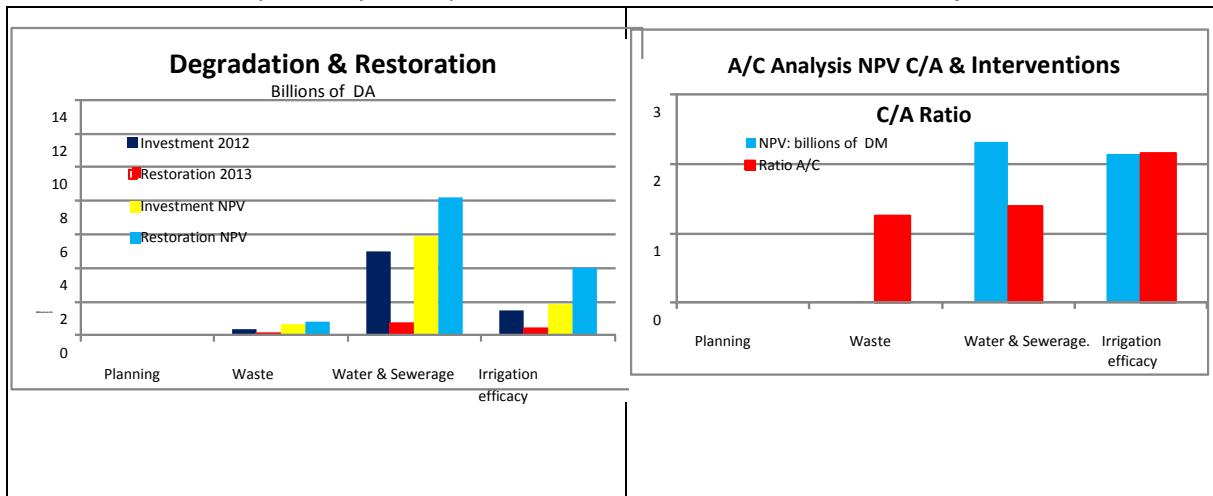
Table 2 : 2012: Seybouse Restoration Cost (in billions of DA)

Seybouse	Investment 2012	Restoration 2013	Investment NPV	Restoration NPV
	Billions of DA	Billions of DA	Billions of DA	Billions of DA
Planning	0	0	0	0
Waste	0,4	0,1	0,7	0,8
Water and Sewerage in rural areas	5,0	0,7	5,9	8,2
Irrigation efficacy	1,5	0,4	1,9	4,0

Source: Authors.



Graph 2 : Seybouse partial restoration cost, 2012 – in billions of DA



Source: Authors.

In the light of recommendations formulated in this study, there have been proposed four chapters of intervention towards an integrated and sustainable management of the Seybouse water resources :

a) **The prioritization of those interventions aiming at reducing the technical and financial losses of drinking water supply and irrigation services, further also likely to improve water management.**

Investment and institutional measures should be oriented mainly towards three types of intervention:

- i. The rehabilitation of drinking water, sewerage and irrigation based on a cost-estimated action plan focusing on the containment of technical and financial losses;
- ii. Structural changes in water management (incentives, governance, pricing by taking into account the requirements of financial sustainability, conservation, and user awareness) and the choice of technology for greater efficiency in economic, financial and environmental terms; and
- iii. Continuous improvement of management indicators and performance for drinking water supply, sanitation and irrigation.

b) **Focusing on efficient investment for the control of domestic pollution in rural, peri-urban and industrial pollution in the Seybouse basin.** It is prioritarily recommended that:

- i. The State invests in strengthening of the drinking water infrastructure and / or sewerage in rural areas, using appropriate technologies. The development of the strategy would be based on persuasive economic and environmental arguments as well as on the development of monitoring indicators such as the reduction of the cost of degradation of water resources.
- ii. The Ministry of Environment completes the study on industrial pollution of the Seybouse basin and further proceeds to the establishment of a performance control and monitoring system for projects launched or to be launched for the most polluting industries in Annaba, Skikda, El Tarf and Guelma.
- iii. Investments for landfill sites include not only the type of traditional burial but are also meant to generate additional revenue in the form of electricity and the processing and closing of dumps in the Seybouse Basin.



iv. Through their local representatives, sectors of water resources and the environment make sure that polluting industries apply the regulation whereunder an obligation is introduced to pretreat effluents before discharge into wastewater systems.

c) **An information network allowing for decentralized observation, follow-up, monitoring of environments and the Seybouse Basin natural resources.** This network should be re-oriented by linking the water institutions and the environment – most particularly ANRH, ABH-Constantine-Seybouse Mellègue, the direction of the Wilayas water resources and the directions of the environment of the Wilayas of the Seybouse basin. This network will be meant to pursue the following objectives:

- i. define and validate exchange protocols with other information sources and databases including the ANRH;
- ii. develop measurement systems for water sampling and monitoring of land use to assess the state of soil and water;
- iii. improve knowledge and assessment of the environment through the control of effluent discharges, with reference to the regulations and their impact on health and the degradation of natural capital as well as contributing to the decision-making based on regular and accurate data and information; and
- iv. provide all users with all information and data relevant to the nature and quality of water and soil as well as constraints, obligations and incentives.

d) **A horizontal action dimension for integrated water management in the Seybouse catchment areas is highly recommended.** A renewed effort is required to support resource planning at the Seybouse basin, taking into account the economic, environmental and social issues, as well as an improvement of the knowledge base, together with improved information systems and good analysis tools. This task and means could be entrusted to the ABH with a clear understanding that planning should not be limited to the purpose of matching supply and demand for water *stricto sensu*; rather, such planning is to also cover such other aspects such as the environment, industry, agriculture, etc.. A "horizontal" system must be set up, stemming from a holistic and integrated thinking on water management in the Seybouse Catchment area. It is strongly recommended that actions taken are supported by a permanent group within the ABH, which should, in the first place:

- i. Strengthen the balance of water resources and uses thereof in the Basin Seybouse basin in collaboration with local institutions, users and operators.
- ii. Enhance PDARE to the purpose of taking into account the investment plans, the cost of degradation of water resources of the Seybouse Basin and restoration thereof - including by way of the planned implementation of STEP, in view of also encouraging the reuse of treated wastewater.
- iii. Develop, by way of transfer of tools and know-how, an expertise in assessing the costs of degradation / restoration and an advisory capacity in the ways and means of integrating these aspects into sectoral strategies and development programs.
- iv. Launch Information and awareness campaigns among the population and schools by ABH-Constantine-Seybouse Mellègue, in view of communicating to water users the deterioration of the Seybouse water resources and the impact thereof on the population.