

The Green Dam in Algeria: An Integrated Approach to Environmental Policy, Climate Adaptation, and Sustainable Development

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Abstract :

The Green Dam project in Algeria represents a strategic national initiative launched in 1970 to combat desertification, restore degraded lands, and promote sustainable socio-economic development. Spanning 1,500 kilometers across multiple provinces and encompassing rangelands, forests, and agricultural areas, the project integrates environmental, economic, and social dimensions. Its rehabilitation (2020–2030) includes afforestation programs using drought-resistant species, irrigation through treated wastewater, rural development initiatives, job creation, climate adaptation measures, and food security enhancement. The Green Dam also aligns with international environmental commitments, including the UN Convention to Combat Desertification (UNCCD), the Paris Agreement, and the Sustainable Development Goals, while serving as a model for regional ecological resilience and cooperation in North Africa. This paper examines the historical origins, implementation strategies, environmental and socio-economic impacts, national and regional developmental significance, and sustainable financing mechanisms required to ensure the project's long-term success.

Keywords: Green Dam; Algeria; Desertification; Afforestation; Climate Adaptation

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1. Introduction

Algeria is increasingly confronted with severe environmental challenges, particularly desertification and land degradation, which currently affect approximately 50 million hectares of national territory. These phenomena pose direct threats to food security, socio-economic stability, and rural livelihoods, especially in arid and semi-arid regions. In response to these pressing issues, the Green Dam project was established as a strategic national initiative aimed at halting the northward advance of sand dunes, restoring vegetation cover, and enhancing ecological and social stability in rural communities.

Problem Statement:

Despite the strategic importance of the Green Dam, Algeria continues to face persistent land degradation and ecological fragility. The urgency of the situation is underscored by recent forest fires, which destroyed approximately 100,000 hectares in 2022 and 17,000 hectares in 2023, highlighting the need for effective rehabilitation and sustainable management. Moreover, climate change exacerbates drought periods and soil erosion, jeopardizing both ecological restoration efforts and socio-economic resilience in affected regions.

Research Sub-Questions:

This study seeks to address the following sub-questions:

1. What are the origins of the Green Dam project, and how has it been implemented since its inception?
2. In what ways does the project contribute to climate adaptation and food security?
3. What national and regional lessons can be drawn to ensure the project's long-term sustainability?

Research Objectives:

The objectives of this study are to:

1. Analyze the origins, implementation, and expansion of the Green Dam project.
2. Evaluate its contributions to desertification control, climate adaptation, and food security.
3. Assess its national and African developmental significance.

4. Explore sustainable financing approaches and community-based strategies to ensure the project's long-term success.

Significance of the Study:

The Green Dam serves as a model of integrated environmental and developmental policy, linking ecological restoration with economic development, rural employment, and climate adaptation. The project's experiences and lessons are relevant not only to Algeria but also offer valuable insights for other African countries facing similar environmental and socio-economic challenges

2. Origins and Implementation of the Green Dam

2.1 Conceptualization and Initial Implementation (1967–1970):

The Green Dam project was first conceptualized in 1967 as a response to the south-to-north progression of sand dunes and the increasing land degradation caused by exploitative agricultural practices, compounded by infrastructural damages from the French colonial period and natural environmental factors. Recognizing the urgency of halting desertification, the late President Houari Boumédiène officially launched the project in 1970, mobilizing over 20,000 personnel from the National People's Army, complemented by voluntary contributions from civil society organizations¹.

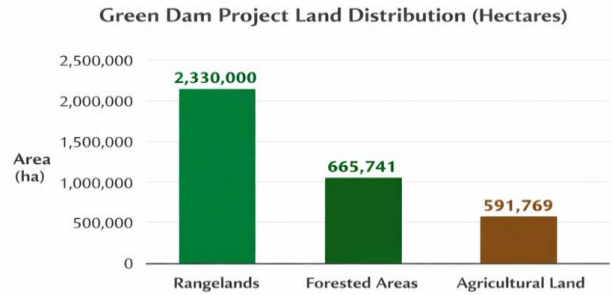
A diverse array of tree species was planted, including Aleppo pine (*Pinus halepensis*), green oak (*Quercus ilex*), and pistachio (*Pistacia vera*), alongside forage plants such as alfalfa (*Medicago sativa*) and esparto grass (*Stipa tenacissima*). The Green Dam extends as a longitudinal ecological belt from arid to semi-arid regions, with annual precipitation ranging from 200 mm in southern areas to 300 mm in northern areas, encompassing approximately 3.7 million hectares. Stretching 1,500 kilometers from Algeria's western to eastern borders with a width of 20 kilometers, it covers the provinces of Djelfa, Batna, Khenchela, Tebessa, Naama, Laghouat, El Bayadh, and M'sila². The primary objectives are to mitigate desertification, restore vegetation cover, enhance ecological stability, and reduce the isolation of rural communities.

2.2. Project Relaunch and Expansion:

The rehabilitation of the Green Dam commenced in 2020, with an initial budget allocation of 75 billion Algerian dinars, renewed annually under the Algerian Finance Law for a seven-year period (2023–2030). The project's coverage has been expanded from 3.7 to 4.7 million hectares³, encompassing 13

provinces—including M’sila, Batna, Khenchela, Laghouat, El Bayadh, Naama, Setif, Djelfa, Bouira, Tebessa, Bordj Bou Arréridj, and Biskra—alongside 183 municipalities and 1,200 designated zones. Of the total area, 63% (2.33 million hectares) is dedicated to rangelands, 18% (665,741 hectares) comprises forested areas, and 16% (591,769 hectares) is allocated to agricultural land⁴.

Figure 01 Land Distribution of the Green Dam Project in Algeria (2023–2030)



Source: Author’s own compilation

The figure illustrates the distribution of the Green Dam project area according to land use types. The pie chart shows that rangelands constitute the majority of the project’s coverage at 63% (2,330,000 hectares), followed by forested areas at 18% (665,741 hectares), and agricultural land at 16% (591,769 hectares). The accompanying bar chart provides a visual comparison of the absolute areas in hectares, highlighting the predominance of rangelands in the overall project. These visualizations emphasize the project’s focus on protecting and rehabilitating semi-arid rangelands while maintaining a balance with forest and agricultural development, supporting both ecological stability and sustainable socio-economic development.

2.3. Integrated Sustainable Development Strategy:

The Green Dam project is implemented through a comprehensive approach integrating environmental, economic, and social dimensions. Assessments of local population needs, unemployment rates, and economic potential guide the creation of employment opportunities aligned with regional capacities⁵. Fertile lands are designated for forestry or fruit tree cultivation, while less productive areas are utilized for industrial purposes, such as agro-processing

units. Ecotourism is also promoted, with concession agreements enabling sustainable recreational use of forested areas. Additionally, the Green Dam provides raw materials essential for traditional industries⁶.

2.4. Afforestation and Irrigation Programs:

To support afforestation, 45 nurseries have been established across 12 provinces, aiming to produce 120 million seedlings over the 2023–2030 period. Species selected are drought- and desertification-resistant, including olive, pistachio, almond, and carob trees, with prickly pear employed as a natural firebreak and fodder resource. Irrigation relies on treated wastewater, ensuring the sustainable growth of forest and rangeland vegetation.

A Coordinating Authority for Desertification Control and Green Dam Rehabilitation was established, comprising representatives from 15 ministries, public institutions, research centers, and two civil society organizations active in desertification mitigation⁷. The Authority oversees the project's implementation, monitors compliance with the UNCCD, coordinates relevant sectors, and participates in international climate conferences. Notably, the absence of the Ministry of Education within this body raises concerns regarding environmental awareness and the development of an environmentally conscious future generation.

3.Action Plan (2020–2030)

The Green Dam rehabilitation follows a phased strategy with short- and medium-term programs:

Phase 1: 2020–2023:

The first phase of the Green Dam rehabilitation project (2020–2023) had a budget of 11.7 billion DZD and involved multiple government sectors, including the Ministries of Justice (Prison Administration), Youth and Sports, and National Defense. During this phase, a total of 23 million seedlings were planted, covering 19,626 hectares out of 26,234 planned, achieving approximately 75% of the target. The afforestation included 17,545 hectares of forests, 448 hectares of rangelands, and 1,513 hectares of orchards. Additional interventions consisted of sand dune stabilization over 143 hectares, water retention structures with a total capacity of 44,894 m³, and the opening of 413 kilometers of rural roads, supporting both ecological restoration and rural infrastructure development⁹.

Phase 2: 2023–2026:

The second phase (2023–2026) of the project has been allocated a budget of 10 billion DZD and engages a broader range of stakeholders, including government ministries, farmers, rural women, civil society organizations, the private sector, the National Rural Engineering Company (GGR), and the National Office for Rural Development Studies. The objectives of this phase focus on expanding afforestation efforts, sand stabilization, water retention, and the establishment of mixed green belts. Specific targets include afforestation of 7,440.5 hectares of forest and 2,640 hectares of rangelands, development of 4,331.5 hectares of orchards, planting of 444.16 hectares of prickly pear, creation of 9,295 hectares of mixed green belts, construction of over 1,012.5 km of windbreaks, job creation for 10,000 individuals, carbon sequestration of 20,000 tons, and maintenance or development of 413 km of rural roads¹⁰.

Table (1): Achievements and Budgets of the Green Dam Project

Phase	Period	Budget (DZD)	Stakeholders	Key Objectives / Achievements
Phase 01	2020–2023	11.7 billion	Ministries of Justice (Prison Administration), Youth and Sports, National Defense, and others	seedlings planted: 23 million
				Forests: 17,545 ha
				Rangelands: 448 ha
				Orchards: 1,513 ha
				Sand dune stabilization: 143 ha
				Water retention: 44,894 m ³
Phase 2	2023–2026	10 billion	Government ministries, farmers, rural women, civil society, private sector, National Rural Engineering Company (GGR), National Office for Rural Development Studies	Rural roads opened: 413 km
				Sand stabilization: 1,129.5 ha
				Water retention: 30,100 m ³
				Afforestation (forest areas): 7,440.5 ha
				Afforestation (rangelands): 2,640 ha
				Orchards: 4,331.5 ha
				-Prickly pear: 444.16 ha
				Mixed green belt: 9,295 ha
				Windbreaks: >1,012.5 km
				Job creation: 10,000
				Carbon sequestration: 20,000 tons
				- Rural roads: 413km

Source: Author’s own compilation

The table illustrates the systematic progress of the Green Dam Project across two phases. Phase 1 (2020–2023) focused on establishing the project’s

foundational infrastructure through planting millions of seedlings, stabilizing sand dunes, and developing rural infrastructure such as roads and water retention structures. Phase 2 (2023–2026) aims to expand the project’s scope and intensify environmental, social, and economic activities, including afforestation of forests and rangelands, establishment of mixed green belts, planting prickly pear as a windbreak and fodder resource, and creating additional employment opportunities, along with enhancing carbon sequestration to mitigate climate change. The table reflects the project’s integrated approach that combines environmental, social, and economic dimensions, highlighting Algeria’s commitment to sustainability and rural development in semi-arid regions.

4. Climate Adaptation and Food Security

The Green Dam serves as a natural barrier against desertification, protecting northern and western agricultural lands. Its vegetation cover moderates local climate, reducing temperatures and increasing humidity, thereby promoting rainfall¹¹. It also provides habitats for wildlife, particularly endangered species, and contributes to climate change mitigation through carbon sequestration and greenhouse gas reduction. Rehabilitated lands, planted with suitable crops and trees, support food security and reduce reliance on imports¹².

The project further fosters rural employment, social cohesion, and population stability in highlands, steppes, and semi-arid regions. Infrastructure projects—including wells, water retention structures¹³, windbreaks, and solar energy systems—enhance livelihoods, reduce urban migration pressures, and encourage ecotourism, thereby raising environmental awareness and stimulating local economies¹⁴.

5.The Developmental Vision of the Green Dam: National and African Dimensions

The Green Dam project in Algeria is not merely a national program aimed at combating desertification; rather, it represents a comprehensive development vision encompassing environmental, economic, and regional dimensions. Initially conceived as a vegetative barrier extending across semi-arid regions, the project seeks to limit the northward advance of sand encroachment and protect agricultural lands in the High Plateaus and steppe regions¹⁵. Studies indicate that this green belt extends across the rainfall zone receiving between 200 and 300 mm of precipitation annually, which represents one of the most fragile ecological zones in Algeria, where land degradation and wind erosion are particularly severe.

The significance of the project lies in its capacity to restore ecological balance in these regions through the rehabilitation of vegetation cover, the improvement of soil fertility¹⁶, and the mitigation of both wind and water erosion. Vegetation plays a crucial role in stabilizing soils and reducing soil loss caused by strong winds and sandstorms. It also contributes to improving the local microclimate by lowering surface temperatures and increasing relative humidity, factors that may enhance rainfall potential in the long term¹⁷. Moreover, these ecological processes support biodiversity conservation, as forests and green belts provide natural habitats for numerous plant and animal species that depend on steppe ecosystems¹⁸.

At the economic level, the Green Dam constitutes an important pillar for strengthening food security in Algeria by protecting agricultural lands and improving their productivity. The restoration of soil fertility and the promotion of climate-adapted agriculture in semi-arid environments—such as the cultivation of fruit trees and pastoral plants—can contribute to the development of local agriculture and reduce dependence on food imports. Furthermore, the project creates new opportunities for rural development by generating employment in afforestation, forest management, ecotourism, and traditional industries linked to natural resources.

From a regional perspective, the Green Dam may serve as an African model for combating desertification and adapting to climate change. The project intersects with major continental initiatives, such as the Great Green Wall Initiative in the Sahel and Sahara region, which aims to restore millions of hectares of degraded land across Africa. Studies suggest that Algeria's experience in establishing the Green Dam was among the early initiatives that inspired similar continental projects. Consequently, the impact of the Green Dam extends beyond national borders to neighboring countries in North Africa, as it may contribute to reducing sandstorms and improving environmental stability across the region. This, in turn, strengthens regional cooperation in natural resource management and in addressing shared climate challenges¹⁹.

6. A Support Fund for Sustainable Financing of the Green Dam

Despite its strategic importance, the Green Dam project faces a number of environmental and economic challenges that may affect its long-term sustainability. Among the most significant of these challenges are climate change impacts²⁰, which lead to longer periods of drought and rising temperatures. These

conditions directly affect vegetation growth and soil stability in arid and semi-arid areas. International reports also indicate that North Africa is among the regions most vulnerable to sandstorms and drought as a result of climate change, increasing the fragility of ecosystems in Algeria²¹

In addition, afforestation and land restoration programs require substantial financial and water resources, particularly in semi-desert areas that already suffer from water scarcity. Some studies also indicate that earlier phases of the Green Dam project encountered challenges related to overgrazing and human pressure on natural resources, which in certain cases contributed to the degradation of planted vegetation cover.

To address these challenges, a sustainable financing approach could be adopted through the establishment of a national and international support fund dedicated to the Green Dam²². Such a mechanism could rely on contributions from the Algerian government, international partners, and climate-related financial institutions. Potential sources of funding may include the Green Climate Fund, as well as environmental and development programs supported by the United Nations. Additional cooperation could be pursued with international organizations such as the Food and Agriculture Organization and the United Nations Development Programme.

7. Conclusion

This study has examined the Green Dam project in Algeria as a strategic national initiative aimed at combating desertification and promoting sustainable development in semi-arid regions. Through an analysis of its historical evolution and recent rehabilitation strategies (2020–2030), the paper highlights the project's transformation into a more integrated approach combining environmental restoration with socio-economic development and climate adaptation.

The findings show that the Green Dam contributes to enhancing ecological resilience, supporting food security, and improving rural livelihoods through afforestation programs, water management practices, and local development initiatives. In this sense, the project reflects an important shift toward a more comprehensive environmental policy framework that addresses both ecological and developmental challenges.

However, the long-term sustainability of the project remains dependent on overcoming key constraints, particularly climate variability, water scarcity, and the need for stronger institutional coordination and sustained financial support.

These challenges underline the importance of adopting adaptive and inclusive strategies that reinforce the effectiveness of such large-scale environmental programs.

Overall, the Green Dam represents a significant public policy experience that demonstrates the value of integrated approaches in addressing complex environmental issues. It also offers relevant insights for other countries facing similar challenges, particularly in semi-arid regions where the link between environmental protection and development remains critical.

Ultimately, the Algerian experience underscores that sustainable environmental policies are most effective when they integrate ecological restoration with long-term socio-economic and institutional transformation.

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