



**IFAD**  
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**REPORT AND RECOMMENDATION OF THE PRESIDENT**

TO THE EXECUTIVE BOARD ON PROPOSED

**TECHNICAL ASSISTANCE GRANTS**

FOR

**AGRICULTURAL RESEARCH AND TRAINING**

BY A

**NON-CGIAR-SUPPORTED INTERNATIONAL CENTRE**



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### ABBREVIATIONS AND ACRONYMS

ACSAD	Arab Centre for the Studies of Arid Zones and Dry Lands
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources)
FAO	Food and Agriculture Organization of the United Nations
NWSAS	North-Western Sahara Aquifer System
SDC	Swiss Development Cooperation
SSO	Sahara and Sahelian Observatory
TAG	Technical Assistance Grant
TCP	Technical Cooperation Programme
UNDP	United Nations Development Programme
Unesco	United Nations Educational, Scientific and Cultural Organization



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NON-CGIAR-SUPPORTED INTERNATIONAL CENTRE**

I submit the following Report and Recommendation on a proposed technical assistance grant for agricultural research and training to a non-CGIAR-supported international centre in the amount of USD 1 065 000.

**PART I - INTRODUCTION**

1. This report recommends the provision of IFAD support to the research and training programme of the non-CGIAR-supported international centre: the Sahara and Sahelian Observatory (SSO).
2. The document of the technical assistance grant (TAG) for approval by the Executive Board is contained in the annex to this report:
  - I. Sahara and Sahelian Observatory: Programme for the Development of a Regional Strategy for the Utilization of the North-Western Sahara Aquifer System
3. The objectives and content of this applied research programme are in line with the evolving strategic objectives of IFAD and with the policy and criteria of its TAG programme.
4. The strategic objectives of IFAD's support for technology development relate to: (a) IFAD's target groups and their household food-security strategies, specifically in remote and marginalized agro-ecological areas; (b) technologies that build on traditional knowledge systems, are gender-responsive, and enhance and diversify the productive potential of resource-poor farming systems by improving productivity and addressing production bottlenecks; (c) access to productive assets (land and water, financial services, labour and technology, including indigenous technology) and sustainable and productive management of such resources; (d) a policy framework that provides the rural poor with an incentive to reach higher levels of productivity, thereby reducing their dependence on transfers; and (e) an institutional framework within which formal and informal, public and private sectors, local and national institutions provide services to economically vulnerable, in accordance with their comparative advantages. Within this framework, IFAD also intends to develop commodity-based approaches to rural poverty alleviation, specifically targeting those items that are produced and consumed by the rural poor. Finally, the establishment of a consolidated network for knowledge-gathering and dissemination will enhance the Fund's capacity to establish long-term strategic linkages with its development partners and to multiply the effect of its agricultural research and training programme.
5. The TAG proposed in this document responds to the foregoing strategic objectives, in particular, to objectives (c), (d) and (e), to the extent that it seeks to develop an appropriate policy and institutional framework for the assessment and sustainable utilization of a geographically extensive common property resource, with the ultimate aim of considerably improving the access of poor rural communities in remote areas of northern Africa to meager water resources in the region.



## **PART II - RECOMMENDATION**

6. I recommend that the Executive Board approve the proposed technical assistance grant in terms of the following resolution:

RESOLVED: that the Fund, in order to finance, in part, the Sahara and Sahelian Observatory, shall make a grant not exceeding one million and sixty five thousand United States dollars (USD 1 065 000) upon such terms and conditions as shall be substantially in accordance with the terms and conditions presented to the Executive Board in this Report and Recommendation of the President.

Fawzi H. Al-Sultan  
President



## SAHARA AND SAHELIAN OBSERVATORY: PROGRAMME FOR THE DEVELOPMENT OF A REGIONAL STRATEGY FOR THE UTILIZATION OF THE NORTH-WESTERN SAHARA AQUIFER SYSTEM

### I. BACKGROUND AND RATIONALE

1. The North-Western Sahara Aquifer System (NWSAS) encompasses an area of over 1 million km<sup>2</sup> within the western Sahara desert in north-eastern Africa: 700 000 km<sup>2</sup> in Algeria, 80 000 km<sup>2</sup> in Tunisia, and 250 000 km<sup>2</sup> in Libyan Arab Jamahiriya. The NWSAS consists predominantly of continental deposits subdivided into several aquifers, namely: the *Continental Intercalaire*, located in north-eastern Africa and extending from south-western Algeria to the northern central region of Libya; the *Complexe Terminal*, which covers the central part of the basin; and the *Coastal Aquifer*, which is limited to the Tunisian and Libyan coastal belt, the so-called *Jefara*.

2. The groundwater reservoir filled with fresh water during the wet periods of the Quaternary Period ending some 8 000 years ago. Since then, the depressions (*sebkhas*) located along the northern border of the Sahara and the large springs located in the eastern part of the north-western Libyan coast have been the cause of draining-out and evaporation of water from the aquifer, resulting in the gradual emptying of the reservoir over time. Sporadic surface-water flows along the base of the Atlas Mountains in Algeria and Tunisia help to replenish the aquifer system but are very limited when compared with the present levels of water abstraction in the three countries.

3. A significant portion of the large water reserves stored in the ground may be physically and economically accessible. The key to optimal utilization of this vast groundwater resource would therefore lie in the identification and implementation of strategies for extraction and development, where payoffs are likely to be the highest and most enduring in terms of impact. The NWSAS is a non-renewable resource. Although its development and utilization could lead to depletion in the long term, there is significant scope for groundwater development. In the absence of alternative sources of water in a region where scarcity of this resource is a major constraint on rural poverty-alleviation programmes, there is a broad range of uses that can be made of water resources provided that principles of economic rationality are observed. The optimal utilization of this groundwater resource can only be determined, however, by identifying the extraction options for the three countries, based on sound data. This, then, is the focus of the present programme.

4. There is a strong need to collect and analyse appropriate data to determine where payoffs are likely to be in terms of possibilities for groundwater development, in particular for agriculture, which is the main rationale for IFAD's involvement. Guided by principles of economic rationality, the urgent need at present is to identify all available options and alternative water sources. Given that water is so crucial to the development of rural economies in the region, its extraction and utilization in remote areas not served by surface *water* for irrigation and drinking water is considered critical to rural poverty-alleviation efforts. Socio-economic factors (including equitable distribution of benefits and access to water by the rural poor) and geo-political considerations are as important as the pure economics of groundwater development and utilization. In the near future, IFAD is expected to develop project ideas for initiatives in oasis areas of Algeria. Libyan Arab Jamahiriya and Tunisia are discussing the possibilities of a joint range-management project along Tunisia's



south-eastern border with Libyan Arab Jamahiriya. IFAD would be approached to design the project, and financing would be sought by the Libyan Government from donor partners and from its own budget. The Tunisian part of the project would be financed through an IFAD loan. Furthermore, when NWSAS groundwater sources are identified and can be readily extractable in technical and economically viable terms, development projects in the relevant countries could be conceived by those countries, based on the utilization of this valuable water resource.

## II. THE PROPOSED PROGRAMME

5. The proposed programme's overall objective is optimal management of the NWSAS water resources shared by Algeria, Libyan Arab Jamahiriya and Tunisia, with particular emphasis on identifying viable options for groundwater development and use by communities engaged in agriculture and other related activities that depend on scarce water supply. The specific objective is to determine alternatives for the economically rational utilization of this groundwater resource by identifying extraction options based on sound data, through:

- (i) updating of the water-resources assessment in order to determine the water-development potential in agricultural development projects in the subregion;
- (ii) defining a matrix for groundwater utilization in terms of annual volumes used/demanded, by location and type of user (including, in particular, the rural poor) and analysing the effectiveness of existing control mechanisms and enforcement structures for water rationing, including price policy, as it affects on rational water use; and
- (iii) the creation of an enabling technical environment to facilitate preparation of a strategy for regional water-resources management and the setting up of a consultation mechanism among the three countries at the basin level with a view to securing optimal management of shared water resources.

These objectives translate into the following three components and outputs.

### **Developing a new Knowledge/Information System on Aquifer Potential**

6. The programme would standardize and update all data related to the groundwater resources of the NWSAS ensuring compatibility of information systems in the three countries. This would include collecting and analysing the geological and hydrogeological information acquired over the past 30 years; setting up an observation network designed to monitor the aquifer's behaviour in terms of abstraction in order to check the reliability of the model responses and assess the environmental impact of ongoing or proposed agricultural development projects; and setting up a data exchange mechanism between the three countries. The state of knowledge related to the NWSAS in the three countries will be updated according to the following activities:

- (i) harmonization of the hydrogeological data bases and geodesic data, and collating and analysing the geological and hydrogeological information acquired since 1970;
- (ii) setting up of an observation network at the basin level with a view to monitor the aquifer's behaviour and check model reliability, and assess the impact of development scenarios.





## **Application of Models for Groundwater Irrigation Projects**

7. The programme will develop and calibrate new aquifer simulation models based on the updated information. Dynamic models will be designed to help understand the nature and dynamics of available groundwater, its depth at various strategic points, and the economics of extraction. This will require installing the new simulation models in the three countries with trained personnel in order to simulate the planned water-development schemes to be adopted by each country and to ensure coordinated management of the shared water resources, when the countries decide to deploy the schemes. This component would help project formulation missions to better specify alternative irrigation-development options based on a more accurate assessment of available water resources. On this basis, the programme will also be able to elaborate groundwater development scenarios and simulation of models for direct inputs in development project design.

8. The modelling exercise will be supplemented through the development of a matrix for groundwater utilization in terms of annual volumes used/demanded, by location and type of user: for agriculture (small farmers, small livestock holders); for potable water supply (urban and rural households); industry (agri-business, tourism); and other public services (defense, oil, etc.). The analysis will be extended to institutional and policy variables that will help assess the effectiveness of existing control mechanisms (i.e., availability of effective enforcement structures for water rationing; use of pricing/subsidies for water boreholes and water use).

## **Establishment of a Regional Consultation Mechanism**

9. The creation of an enabling technical environment to facilitate the preparation of a strategy for regional water-resources management will require setting up a consultation mechanism among the three countries at the basin level. Such a mechanism will be established with a view to securing optimal management of the shared water resources. This will be supported under an FAO/TCP grant of USD 262 000 and will be launched after the successful execution of the first two components under the programme described above.

## **III. IMPLEMENTATION ARRANGEMENTS**

10. The Sahara and Sahelian Observatory (SSO) organized a formal consultation among the three countries in April 1998 that led to the preparation of a programme and implementation framework, as agreed by all the stakeholders and outlined below. At the international level, the SSO will be the executing agency responsible for coordination and the monitoring and evaluation of project performance through scientific supervision and financial audit. As the executing agency, SSO will be responsible for: liaising with IFAD and administering programme funds; recruitment and hosting the regional programme director in Tunisia; selecting and recruiting consultants in cooperation with the regional programme director and according to the programme approved by the steering committee; procurement of programme equipment; and providing the regional programme director with all logistic support required for the proper functioning of the programme (office with the assistance of the host country, secretariat, publishing reports and securing an annual external financial audit of the programme).

11. The steering committee will be composed of representatives of the countries, the funding agencies, SSO and relevant scientific organizations having expertise in the subject (Unesco, Food and Agriculture Organization of the United Nations (FAO), Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) and Federal Institute for Geosciences and Natural Resources (BGR)). The steering committee will be responsible for: assessing the validity and quality of the technical results obtained during the



preceding period; discussing and approving or adjusting the work programme for the next period as well as the related budget proposed by the regional programme director and SSO. The steering committee will be presided over by SSO and will meet once a year.

12. The regional programme director will be based in Tunisia and will be responsible for the technical implementation of the programme, within the structure of SSO, namely: securing the smooth progress of the programme; coordinating national inputs; planning, organizing and monitoring the missions of consultants; organizing meetings and training workshops; providing technical guidance for activities and monitoring programme results in accordance with the recommendations of the steering committee; preparing progress reports to be submitted to the steering committee, in collaboration with the national coordinators; preparing assessment reports at the request of the steering committee; and preparing technical reports for the donors.

13. The national coordinators - who will be appointed by the countries and are to have scientific and technical skills suitable to the programme activities - will actively participate in the design, planning and implementation of the national activities, in collaboration with the regional programme director. They will also participate in regional activities such as: design of the conceptual model, calibration of models, analysis of the results of simulations of development scenarios.

#### **IV. INDICATIVE PROGRAMME COSTS AND FINANCING**

14. The total cost of the proposed programme is estimated to be USD 2 037 000 over three years. These costs include the hiring of international expertise and procurement of selected field equipments particularly for collection and analysis of hydrogeological information and transport to and from the field sites. The budget also provides for a meeting of stakeholders each year to review progress and discuss work plans, as well as a workshop during the last year of the programme to evaluate implementation and the countries recommendations for follow-up activities at the individual country level. This will be part of the consultation mechanism for which FAO will act as executing agency and will provide incremental support under its Technical Cooperation Programme (TCP) for a total amount of USD 262 000, once the models have been refined and validated. Incremental expenditures over and above ongoing SSO operations during the three-year period will be covered by contributions from IFAD (52%), Switzerland (19%) and country contributions (29%), in accordance with the financing plan depicted in Table 2.



**Table 1 - Total Costs by Category and Year of Implementation  
(USD)**

Category	Donor	Contribution			
	Year 1	Year 2	Year 3	Total Country Contribution (3 years)	Grand Total
<b>1- Personnel</b>					
International	254 000	266 000	147 000		667 000
National	40 000	50 000	29 900	409 500	529 400
<b>Subtotal</b>	<b>294 000</b>	<b>316 000</b>	<b>176 900</b>	<b>409 500</b>	<b>1 196 400</b>
<b>2- Travel</b>					
International personnel	10 000	7 000	3 000		20 000
Meetings and international workshops	20 000	20 000	14 000		54 000
Missions of national coordinators	15 000	10 000	15 000	48 000	88 000
<b>Subtotal</b>	<b>45 000</b>	<b>37 000</b>	<b>32 000</b>	<b>48 000</b>	<b>162 000</b>
<b>3- Equipment</b> (computers, field equipment, vehicles)	<b>254 100</b>	<b>35 000</b>	<b>0</b>	<b>75 000</b>	<b>364 100</b>
<b>4- Subcontracts</b>	<b>20 000</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>20 000</b>
<b>5- Operating expenses</b> (regional director)	<b>35 000</b>	<b>35 000</b>	<b>45 000</b>	<b>60 000</b>	<b>175 000</b>
<b>6 - SSO logistic and administrative support</b>	<b>50 000</b>	<b>45 000</b>	<b>25 000</b>	<b>0</b>	<b>120 000</b>
<b>GRAND TOTAL</b>	<b>698 100</b>	<b>468 000</b>	<b>278 900</b>	<b>592 500</b>	<b>2 037 500</b>

**Table 2 - Financing Plan  
(USD)**

Category	Total	IFAD	Switzerland	Incremental Country Contribution
<b>1- Personnel</b>	<b>1 196 400</b>	<b>579 900</b>	<b>207 000</b>	<b>409 500</b>
<b>2- Travel</b>	<b>162 000</b>	<b>84 000</b>	<b>30 000</b>	<b>48 000</b>
<b>3- Equipment</b>				
Computers, field equipment	154 100	78 100	76 000	75 000
4 vehicles	135 000	135 000	0	0
<b>Subtotal</b>	<b>364 100</b>	<b>213 100</b>	<b>76 000</b>	<b>75 000</b>
<b>4- Subcontracts</b>	<b>20 000</b>	<b>15 000</b>	<b>5 000</b>	
<b>5- Operating expenses</b>	<b>175 000</b>	<b>85 000</b>	<b>30 000</b>	<b>60 000</b>
<b>6 - SSO logistic and administrative support</b>	<b>120 000</b>	<b>88 000</b>	<b>32 000</b>	
<b>GRAND TOTAL</b>	<b>2 037 000</b>	<b>1 065 000</b>	<b>380 000</b>	<b>592 500</b>
Percentage share	100%	52%	19%	29%



## STATUS OF AQUIFER DEVELOPMENT AND UTILIZATION IN THE SUBREGION

1. The current rate of extraction from the NWSAS (Continental Intercalaire and Complexe Terminal Aquifers) is on the order of 450 hm<sup>3</sup>/yr in Tunisia, 1 300 hm<sup>3</sup>/yr in Algeria and 250 hm<sup>3</sup>/yr in Libyan Arab Jamahiriya. Groundwater development in the Algerian and Tunisian Sahara started more than 50 years ago and more recently in Libyan Arab Jamahiriya. However, growing population pressure and the lack of renewable water resources in the Sahara are leading to increasing attention to the utilization of the NWSAS's groundwater potential.

2. An extensive hydrogeological study of the northern Sahara basin was carried out in 1968-1971 with technical assistance from Unesco and financial support from United Nations Development Programme (UNDP). However, the study was based on the limited data available and included only part of the Western Sahara basin in Algeria and Tunisia. The studies mainly defined the hydrogeological framework of the aquifer system and subsystems, and developed models to simulate the response of the aquifers to various development scenarios. These models have not been verified or updated since 1981-1983, aside from the fact that they are limited geographically to two countries. In the past 15 years, a number of new developments have occurred that justify the revision of the models and scenarios on the basis of more comprehensive data that are now available. Among these are:

- (i) The significant increase in water withdrawal in Algeria and Tunisia since 1982 has had serious consequences for the status of water availability in the aquifer, and reciprocal effects from abstraction between the two countries. In Libya, growing demographic pressure and the resulting for demand food, mostly along the coast where agricultural production is facing seawater intrusion and dropping water levels, are eliciting increasing attention to the NWSAS's groundwater potential. The urban and industrial development of the western part of the Jefara Plain requires additional water supply, which is planned to be provided by the NWSAS. Increased irrigated areas and water transport to the coast are likely to double the present extraction levels. Another important factor will seriously affect the NWSAS in the future: a significant part of the water flowing in the aquifer is recharged from the Palaeozoic sandstone aquifer in the South (Jabal Fezzan-Jabal Hasawna), where the well fields supplying water to the western conveyance system of the Great Man-made River Project are located. The planned extraction of 2.5 hm<sup>3</sup>/day (approx. 900 hm<sup>3</sup>/yr ) from the Palaeozoic aquifer will dramatically reduce the replenishment of NWSAS and may completely change its behaviour.
- (ii) In Tunisia, the planned expansion of irrigated areas will require the mobilization of an additional 350 hm<sup>3</sup>/yr between now and the year 2020.
- (iii) The drilling of a significant number of new wells and assessment studies performed in the three countries have yielded valuable information for understanding the NWSAS's groundwater hydraulics.
- (iv) The promotion of water-basin awareness in the three countries potential for regional cooperation in the management of water resources and is an indication of the countries' willingness to significantly intensify the development of their groundwater resources, mostly for agriculture.



3. SSO is an intergovernmental organization that links a number of programmes in the region into complementary subprogrammes. It has already made efforts to bring the three countries together for regional cooperation on management of the aquifer. SSO also serves as a mechanism for monitoring and evaluating desertification. It seeks to optimize knowledge and the exchange of successful experiences in the local management of natural resources (including optimization of water resources). Accordingly, the aquifers of the major basins that are shared by several countries are central to the SSO's mandate.