



PRESIDENCY OF METEOROLOGY AND ENVIRONMENT  
KINGDOM OF SAUDI ARABIA



# MILLENNIUM ECOSYSTEM ASSESSMENT

Sub-Global Arab Millennium Ecosystem Assessment

**Summary for Decision Makers**

**Saudi Arabian Millennium Ecosystem Assessment  
For  
Assir National Park  
June 2010**





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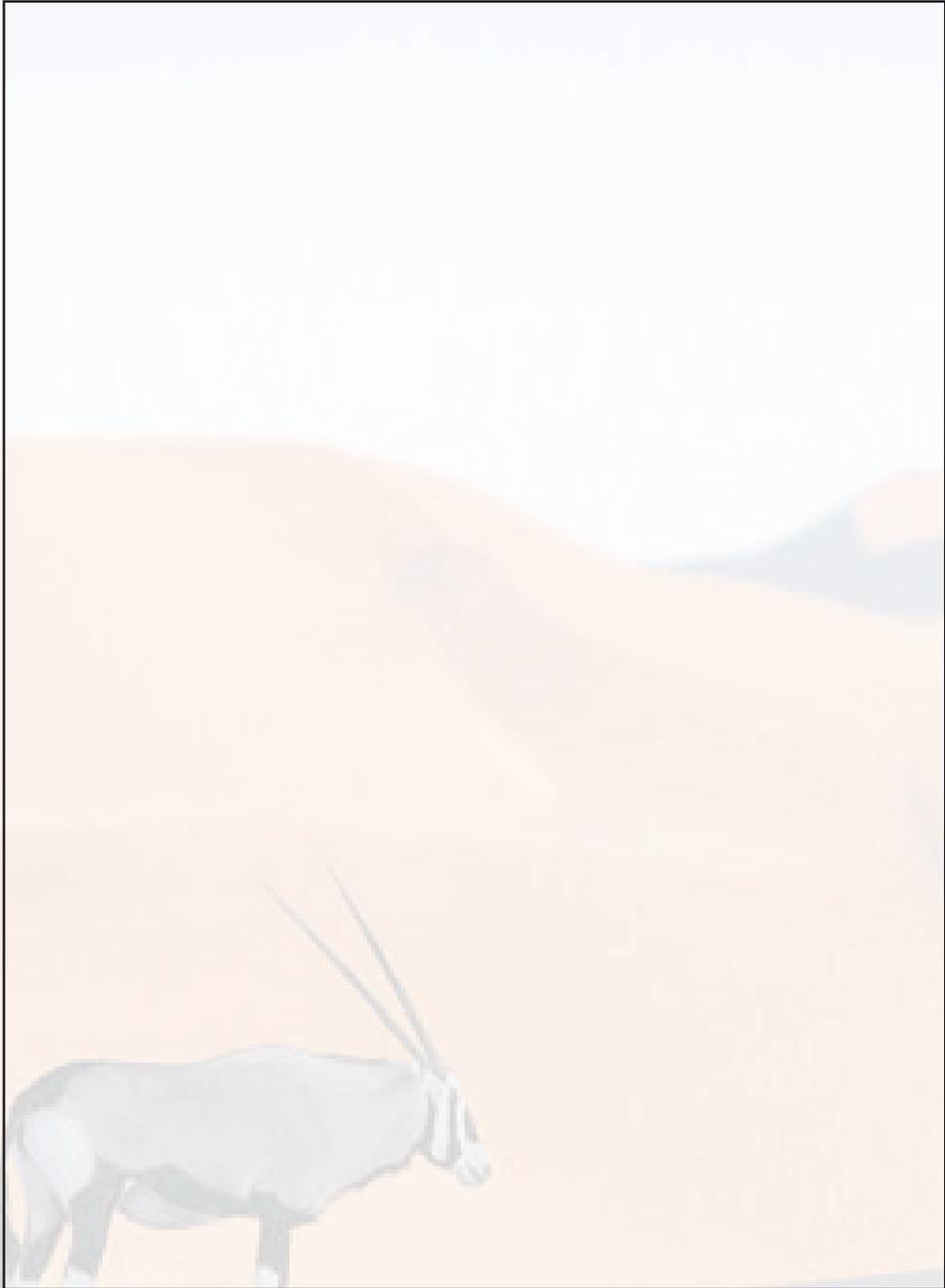
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The study of the Millennium ecosystem assessment for Asir National Park (ANP) in Saudi Arabia has been undertaken with regard to the concepts of human well-being and ecosystem services. Environmental changes are induced by drivers and caused by pressures and also affect each other. These changes interact with demographic, social and material factors in determining human well-being.

In order to halt negative changes of the environment and to improve human well-being, responses are needed which include measures by decision-makers, stakeholders and by the society for the mitigation and adaptation to environmental changes. This summary gives broad lines for decision makers so that projects can be designed by making use of all the information provided in this study and to continue to update them in the future aiming constantly to improve the environmental status and hence human well-being.



### **Forest ecosystem in ANP**

The study area, Asir National Park, includes a combination of four ecosystems namely mountain ecosystem having juniper forest, terrace agriculture, and grazing land, and coastal and marine ecosystems. Generally, the role of Juniper forests in protection of watersheds, soils and regulation of rainwater flow is not disputed. The ecosystem has been, for times immemorial, the source of wood, grazing material and medicinal plants. In the past, these forests were protected by the inhabitants through the traditions and customs using a system called Al Hema where every tribe or a clan has its own part of the forests and no one was allowed to get into it without permission. In recent times, an open grazing system was established replacing the

traditional protection system that has led to the natural forests not well protected. Forest guards are very few and scattered; some of them without effective means of transport or communications. Forest management is lacking which worsen the situation and all the studies carried out by different research institutions in the country



**Grazing in the forests - indirect food production**

revealed that the forest ecosystem and hence all other relevant ecosystems are deteriorating in ANP.



**Soil erosion in ANP**

Ecosystems provide a variety of benefits to people, generally known as ecosystem services. Ecosystem services are vital for the well-being of people everywhere. The benefits that people obtain from ecosystems include services such as food, fuel, fresh water, regulation of human diseases, education, soil erosion control, medicinal substances, recreation, and protection from natural hazards such as floods.



### **Agriculture in ANP**

Rainfall is the main source of water in ANP in addition to desalinated water and groundwater. The effects of global climate change on the water resources in the region need to be studied with greater attention. As predicted globally, climate change may play a major role in determining the availability of potable water and water for agriculture and other purposes. The scientists have proposed that increase in temperatures in arid zones will decrease precipitation leading to drying up of shallow wells as a result of reduced recharge causing water tables to drop while more severe storms will produce greater damages as a result of inundation and erosion. However, the preliminary results of PRECIS, the Hadley Centre's regional climate model, run by PME for the period 2070-2100 time horizon showed an increasing trend in the south-western Saudi Arabia, which includes ANP, and some inland areas while the analysis has shown decreasing trend of precipitation over north-western parts of Saudi Arabia.

In the last three decades, the life of inhabitants in ANP has changed and improved with the improvement of socio-economic condition in the country. The increase in the population density rate in ANP led to huge urban expansion and increased exploitation of region's agricultural potential. Fifty-eight percent of the farmers

interviewed in the study stated that they grew only wheat, maize and barley, while forty two percent added millet and 17% said they grew vegetables and fruits in addition.

The survey revealed that most of inhabitants' food habits in ANP have changed. People now rely on rice instead of wheat and on white bread instead of millet's bread. The driving force behind the changes in crop production and food habits have been to some extent economic, but individual preference played the major role in this change. It is not clear what produced the change in individual's preference. Interviews with local people indicated that the influx of new people to the region and increased communication with outside world, such as television and other media sources, were responsible for the local people making changes in the crops being produced and in the food being consumed. In the foreseeable future. It is believed by locals that the use of terraces for agriculture will decline, primarily due to the lack of terrace maintenance due to non-availability of labor. Local inhabitants predict that land-use changes will continue to take place. That is, the clearing of forest areas will take place for the production of agricultural crops because of the economic advantage of crops over forest products. This is particularly true at higher altitude where



### **Biodiversity- Marine birds along the coastal areas of ANP**

rainfall averages 400-500mm per year. Dams installed across wadis are used to divert water for irrigation. With a forecast of availability of agricultural water to decrease in the future, crop production will decline resulting in increased food imports.

As for fuel, the trend in near future is that the use of oil and gas will continue to replace wood and charcoal because of the ease of availability and their use, according to the survey of local inhabitants. This has and will continue to cause a decrease in wood cutting, but not stopping it totally.

Due to the discovery of oil in the country and the improvement of the economic situation, the agricultural terraces were abandoned leading to gradual damage and destruction. Juniper forests in Asir National Park, therefore suffered deterioration and consequently resulting in severe soil erosion in some areas. Some new terraces now exist in privately owned households, which are well maintained for cereal production.

Asir region of Saudi Arabia, and hence ANP presents a striking biodiversity. This is because of the presence of natural forest ecosystem which supports the majority of biodiversity elements. Its conservation is the direct concern of three national agencies namely Ministry of Agriculture, PME and NCWCD.

The current irreversible and major threats to the forest ecosystem in ANP include the establishment of settlement buildings scattered every where. Moderate threats include overgrazing, deforestation, hunting, overfishing, pollution, solid and liquid waste management, littering associated with tourism and recreation, pesticides, insecticides and exotic plants, and invasive species, such as *Opuntia ficus-indica*, *Argemone Mexicana* etc. Although legally prohibited, fuel-wood cutting still exists at a lower pace with the most affected areas being on the mountain's lower slopes. These threats are clearly recognized by the government of Kingdom of Saudi Arabia but due to lack of forest management, no effective steps were taken. The development of cost-effective soil, water and biodiversity conservation practice are going on but not at the desirable level since degradation of the forest ecosystem is going faster than remediation efforts. This is due to limited experience and lack of specialized personnel to promote sustainable forest management and to combat land degradation in mountainous areas.

The main fundamental social and economic problems facing the forestry sector development are the following:

- High costs of the reforestation expansion in forest sites.
- Lack of forestry specialists and hence lack of forest management.
- Overpopulation and population increase.
- Unorganized intensive eco-tourism.
- Unorganized urban and agricultural expansion in forest sites like buildings and associated road construction in such a way that didn't give much consideration to the forest ecosystem, as well as agricultural expansion.

- Human activities such as wood cutting, hunting etc.
- Spread of pests and diseases.

The last three decades have seen socio-economic, educational, technical, environmental, political and institutional changes in Saudi Arabia. These changes have their own direct and indirect negative impacts on forests. These are likely to worsen in future as a result of the following direct and indirect driving forces. Direct driving forces include: Land use change, Air pollution emissions, wastewater discharges, Climate change and Nutrient status. Indirect drivers of change are primarily demographic, economic, sociopolitical, technological, cultural and religious. These include:

- Increase in population and its migration to urban centers and nearby forests.
- Most of the urban centers in Asir National Park are located within the forests areas. Therefore, the forests will be affected by urbanization, agricultural activities and expansion of road network in forests.
- Environmental issues will get worsened because of pollution, scarcity of water, desertification, sands movements, increased demand for water, grazing lands and wood for fuel.
- Lack of private sector interest in the forests management and development.
- As a result of the government policy to protect water resources; people start to use forests areas for agriculture because it receives a lot of rain; this will lead to decreased forest area.
- Increased environmental tourism will cause more pressure on forests because of its favorable weather conditions, which may result in the deterioration of forests.

In spite of the improvement of the economic situation due to oil based economy, the local people still depend on the forest ecosystem for their well-being as this ecosystem still provides environmental protection and significant economic value even if some of these goods and most of the services are not traded by a market value.

Cultural drivers include changes in lifestyles, such as from traditional to more-modern values and norms with respect to environment, knowledge and education. Where forested areas are lost, this is often associated with a loss of traditional cultural values. The other drivers such as increased health-care facilities, government emphasis on education and eco-tourism will influence socioeconomic aspects as well as result in increased capacity building and training programs. In discussions with local inhabitants, it was found that tourism and eco-tourism will increase. Those interviewed believed that the government will continue to improve educational facilities, and thus, the benefits from education will be spread amongst greater numbers. This is also clear from the governmental budgetary allocation for education at national

and regional (ANP) level, increase in the number of educational institutions and the number of students entering these institutions.

The Kingdom of Saudi Arabia has established a policy to create and maintain a system of parks and related reserves. The purpose of this policy is to ensure that the scientific, natural and cultural resources of the Kingdom will be identified and given protection for the benefit and enjoyment of present and future generations. The lack of qualified personnel to manage the sustainability of natural resources is putting a challenge to this policy.

The conceptual framework for the Millennium Ecosystem Assessment (MA) puts human well-being as the central focus for assessment. MA recognizes that biodiversity and ecosystems are part of the framework, and as such, have intrinsic value, and that people take decisions concerning ecosystems based on human well-being as well as intrinsic value. The MA conceptual framework focuses attention on the linkages between ecosystem services and human well-being.

A full assessment of the interactions between people and ecosystems requires an approach that reflects the multi-scale nature of decision-making, allows the examination of driving forces and provides a means of examining the impact of ecosystem changes and policy responses.

A knowledge of the factors that causes changes in the ecosystem and ecosystem services is essential in designing interventions that produce positive impacts while minimizing negative ones. A driver, in the MA approach is any factor that changes an aspect of an ecosystem. The MA explicitly recognizes the role of decision-makers who affect ecosystems, ecosystem services and human well-being.

Within the study area, decisions, policies or interventions affecting ecosystem and its assessment issues are generally directed by three agencies namely; the Presidency of Meteorology and Environment (PME), which is the central environmental protection agency, the National Commission for Wildlife Conservation and Development (NCWCD), which is now known as “**Saudi Wildlife Commission**” and the Ministry of Agriculture, which together with its responsibility for the conservation of natural resources, created and operate the Asir National Park (ANP).

Asir Governorate plays a secondary role by providing technical and logistical support to the national agencies. Stakeholders and the private sector play a minor, but important role, in influencing the above agencies in so far as environmental issues are concerned.

So the concept of an ecosystem provides a valuable framework for analyzing and acting on the linkages between people and the environment. The ecosystem ap-

proach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable uses in an equitable manner. In order to implement the ecosystem approach, decision-makers need to understand the many effects on an ecosystem when changes occur as a result of implementing a new management or policy scheme.

Human well-being consists of many constituents, including the basic material for a good life, freedom and choice, health, food, social relations and security. Human intervention in ecosystems can amplify the benefits to human society. However, because of the inertia in both the ecological and human systems, changes made today may not be felt for decades.

It is widely recognized that stakeholder participation in planning and decision-making is essential for any proposal to be successfully implemented. To ensure the involvement of stakeholders, public education and awareness is considered to be an effective tool.

Responses are considered to be human actions such as policies and strategies for a given purpose; they may be technical, economic or institutional, and may operate at various levels of management. In Saudi Arabia, these responses generally emanate from the highest level of government. Effective action to address problems related to ecosystem services requires improved coordination across international, regional, national and local levels of decision-making. Almost any action affecting an ecosystem has consequences including trade-offs. Thus, effective ecosystem management requires effective coordination among government institutions directly responsible for environment protection and among relevant institutions and sectors.

An establishment of a Ministerial Committee on Environment in 1994 under the Chairmanship of HRH Prince Sultan Bin Abdul-Aziz, the Crown Prince and Minister of Defense and Aviation, Inspector General was to ensure effective coordination among relevant sector ministries and government institutions on environmental issues. This is the highest environmental policy-making body in the country with PME as the General Secretariat of the Committee. Other Ministries and agencies represented in the Committee are Ministries of Defense and Aviation, Interior, Petroleum and Mineral Resources, Agriculture, Water and Electricity, Trade and Commerce, Planning, Municipality and Rural Affairs, and KACST.

To meet the current environmental challenges posed by the development taking place in Saudi Arabia, Council of Ministers by Resolution No. 22 dated 29.01.1430 H (26 January 2009) established Environmental Council (EC) as a substitute for the Ministerial Committee on Environment (MCE). The Council's responsibilities include developing policies, regulations and national strategies on the environment in order to ensure that the developmental work undertaken by all government and private sectors take environmental protection, conservation of natural resources and

principles of Sustainable Development into consideration through various stages of development. This will be achieved through the application of Environmental Regulations and its Implementation Procedures, and implementation of the local environmental legislations as well as the Regional and International Conventions, Treaties and Protocols ratified by the Kingdom. The Council is also having the role of coordination between those sectors to follow-up their environmental performance through specialized channels within the Council in order to be studied and developed for approval and implementation.

The Environmental Council is composed of sixteen members represented by a high ranking official from the following ministries and agencies; Presidency of Meteorology and Environment, Ministry of Foreign Affairs, Ministry of Municipal and Rural Affairs, Ministry of Petroleum and Mineral Resources, Ministry of Health, Ministry of Trade and Industry, Ministry of Water and Electricity, Ministry of Agriculture, Ministry of Transport, Ministry of Finance, Ministry of Economy and Planning, Ministry of Information, King Abdulaziz City for Science and Technology, Saudi Commission for Wildlife, the General Authority for Tourism and Antiquities.

In addition, at the local level, there are permanent committees at the governorate levels under the governor of the region to look into and deal with different local and regional environmental issues.

Ecosystems are dynamic in nature. As such, decision-makers must understand their dynamic nature and consider changes in the decision-making process themselves. Management of these changes should be adaptive and flexible to benefit from past experiences, to hedge against risk and to consider uncertainty.

The new challenge to decision-making is to make effective use of information and tools in the changing context so as to improve the decisions. The following is a list of elements of decision-making processes that tend to improve the decisions related to ecosystems and human well being:

- Use the best available information
- Ensure effective and informed participation of important stakeholders
- Recognize that some decision-making processes have significant subjective elements as not all values can be quantified.
- Consider equity and vulnerability in terms of the distribution of costs and benefits.
- Ensure accountability and provide for regular monitoring and evaluation.

Wide ranges of tools are available to assist the decision-making processes in connection with ecosystems and their services. Examples of such tools include:

- Tools which facilitate stakeholders' participation, such as neighborhood forums, community issues groups, focus groups and ecosystem service user forums.
- Information-gathering tools, primarily those that are focused on collecting data and opinions.

- Planning tools to evaluate potential policy options such as consensus participation, cost-benefit analysis, multi criteria analysis, stakeholders decision analysis and trade-off analysis.

It has been shown that past actions to slow or reverse ecosystem degradation while yielding significant benefits have not kept pace with growing pressures and demands. Effective responses that tend to result in sustainable management of ecosystems, must address the pressures that lead to the degradation of ecosystems and their services and overcome a range of obstacles impeding the improvement of ecosystems. Some of these obstacles include:

- Lack of knowledge concerning ecosystem services and ecosystem management, policy, behavioral, technological and institutional responses that could enhance benefits while conserving resources.
- Market failures and the non-alignment of economic incentives.
- Social and behavioral factors such as those groups who are particularly dependent on ecosystem services.
- Low investment in the development and spread of technologies that could increase the efficiency of ecosystem services by enhancing benefits and conserving resources.

Furthermore, positive steps are needed to address the following threats to the ecosystem failing which the situation will further deteriorate.

- Population in the Kingdom is expected to reach 60 million by 2050 with an annual rate of 2.4%, population in forest areas will amount to 30 million. The roads are also expected to expand in future to 15463 km (approximately 1.5 million ha) thus affecting the vegetation cover in forests and rangelands.
- Diseases, pests, dieback and mass mortality currently surround Forests. If no intervention occurs, the situation will worsen with time.
- Given the establishment of the Supreme Commission for Tourism, the efforts to promote the internal tourism especially the eco-tourism during the hot summer and the increasing number of national and foreign tourists, Asir National Park will not be able to cope with these numbers.
- Given the arid climate of the Kingdom, the water scarcity and the high costs of afforestation, expansion of forests will be very slow.

There are many response options for enhancing ecosystem services, which may be made effective by meeting the following conditions.

- Ensuring better information and data on beneficiaries and those hurt by changes in ecosystem services for having an effective system of payment for ecosystem services.

- Address lack of knowledge concerning ecosystem services, management policy, behavioral, technological and institutional responses that could enhance benefits while conserving resources.
- Address market failures and non-alignment of economic incentives.
- Evaluation of social and behavioral response of those groups particularly dependent on ecosystem services.
- Increase investment in the development and spread of technologies that could enhance the efficiency of ecosystem services and their benefits.

A list of promising interventions needed in the areas of institutions and governance, economics and incentives, market mechanisms, social and behavioral responses, technological responses and knowledge responses are as follows:

- Development of institutions to regulate interactions between markets and ecosystems.
- Development of institutional frameworks that promote a shift from highly sectoral resources management approaches to more integrated approaches.
- Elimination of subsidies that promote excessive use of ecosystem services.
- Measures to reduce consumption of unsustainable managed ecosystem services.
- Improved communication, awareness and education.
- Promotion of technologies that increase agriculture and livestock production without any harmful impacts on the land or water resources.
- Use of all relevant forms of knowledge and information in assessments and decision-making.

In producing successful responses, consideration should be given to the concept that trade-offs among ecosystem services may be necessary to produce the best possible set of benefits to stakeholders. Finally, another factor to consider is the necessity for monitoring an ecosystem and its services in order to be able to evaluate the effectiveness of a given response. Scenario development allows to explore a possible set of outcomes that might result if there is a change in the basic assumptions. Scenarios reflect different assumptions about how current trends will unfold, how critical uncertainties will play out and what new factors will come into play.

The three scenarios which have been discussed in this study refer to three different levels of interventions on how the mountainous region of the Asir National Park will be managed with respect to their impact on human well-being and the environment. The three different scenarios are:

- Scenario 1:** No intervention: market forces dominate, locally called “Al-Na’amah”.
- Scenario 2:** Implementation of Public awareness, capacity building and training programs, locally called “Al-Maha Al-Arabi”.
- Scenario 3:** Strong government policies and control measures geared up for sustainability, locally called “Al-Nimir Al-Arabi”.

Each scenario has two components, one for the forests and the other for agriculture both located within the mountainous region of ANP. Each component has the same current state for three scenarios. The Future impacts on both components resulting from three scenarios interventions have been presented. All the scenarios have been subjected to the same uncertainties, such as future climate, international policies and local market forces.

**Scenario 1:** No intervention: Market forces dominate (Na'amah) :

This scenario looks at what the future may hold when no interventions are planned. Under these circumstances, market forces will dominate and economic development will proceed at a pace at least equal to what occurred in the past or faster.

**Scenario 2:** Public awareness campaigns conducted, capacity building and training programs planned and implemented (Al-Maha Al-Arabi) :

As in the previous scenario, no direct interventions, either by the government or the private sectors, are planned. However, an increased public awareness of environmental issues and sustainability in the forest area will pressure the government to initiate capacity building and training programs.

**Scenario 3:** Strong government policies and control measures geared up for sustainability (Al-Nimir Al-Arabi) :

This scenario is obviously the most desirable and the most expensive. Not only does it includes control measures to provide environmental protection to the forested areas but also includes expenditures for socio-economic factors to improve the quality of life of the local inhabitants. This will result in the following:

- Government policies that promote solutions with the goal of enhancing human well-being and protecting environment.
- Heavy investment in education, capacity-building and training programs, increased funds for science and technology including research and development to address socio-economic impacts of forest areas.
- Prepare economic development plans that minimize negative impacts on forest areas.
- Support Supreme Tourism Commission in adopting measures for controlling tourism in forested areas.
- Promote eco-tourism as a means for educating local inhabitants and the general public on the importance of environmental protection.
- Enhance and strengthen coordination among governmental agencies, non-governmental

organizations and the private sector in planning and development activities.

- Human well-being and sustainable environment will become the prime objective in an integrated approach for managing the forests and adjacent agricultural areas.
- A more progressive approach, including the involvement of local inhabitants and public awareness will replace existing traditional cultural habits and attitudes.
- Health and environmental issues will become a major concern of the government.
- Degraded portions of forest ecosystem will be rehabilitated.

In addition, successful implementation of relevant international Conventions such as Convention on Biodiversity (CBD), Convention to Combat Desertification (CCD), United Nations Framework Convention on Climate Change (UNFCCC) and the Ramsar Convention on Wetlands etc. will certainly increase the efficiency of ecosystem services and consequently improve human well-being.



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