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المركز الوطني لتنمية الغطاء النباتي
National Center for Vegetation Cover
المملكة العربية السعودية

وزارة البيئة والمياه والزراعة
Ministry of Environment Water & Agriculture

Forestry sector review of Kingdom of Saudi Arabia

2021

Strengthening MoEWA's Capacity to implement its Sustainable Rural Agricultural Development Programme (2019-2025) (UTF/SAU/051/SAU)

Food and Agriculture Organization of the United Nations,
Riyadh, Kingdom of Saudi Arabia

Contents

List of tables

List of Figures

Abbreviations

A.S.L	Above See Level
ACSAD	Arab Center for the Studies of Arid Zones and Dry Lands
AKECU	ASEAN-Korea Environmental Cooperation Unit
AOAD	Arab Organization for Agricultural Development
C&I	Criteria and Indicators
CBD	Convention on Biological Diversity
CEDARE	Environment and Development Center in the Arab region and Europe
CFNR	College of Forestry and Natural Resources
CIFOR	Center for International Forestry Research
CITES	Convention on International Trade of Species
EU	European Union
FAO	Food and Agriculture Organization of United Nations
FD	Forest Department
FI	Forest Institution
FMP	Forest Management Plans
FRA	Forest Resource Assessment
FSR	Forestry Sector Review
GAMEP	General Authority for Meteorology and Environmental Protection
GDP	Gross Domestic Product
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ha	Hectare
ICARDA	International Center for Agriculture Research in Dry Areas
IFAD	International Fund for Agriculture Development
IPGRI	International Plant Genetic Resources Institute
ITTO	***International Tropical Timber Organization***
IUCN	International Union for Conservation of Nature
JCEDAR	*Joint Committee on Environment and Development in the Arab Region*
KSA	Kingdom of Saudi Arabia
LM	Learning Module
MoEWA	Ministry of Environment, Water and Agriculture
NCVC	National Centre for Vegetation Cover Development and Combating Desertification
NCWCD	National Commission for Wildlife Conservation and Development
NFP	National Forest policy
NIRAS	Nationale Einrichtung für radioactive Abfäille und angericherte Spaltmaterialien
NR	Natural resource
NRM	Natural resources management
NWFPs	Non Wood Forest Products
PERSGA	Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden
REDD+	Reducing Emissions from Deforestation and forest Degradation, including the role of conservation, sustainable forest management and forest carbon stock

	enhancement
RSGA	Red Sea and Gulf of Aden
SFM	Sustainable Forest Management
SWOT	strengths, weaknesses, opportunities, threats
TNC	Third National Communication Report
UN	United Nations
UNCCD	The United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNESCO	United Nations Education, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank
WFP	World Food Programme of UN
WMO	World Meteorological Organization
WWF	Worldwide Fund for Nature Conservation

Executive Summary

Introduction

Saudi Arabia is about 1,969,000 square kilometres and covers two thirds of the Arabian subcontinent. It has a semiarid, to hyper arid climate, characterized by very low rainfall and extremely high evapotranspiration, resulting in water scarcity, and reduced vegetal cover.

Only 2% of the country's land area is considered suitable for agriculture with forest lands covering 2.7 million hectares and rangelands over 171 million hectares. KSA also includes 158,000 hectares of mangroves. Saudi Arabia is among the world low forest cover countries with only 1.3 % of its total area under forest. The current population of Saudi Arabia is 35,948,040 with 5.2 million people depending on forest for their livelihoods.

In addition to woody and non woody forest products, forest ecosystem of the Kingdom provides essential protection functions by preserving the soil from water and wind erosion, source of biodiversity, carbon sequestration and help in the distribution of water and control its flow, and also increased moisture in the soil. In addition, forests have economic, recreational, scenic, touristic, and climatic values.

Over the last 50 years, several countries conducted forestry sector review and have reformed the forestry sector through restructuring of the forest institutions, developing and preparing national forestry policies, strategies and plans to respond to demands for forest products and services, as well as to comply with international conventions and agreements. However, recently societal demands have shifted towards more conservation, protection and development and sustainable management of forests. Food security and poverty reduction have become a central and major concerns, as it is the case of climate change adaptation and mitigation.

The overall objective of the Forest Sector Review (FSR) is to provide a detailed situation analysis of the forest sector in KSA and recommend interventions to position the sector as a key contributor to the KSA Vision 2030 and other national and international development goals.

Approaches and method

The FSR Methodology encompassed a mix of quantitative and qualitative data collection from primary and secondary sources where, interdisciplinary approach was used to collect data integrating literature search and review. The secondary sources encompassed review of historic and contemporary relevant reports and studies by national, regional, and international organizations and bodies. Related literature, relevant reports, statistics, and maps had been read and reviewed with particular focus on the key issues related to forestry and environment in KSA. For primary data collection, two stage Consultative, Participatory, Interactive Methodology adopted:

1. Consultation with key stakeholder and staff in forestry sector;
2. Consultation and validation workshops where, inter-sectoral consultations with related key stakeholders conducted and where proposal of the sector reform and strategic interventions discussed and validated.

The method was based on the best practices that applied for other similar countries to explore the opportunities for new development programs and identifying ways of developing the forest sector at all levels.

The existence and effectiveness of enabling forestry related institutions, human resource, policies, laws, and regulation were reviewed. The legal and institutional frameworks were also assessed to identify gaps and areas that need to be enhanced to support the recommendations made.

The sector review has identified forestry sector development opportunities, gaps, challenges, and weakness, keeping in view the existing institutional, legal, and associated implementation capacity. The review indicates a challenging situation in the forestry sector with gaps covering organizational, technical, legal, social, and capacity issues.

Findings of this review showed that the forestry sector is under-staffed, under-equipped, with low technical capacity, with very thin representation at national, regional and district levels, with no appropriate legal framework to address the urgent environmental challenges that Kingdom is facing.

The proposed institution organogram is presented, and it was noted that the immediate priority is on human resource development and training as to build functioning departments and units at different administrative levels. The organizational development and capacity building should allow certain level of a capacity, management, and resourcing at central, regional, and local level.

Specific recommendations are also made regarding the development of a national forest policy to provide direction on how forest resource in KSA will be sustainably managed, monitored, reported and how Saudi people will derive optimal benefit from their forests resources and facilitate integration, decentralization, establishment of strong outreach for strengthen the linkages between the forestry institution with the local communities and to facilitate effective people's participation and privatization as the foundation for concerted socio-economic development.

Recommendations were also made on the forest research includes coordination of national forest research, research orientation, international linkages, national synergies and linkages, coordination, and cooperation.

Based on different recommendations operational needs for investments are specified in the report as strategic intervention and promising fields for investment to foster forestry development in KSA.

The strategic interventions' themes include improvement of KSA forest cover and productivity, forest eco-system management, forest response to livelihood and climate change, forest governance, enhancement of enterprise and creation of partnerships, forest research, gender mainstreaming and sectoral coordination.

It is expected that the proposed recommended forestry sector reform and implementation of the proposed strategic interventions will improve and influence directly the KSA forestry development in the future.

Part one

Introduction

Strengthening MoEWA's Capacity to Implement the Sustainable Rural Agricultural Development Programme (SRAD) SRAD Project

FAO and Ministry of Environment, Water and Agriculture (MoEWA) have signed the FAO-Saudi Technical Cooperation Programme (2019-2025) which will facilitate, coordinate and manage all technical and advisory services to be provided by FAO to the MoEWA. The project "UTF/SAU/051/SAU" Strengthening MoEWA's Capacity to Implement the Sustainable Rural Agricultural Development Programme (SRAD) is the first project that has been approved within the framework of FAO-Saudi Technical Cooperation Programme (2019-2025). The project aims to provide technical and advisory assistance to the MoEWA in implementing its flagship sustainable rural agricultural development Programme that has recently been approved within the context of the National Transformation Programme of the Saudi Vision 2030.

The expected results of the SRADP will be achieved through implementation of nine project components: i) Development of coffee Arabica production, processing and marketing; ii) Development of beekeeping and honey production; iii) Development of rose production and trade; iv) Development of sub-tropical fruits production, processing and marketing; v) Strengthening capacity of small-scale fishermen and fish farmers; vi) Strengthening capacity of small-scale livestock herders; vii) Development of rain-fed cereals production; viii) Enhancing value addition from smallholdings and rural activities; and ix) Strengthening MoEWA's capacity in sustainable management of rangelands, forests and natural resources to support rural livelihoods.

The proposed project is expected to achieve six outcomes within its timeframe and available resources. These outcomes are: i) technologies and innovative practices identified and adopted to sustainably increase rural agriculture productivity; ii) innovative practices and technologies pilot tested and adopted to restore and conserve natural vegetation cover and sustainably manage vital natural resources; iii) capacity of rural agriculture institutions and small producers enhanced for better access to resources, services and markets; iv) technical capacity of government and stakeholders strengthened to curb land degradation and combat desertification; v) capacity of public and private sector actors strengthened to develop rural agro-enterprises and create productive and decent rural employment, particularly among youth and women; and vi) information and knowledge products developed and disseminated for evidence based sustainable rural agriculture development.

This project is consistent with the national development goals, fits within the Saudi Vision 2030, contributes directly to achievement of the objectives of the National Agriculture Strategy, the National Environment Strategy and supports fully the achievement of the development goal of the SRAD Programme (2019-2025) and contribute to KSA SDG targets specifically SDGs 2, 13 and 15. The project will be implemented by FAO through direct implementation modalities in full collaboration and partnership with the MoEWA Under-secretariats for Agriculture, Environment and Livestock

In reference to above context, the SRADP undertook a review and situation analysis of the forestry sector to provide assessment that would support rehabilitation, conservation, and sustainable management of forest resources within the Kingdom of Saudi Arabia.

Justification for the Forest Sector Review (FSR)

This report has been prepared as a part of the strategic orientation to rehabilitate and restore the degraded forest land in KSA, in line with National Environment Strategy, National Forestry Strategy, Greening the Kingdom Programme and within the framework of Project on Strengthening Ministry of Environment, Water and Agriculture (MoEWA) Capacity to implement its Sustainable Rural Agricultural Development (SRAD) Programme (2019-2025), which has been jointly formulated by FAO and the MoEWA.

The forest resource in the Kingdom, are unique ecosystems found in the mountains and the lowlands. They perform multiple functions and provide economic, social, and environmental benefits, including supporting the maintenance of watershed services, slow storm runoff, minimizing flood damage, reducing soil erosion and improve water infiltration rates and aquifers recharge. Saudi Arabia Forest also provide fuelwood, biodiversity, honeybee forage, and pollution control and climate mitigation and carbon storage. These resources are fragile, vulnerable and exposed to serious threats of urbanization, infrastructure development, unsustainable investment, climate change, overgrazing, agriculture expansion, illegal tree cutting, drought and diseases. Regardless of the rate of deforestation and degradation overall, the forest resources in KSA are degraded at a much fast rate than they are being rehabilitated and that an increased level of investment and greater political commitment to support investment and regulation for the forestry sector will be needed during the coming years. Despite its social importance, economic and environmental role, the forestry sector in KSA has, in the past, been neglected and underfunded.

Environmental protection and conservation require adopting and implementing appropriate policies, legal, institutional and economic frameworks to limit the side effects of the anthropogenic and natural disturbances and economic development in KSA. This requires taking the necessary measures to ensure the sustainability of the country forest resource through sustainable management, reforestation and afforestation, restoration of degraded forest ecosystems, selection of drought-tolerant species, protected and high-yielding tree crops, expanding protection boundaries for natural forests, and implementing an integrated watershed and coastal zone management system. Moreover, the forest policy, legal and regulatory framework is to be further developed to contribute to conservation and development of forest resource in the Kingdom.

Capable forest institutions are crucial for the implementation of Saudi Vision 2030, development policies, strategies, development plans and link the national goals and commitments to the international objectives, to achieve synergy among these programs and agreements.

There is an urgent need for the presence of forestry authorities at Regional and local levels for continuous stream of technical assistance and support to tackle some of the newly local, national and global emerging issues, concept and new approaches.

To prepare for the development of institution, human resource, policies, and legal framework needed to promote and foster conservation, protection, and development of forest resource in the Kingdom, a comprehensive forestry review was undertaken.

Finally, because of recent increasing concern of KSA on forest and environment management, the review comes at a particularly critical point in time. Today Forest Department is facing additional responsibilities that will require a major restructuring and reforming of its organization and a reassessment of its future role.

Purpose and objectives of the Forest Sector Review (FSR)

KSA forest resources are important contributor to the country's environment, economy and to the livelihoods of its population. However, these resources are constrained by substantial technical, institutional/organizational and governance issues, which also indirectly drive forest loss.

The Saudi Arabia's forestry sector review aims at providing an updated status of the forest sector, and to inform Government about grey areas in policies and planning and to identify strategic prioritized action required to develop the sector in line with Saudi Vision 2030. This Review focuses on the current state of the forest, the services and commodities they provide and their future influence on land degradation, desertification control and sustainable development in the Kingdom, especially in the rural areas.

The main objective of the forest sector review is to provide a detailed analysis of the forest sector in KSA, undertake benchmarking with forest sector in countries with similar environment and recommend interventions to position the sector as a key contributor to the KSA Vision 2030 and other national and international development goals. Specifically, the review aimed to:

- Examine in detail the current state of the KSA forest sector, including organization's structure, staffing and capacity, stakeholders, and relevant policies, strategies, plans, and interventions guiding the development of the sector.
- Assess the social, economic, and environmental contribution of the forest sector.
- Benchmark KSA forest sector with other countries with similar environment and distill best practices and lessons learnt.
- Provide key recommendations to improve the sector.
- Outline priority interventions required to improve and develop forestry sector in KSA including indication of the magnitude of investments needed.

Coverage of the report

The report is structured in five parts as below:

Part one covers justification for the FSR, its purpose and objectives, approach and the methods adopted, and outline of the report.

Part two presents an analysis of the KSA forests resources. This part describes in depth the forest resource in KSA including identification of different ecosystems and vegetation cover; types of forests; forests environmental, economic, and social role; and threats.

Part three focus on the stakeholder's analysis and mapping, legal and institutional framework, and forest management. This part also covers the conclusions and recommendation associated with results obtained from the FSR analysis.

Part four cover the development program proposed for the forestry sector based on the sector review findings. The program outlines the main measures and actions to be taken to address problem, challenges, and barriers identified by the sector review. It also intends to guide the future development of KSA's forestry sector for the coming five years.

Methodology

The review was undertaken by a multidisciplinary team with wide range of expertise including forestry, natural resources management, social economics, GIS and remote sensing drawn from the FAO Programme in KSA and the National Center for Vegetation Cover and Combating Desertification (NCVC).

The methodology encompasses a mix of quantitative and qualitative data collection from primary and secondary sources. The process involved consultation with national and international experts and local communities through meetings organized by the NCVC and Ministry of Environment, Water and Agriculture. Based on the results of the consultation, a comprehensive SWOT analysis was conducted by the team to identify the key features of the forest sector in KSA. Furthermore, benchmarking was undertaken with countries with similar context. The team also organized working session to share and validate the results of the review and discuss the strategic interventions proposed. The Below section, sheds light on the details of the processes and action undertaken during the Review.

Secondary Data and Information Collection

An interdisciplinary approach was used to collect data for this review integrating national databases search, literature examination & organization of interviews across a wide range of disciplines including technical, social, economic, and cultural issues. The secondary sources encompassed a review of historic and contemporary relevant reports & studies by national, regional & international organizations and bodies. Related literature, relevant reports, statistics, and maps had been read and reviewed with a particular focus on the key issues related to the technical, economic and social of forestry and the environment in KSA. More than one hundred of related literature, relevant reports, statistics, and maps had been read and reviewed with a particular focus on the key activities on natural resources in KSA. They include documents originating from the Government of KSA, UN agencies and a number of academic studies and various NGO reports. The bulk of the reviewed documents consisted of government policies, strategies & planning, technical studies, background papers, the latest documents referred to the selected states, specific reports & documents on relevant projects, and international and national publications relating to forestry and forest sector review. A full list of documents and papers consulted can be found in Annex (Bibliography).

Primary Data and Information Collection

Based on stakeholder analysis and mapping during the Review, the team organized and conducted a number of data collection and information consultative activities to ensure first-hand and primary data and information gathering. Techniques used included direct individual interactive sessions, organization of consultation working sessions, and discussion group meetings. To overcome the gap of direct consultation with communities and other identified relevant stakeholders, the Review team, gathered, and organized a series of meetings and working sessions with relevant officials and studied various recent reports. The process also includes the organization of a national validation workshop, which is still to be organized for the final approval of the FSR.

Stakeholders Identification and Mapping

As a part of the institutional review, NCVC and FAO teams organized working sessions where all possible stakeholders for the forestry sector were identified and mapped. The process reviewed the current roles and interests of the respective stakeholders and the possible future contributions to the forestry sector.

Data and information analysis

In-depth analysis and synthesis of available forestry data were crucial to assess performance and better-comprehending priority problems, main challenges, and urgent needs for the forestry sector. The following tools and methods were used to analyze available information and gain insight into the forest sector in KSA.

SWOT analysis

SWOT analysis was used to assess sector strengths and weaknesses (internal characteristics) and opportunities or threats (external factors). The primary aim of SWOT analysis is to examine internal and external system characteristics simultaneously, with the aim of supporting operational decisions. Preliminary SWOT analyses were discussed with different stakeholders including the local community.

FAO tools for stakeholder mapping and analysis

As part of the forestry sector review Stakeholder mapping and analysis were undertaken using a combination of different methods including FAO tools and ecosystem services method for stakeholder mapping and analysis

FAO Tools Stakeholder Mapping and Analysis tools developed by FAO (FAO, 2009) were used to identify and assess the key stakeholders and their potential roles and/or relationships with the forestry sector and management.

Tool 1. Stakeholder analysis: This tool is an excellent way to understand the main needs for enhancing stakeholder participation. It identifies the current 'participation health' of the forestry sector.

Tool 2. Visioning: Visioning can assess forestry stakeholders' perceptions of the forestry process.

Tool 3. Relationship mapping: This helps identify how relationships among forestry stakeholders are weak or strong and who will be involved.

Tool 4. Problem analysis: explore the causes of 'insufficient participation in forestry decision making.

Tool 5. Strengths, weaknesses, opportunities, and threats (SWOT) analysis to explore both the negative and positive aspects, of participation in forestry decision-making and action.

Tools 6 and 7, target scoring and H diagrams: These quick assessment tools can be used to evaluate stakeholders' perceptions of degrees of participation.

Millennium ecosystem assessment

The Millennium Ecosystem Assessment was used to distinguish broad categories of forest ecosystem services and goods which were grouped together in (1) "Provisioning Services", including food, water, fiber, wood, biofuels, plant oils, and maintaining genetic diversity; (2) "Regulating Services", including carbon sequestration, erosion prevention, pollination, and pest regulation; (3) "Supporting Services" including providing habitat, soil formation, and nutrient cycling.

For the purpose of this review, 'interest' in ecosystems services was defined simply as interest in the provisioning, regulating, cultural ecosystem services and action required for their sustainability as listed in the Table 1 below.

Table 1. Millennium ecosystem assessment ecosystem services classification and action required for their sustainability.

Provisioning Goods and Services ***(products obtained from ecosystems)***	**Regulating Services** ***(benefits obtained from the regulation of ecosystem processes)***	**Cultural Services** ***(non-material benefits obtained from ecosystems)***	**Resource health and sustainability** ***(Action required to sustain ecosystem services & goods)***
timber, fuel wood Food Fresh water Biochemical Genetic resources Ornamental resources	Air quality regulation Climate regulation [global/regional/local] Disease regulation Erosion [soil] regulation Natural hazard regulation Pest regulation Pollination Water [flood] regulation Water purification and waste treatment	Aesthetic values Cultural heritage values Educational values Inspiration Knowledge systems Recreation and tourism Sense of place Social relations Spiritual and religious values	Rehabilitation & Restoration Afforestation & reforestation Protection and conservation Sustainable Management

Adopted and modified from Susanne Raum, 2018

To be able to better distinguish stakeholder involvement and interests in the various forest ecosystem services, their interest in the different services was then determined through a 'rapid' keyword analysis of the ministries, institutions, and organizations' webpages: 'home', 'about us', 'what we are' or 'what we do'. Only stakeholders who specifically mentioned the environment, natural sources, and related forests and one or more ecosystem services were listed. This was done based on the millennium ecosystem assessment.

International best practices and Benchmarking

Benchmarking is the process of learning from successful best practices and applying them in new projects, initiatives, and activities. Benchmarking therefore seeks out and implements best practices at the most affordable cost and in the most efficient way. The process searches for best practices for a given activity to ensure superior results by identifying and learning from good practices in other countries and organizations.

For the present Forest Sector Review (FSR) in KSA, the benchmarking process involved four steps as follows:

i. Identification of benchmarking parameters of importance drawing from the findings of the situation analysis of the Forest Sector in KSA.

ii. Review of international guidelines, standards and frameworks of relevance for the management and development of a national forest sector.

iii. Selection of countries with similar ecology, climate, topography, environment, challenges, and problems as KSA and review of their experience in forest management and development; and

iv. Identification of forest sector best practices and lessons learned as guidelines for KSA forest sector development.

Summary of international best practices and benchmarks are presented in table 2 below

Table 2. FSR Best Practice and benchmarks

Best Practice	**Best Practices Reference**	**Criteria as related to KSA**
1. Forestry sector review	• FAO, 2019. Forestry sector review: Pakistan • Ministry of Environment, Forest and Climate Change, 2017. Ethiopia Forest Sector Review • FAO, 2015. Analysis of the Forest Sector in Bosnia and Herzegovina • FAO, 2008. Asia-Pacific Forestry Commission, 2008. Re-inventing forestry agencies: Experiences of institutional restructuring in Asia and the Pacific • GTZ, 2010. Forestry Sector Analysis: Republic of Tajikistan • Ministry of Environment, Forest and Climate Change (MEFCC), 2018. National Forest Sector Development, Ethiopia, Situation analysis • World Bank, 2004. Forestry Sector Review: Mongolia • World Bank, 2001.Turkey Forestry Sector Review Report No. 22458-TU • Ben N. Donkor and Richard P. Vlosky, 2003. A Review of the Forestry Sector in Ghana • Fowler, M., abbott, P., akroyd, S., channon, J., and dodd, S. (2011). Forest Sector Public Expenditure Reviews: Review and guidance note, Program on Forests (PRoFoR), washington dc. • Mark Anthony M. Ramirez Amy M. Lecciones Xyrus Godfrey B. Capiña, 2019. Social Forestry in the ASEAN Region: Gaps and Strategic Interventions	• Similarities in - Ecology and environment - Climate and topography - Forestry an Environmental challenges and problems • Successful practices and lesson learned in Sector reform: • Best Approach and methodology • Best Stakeholder involvement approach
2. Forest policy and legal framework	• FAO, 2005. Best practices for improving law compliance in the forestry sector, FAO FORESTRY PAPER 145 • FAO,2010. Developing effective forest policy, A guide, forestry paper 161 • FAO & ITTO, 2009. A POLICY BRIEF: Forest governance and climate-change mitigation • FAO, 2008. Asia-Pacific Forestry Commission, 2008. Re-inventing forestry agencies: Experiences of institutional restructuring in Asia and the Pacific • Paul Mwari Maina, 2018. Impact of poor governance on deforestation in Africa, conference, paper	• Similarities in Forestry and environmental challenges and problems • Successful practices and lesson learned in policy & legal framework reform - Approach and methodology - policy & laws formunlation - Policy and law implementation

	• A.P. GAUTAM, G.P. SHIVAKOTI and E.L. WEBB , 2004.A review of forest policies, institutions, and changes in the resource condition in Nepal, International Forestry Review 6(2), • Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet), 2017. Baseline review and gap assessment on forestry strategic planning in Asia-Pacific economies • NIRAS, 2016. Forest Policy, Legal and Institutional Framework. National REDD+ Strategy for Liberia • UN REDD Programme, 2o13. Final recommendations to enact legal reforms for REDD+ implementation in Kenya , issue no 3 • World Bank, 2007. Forest law and sustainable development: Addressing Contemporary Challenges Through Legal Reform • Kohler, Volker; Schmithüsen, Franz Josef, 2004. Comparative analysis of forest laws in 12 sub-Saharan African countries	
3. Forest institutional framework	• FAO, 2008. Re-inventing forestry agencies: Experiences of China • FAO, 2008. Re-inventing forestry agencies: Institutional restructuring of forestry agencies in Vietnam since 1994 • FAO, 2008. Re-inventing forestry agencies: Experiences of Philippines • FAO, 2008. Institutional restructuring, reform and other changes within New Zeeland forestry Sector since 1986 • FAO, 2008. Institutional innovation to support community forestry in Nepal • FAO, 2008. Institutional restructuring in Sarawak, Malaysia • FAO, 2008. RE-Inventing the United States Forest Service: Evolution from Custodial Management, to Production Forestry, to Ecosystem Management	• Similarities in - Ecology and environment - forest cover and distribution - Administrative organization - Environmental Institutional challenges and problems • Successful practices - Organizational structure - Decentralization - Human resource & capacity building

Consultation

A consultation process was carried out through meetings, workshops, group discussions, and seminars to capture the views and opinions of different stakeholders to ensure that, these views and comments reflected the priorities of people involved in the forestry sector. Communication briefings were also circulated by the team through internet and direct contact. To further improve and enrich the information gathered later the consultation of target groups at a local level was also asked to provide views on related issues that were potentially challenging based on discussions being held with local stakeholders.

The sector review process planning was developed through a broad-based consultative process where relevant stakeholders have been involved through:

- Meetings
- Group discussion sessions at local, regional and national levels
- Interviews through conducting socio-economic surveys at regional and local level.

The forestry sector review document sets out a final version that:

- Reflects views, suggestions and comments submitted to the consultation,
- Will follow up an extensive and continuing Programme of targeted engagement, consultation, and discussion with different stakeholders.
- Validation and approval by the National Center of vegetation cover

Comprehensive consultation was conducted by the review team including:

i. More than 15 consultative (interactive) meetings have been organized with MoEWA's Environment Sector staff.
ii. More than 10 meetings with FAO, Natural Resources Management team and other technical cooperation team.
iii. In-Depth study to understand specific issues that came up, various supplementary information was collected through the use of successful Case Studies and discussions.
iv. Interviews and discussions with key forestry and range management staff at the federal level who are involved in the related development program implementation,
v. Several in-depth discussion sessions with FAO NR team members to evaluate certain parameters related to the factors affecting Saudi Arabia's forests and their management,
vi. Several focus group sessions with MoEWA staff to identify the main challenges facing forest & range sectors together with natural resources at large.
vii. Socio-economic survey targeting communities adjacent to some forest in different regions.

Part two

Forest Resource in Kingdom of Saudi Arabia (KSA)

Location

The Kingdom of Saudi Arabia situated in the Southern-Eastern part of the Asian Continent covers a large area of about 2,150,000 km^2, which is about 80 percent of the total area of the Arabian Peninsula. The country lies between 15.2° and 32.6° North and 34.1° and 55.5° East. It has 1700 kilometers of coastline on its Western Coast along the Red Sea and 560 kilometers on its Eastern Coast along the Arabian Gulf. Saudi Arabia is geographically the largest country in Western Asia and most of its terrain consists of arid deserts, lowlands, and mountains.

Saudi Arabia is bordered by Jordan and Iraq to the North, Kuwait to the Northeast, Qatar, Bahrain, and the United Arab Emirates to the East, Oman to the Southeast and Yemen to the South. Saudi Arabia is divided into 13 administrative Regions/ Provinces (Manatiq) as shown on Map 1. Below. The Regions are further divided into 136 Governorates (Muhafazat) and further divided into 1347 Municipal level (Marakiz).

Map.1. Kingdom of Saudi Arabia map

Population

The population of Saudi Arabia was estimated to be 29.9 million in 2013 and 31.02 million in 2015 (TNC 2016). The current population of Saudi Arabia in 2022 is estimated at 35,948,040 (Worldometer). The population density in Saudi Arabia is 16 persons per Km^2 (42 people per mi^2) where**,** 84.0 **%** of the population is urban (29,255,576 people) and 16% is rural. Almost 100% of KSA forest resources are found in rural areas where around 16% of the country's total population live. Moreover, forest trees and shrubs are found in the form of agroforestry components of the farming system, around and within small agricultural lands. Fuelwood is still a major source of energy in the rural area where, many forests are providing the rural population with fuelwood and charcoal as the main source of energy for their domestic needs. Fuelwood and charcoal meet the important energy needs of rural populations living within or near forested areas, particularly in cold mountain regions.

Although their production is not well quantified, non-wood forest products (e.g., fodder, game, honey, gum, fruits, mushroom, dyes, medicinal and aromatic plants) are important in local economies, providing for household needs and serving as a source of supplementary income at the local level. In some cases, non-wood forest products (NWFPs) such as bee honey also contribute to the national economy.

Topography

Saudi Arabia is a quadrilateral land mass, occupying a major part of the Arabian Peninsula. It covers an area of about 2,150,000 sq. km. The vast landscape is composed of a variety of habitats such as mountains, Valleys (Wadis), sandy and rocky deserts, meadows (Raudhahs), salt pans (Sabkhahs) and lava areas (Harrats), etc. In a broad geographical sense, Saudi Arabia can be divided into two distinct zones: the rain-fed highlands of the western and southwestern regions (Sarawat Mountains) and the vast arid and hyper-arid lands of the interior (Najd).

The Najd area, which occupies ae big share of Saudi Arabia, is located on the eastern side of the entire Sarawat Mountains and adjoining areas. It has a varied and deserted- topography such as vast sand seas, bare plateaus, small mountains, plains, etc. The deserts are composed of Aeolian sands and are more or less continuous with Great Nafud in the north and Rub al-Khali in the south, both of which are connected by arch shaped Dahna sands. The Central Region in general, is characterized by patchy, gravel deserts, hillocks and wadies whereas northern and north-central regions of the country are an exposed complex of Pre Cambrian igneous and metamorphic rocks.

The altitude of the plains in the Central Region is about 500-800 m and the relative height of the mountains and escarpments (Jabal Shammar, Jabal Tuwayq) varies from 300-600 m. The Eastern Region is broadly divided into 1). Summan plateau, an open plain adjacent to the Dahna sands, 2). the Northern plains which are bordering with Kuwait, 3). the coastal lowlands and 4). the Rub' al-Khali, the largest, continuous sand body in the world

The mountains of the southwestern region form a continuous chain of escarpments, extending from Taif to the Yemen border. The peaks reach elevations of over 2000 m in the vicinity of Taif and extreme south and over 3000 m in the Abha area. On the western side of the highlands, the mountains fall in a series of dramatic escarpments and finally merge with the Tehama coastal plain while the eastern sides slop gradually towards the interior parts of the country. Mountains on the northwestern sides are generally discontinuous, less rugged, and much drier. The east-facing slopes decent gradually and end in a high plateau.

The mountains on the western side, especially the Asir Mountains are characterized by a cool climate, relatively high precipitation, and high humidity. The landscape of the region holds a variety of plants, most of which have an affinity with the plants of East African countries. The spectacular beauty and pleasant climate of the Asir Mountains attract many people from the central and eastern parts of the country during summer. The mountains of the Jizan Region, especially the Fayfa Mountains reach a height of about 2000 m. The west-facing slopes are steep while its eastern side slopes gently towards the inland plateau. The highest peaks of the mountains are heavily populated with new houses and agricultural lands added every year.

Tehama lies between the Red Sea and the Escarpments. It is narrow on the northwestern side and wider on the southwestern side. This is an open plain, generally divided into the shoreline, salt pans, plains and wadies. Tehama is dissected by major wadies and their tributaries. During rainy days flash floods often overflows the low banks of the wadies and spill over a wide area

It can be concluded that, the main topographic features of KSA are:

1. The Empty Quarter (Al-Rub Al Khali) desert.
2. The Eastern plateaus and plains.
3. The Northern Mountains and Plateaus.
4. The "Najd" plateaus of the Central Region.
5. The Western highlands.
6. The "Tehama" plains in the southwest.
7. Widespread Mountain and desert valleys.

Climate and Weather in Saudi Arabia

The Saudi Arabia (KSA) vegetation cover varies depending on climate variation which is greatly depending on the geography and the season. The Climate of Saudi Arabia lies in the tropics between 16° N and 32°N latitudes and 37-52° E longitude. It is a large peninsula that lies between the vast continental land masses of Africa and Asia. These factors make Saudi Arabia one of the hottest countries in the world with low humidity except in summer along the coastal regions.

There are three climatic zones in the kingdom: (1) desert almost everywhere, (2) steppe along the western highlands, forming a strip less than 100 miles (160 km) wide in the north but becoming almost 300 miles (480 km) wide at the latitude of Mecca, and (3) a small area of humid and mild temperature conditions, with long summers, in the highlands just north of Yemen (Qassem and Shakhawat, 2018)

Temperature

The country is characterized by distinct climatic regions, due to high spatial and temporal temperature variability. According to Köppen and Geiger, the climate of KSA is a “desert climate” where, the major parts of KSA are hot and dry and precipitation is infrequent, and temperature is high. Saudi Arabia has a warm dry desert climate with very high temperatures in most of the country. Temperatures in Saudi Arabia however are different in each region. Extremely high temperatures are measured in the whole country during summer, both during the day and locally also at night.

Winters, from December to February, are cool, and frost and snow may occur in the southern highlands. Average temperatures for the coolest months, December through February, are 74 °F (23 °C) at Jeddah, 58 °F (14 °C) at Riyadh, and 63 °F (17 °C) at Al-Dammam. Summers, from June to August, are hot, with daytime temperatures in the shade exceeding 100 °F (38 °C) in almost all of the country. Temperatures in the desert frequently rise as high as 130 °F (55 °C) in the summer. Humidity is low, except along the coasts, where it can be high and very oppressive (Qassem and Shakhawat, 2018). However, the south has more moderate temperatures, which can go as low as 10 degrees Celsius (50°F) during summer at night. In winter the temperatures are moderate in general but turn cold at night sometimes descending below freezing.

Rainfall

Saudi Arabia has a semi-arid to hyper arid climate, characterized by very low rainfall (annual average of 150mm) and extremely high evapotranspiration (Abdurrahman, 2001).

The rainfall though very little on average, also shows a spatial variation with the southwestern highlands showing a higher amount of precipitation. Apart from topographical factors, Saudi Arabia's climate is also affected by tropical winds, latitude, proximity to the sea, altitude etc.

The precipitation in most areas of KSA is scarce, infrequent, and generally falls from October through April. Throughout other months, there is almost no precipitation except for the southwestern region of Saudi Arabia. The spatial variation of the precipitation in the southwestern region is high due to mountainous regions. The southwestern region of KSA is characterized by rainfall events during the entire year due to the topographically driven convective rain (Subyani, 2004)
Most of Saudi Arabia is dry, for example only 111.0 mm (4.37 in) of rainfall is recorded annually in Mecca. The low-lying desert areas and the coastal regions are even more dry. The Asir Mountains are clearly wetter than the rest of the country where, precipitation amounts are measured that are up to 500 millimeters (19.6 inches) per year at the highest places.

Spring is the highest rainfall and winter is the second-highest as precipitation occurring seasons. These contribute significantly towards the large quantities of precipitation, which happen through the wet season over all the regions of KSA. Only small quantities of rain are observed through the summer and in the dry season (from Jun to September) while autumn received lowest annual precipitation. The SW region receives rain in all seasons, with a maximum in spring, while the NW and NE regions receive very small quantities of precipitation in the summer season. The SE region is almost totally dry.

The spatial distributions of the wet season (November to May) precipitation indicate that the region of lightest precipitation is situated over the Rub Al-Khali. The relatively heavy rain zone is inclined southwest to northeast areas of SA. On the contrary, the dry season (June through September) precipitation pattern for these two time periods indicates that the north of SA is almost rainless. During this season, very low precipitation totals were found in the north of SA, but the highest totals

were found in the south. Irrespective of the season, significant quantities of rain persist in the southwestern region of KSA (Hosny and Mansour ,2015)
Woodlands and forests are scattered across various climatic regions in Saudi Arabia. Juniper woodlands extend as a narrow belt 7,000 kilometers long in the southwestern region, at an altitude of about 2,000-3,000 meters. Olive woodlands grow at 1,500-2,000 meters. Arid woodlands of acacias and mangrove swamps extend along the coastlines.

Vegetation Cover

Kingdom of Saudi Arabia has a varied heritage of plant diversity, encompassing a wide spectrum of habitats ranging from mountains, sand seas, rocky deserts, meadows, salt pans, etc. and a variety of climatic regimes, ranging from Mediterranean, semiarid, and arid climates.

Vegetation in Saudi Arabia is divided into five broad categories. 1. Vegetation of the coastal plains and Sabkhas 2. Deserts and scarcely vegetated areas 3. Dwarf shrublands 4. Woodlands and xeromorphic shrub-lands of high-altitude areas and 5. Wadi Communities. Each of these is further divided into several subcategories (See the Vegetation Map 3) and details of various plant associations can be described as follows

1. Coastal zones and sabkhas

a. Coastal zones and sabkha vegetation and very open drought-deciduous thorn woodlands of the coastal plains and lower foothills.

Coastal zone is characterized by low sand dunes and saline marshes. Vegetation is generally scattered and poor in such terrains, often seen with extensive monospecific stands such as *Halocnemum strobilaceum, Halopeplis perfoliata, Limonium axillare, Nitraria retusa, Odyssea mucronata, Suaeda monoica, S. vermiculata, Zygophyllum coccinium, Z. simplex* etc.

Mangrove stands, represented by *Avicennia marina* and *Rhizophora mucronata*, occupy in the protected bays and estuaries of the Saudi coast. Among the two, the former is the commonest, distributed along the Red Sea coast and the Arabian Gulf while the latter is known from the southern Tehama coast and Farasan Archipelago. Depending on the soil texture whether it is saline, silt, sand or alkaline, several populations and plant associations have been found in the southwestern and northwestern coastal lands (Tehama).

Major populations recorded from Tihama are *Aeluropus lagopoides, Cressa cretica, Hyphaene thebaica, Leptadenia pyrotechnica, Limonium axillare, Odyssea mucronata, Seidlitzia rosmarinus, Suaeda monoica and Zygophyllum coccineum*. Among the communities present in these zones are: Mangrove community (*Avicennia marina* and *Rhizophora mucronata*), *Panicum-Pennisetum* community (*Panicum turgidum, Pennisetum divisum, Lasiurus scindicus, Acacia tortilis*), *Panicum-Aeluropus* community (*Panicum turgidum, Aeluropus lagopoides, Ochthochloa compressa*), *Limonium-Sporobolus-Aeluropus* community, *Suaeda-Limonium-Sporobolus-Aeluropus* community and *Suaeda monoica-Tamarix* community (*Suaeda monoica, S. vermiculata, Tamarix nilotica*)

b. Open xeromorphic grasslands

Dominant species: *Acacia tortilis*, *Panicum turgidum, Leptadenia pyrotechnica, Lycium shawii, Calligonum comosum, Centropodia forsskalii, Moltkiopsis ciliata, Cyperus conglomerates, Dipterygium glaucum, Indigofera spinosa, Tephrosia apollinea, Ochthochloa compressa, Kohautia caespitosa, Blepharis ciliaris*

2. Deserts and sparsely vegetated areas

a. Open xeromorphic dwarf-shrub lands of rock and gravel deserts

Dominant species: *Acacia tortilis*, *Haloxylon salicornicum, Astragalus spinosus, Gymnocarpos decandrum, Achillea fragrantissima, Halothamnus bottae, Tephrosia apollinea, Salvadora persica, Cadaba farinosa, Leptadenia pyrotechnica*

b. Deep sands

Dominant species: *Calligonum comosum, Haloxylon persicum, Calligonum crinitum ssp. arabicum, Dipterygium glaucum, Tribulus macropterus var. arabicus, Artemisia monosperma, Centropodia forsskalii, Stipagrostis drarii, Scrophularia hypercifolia, Eremobium aegyptiacum, Cyperus conglomeratus, Cutandia memphitica, Plantago boissieri*

c. Scarcely vegetated sand dunes and sand covered gavel plains.

Dominant species: *Acacia* spp. and *Calligonum comosum*

3. Dwarf shrub lands

a. Very open Xeromorphic dwarf shrub lands

Dominant species: *Calligonum comosum, Haloxylon salicornicum*

b. Open xeromorphic dwarf shrub lands

Dominant species: *Haloxylon salicornicum, Rhanterium epapposum, Acacia gerrardii, Acacia ehrenbergiana, Ziziphus nummularia, Lycium shawii*

4. Montane woodlands

a. Drought deciduous thorn woodlands and shrublands (*Acacia-Commiphora* woodlands between 500-1000 m asl)

Dominant species of northern parts of southern Hijaz Mountains (Jeddah-Taif): *Acacia asak, A. ehrenbergiana*, *A. hamulosa, A. etbaica, Commiphora kataf, C. myrrha, Delonix elata, Euphorbia cuneata, Maytenus senegalensis*

Dominant species of the middle parts of southern Hijaz Mountains (Asir): *Acacia ehrenbergiana, A. hamulosa, A. mellifera, Cadaba farinosa, Dobera glabra, Maerua crassifolia, Euphorbia fractiflexa, Indigofera spinosa, Panicum turgidum, Chrysopogon plumulosus, Blepharis ciliaris*

Dominant species of the southern parts of southern Hijaz Mountains (adjoining mountains near Yemen border) *Acacia ehrenbergiana, A. mellifera, A. tortilis, Adenium obesum, Aloe officinalis, Combretum molle, Delonix elata, Dobera glabra, Hyphaene thebaica, Maerua crassifolia*

b. Drought deciduous thorn woodlands (*Acacia* woodlands along the western and eastern upper slopes between 1000-1500 m asl)

Dominant species: *Acacia asak, A. etbaica, A. origena, Adenium obesum, Anisotes trisulcus, Barleria bispinosa, Cadia purpurea, Grewia* spp

c. Semi evergreen Sclerophyllous woodlands and sclerophyllous scrub (between 1500-1800)

Dominant species: (Barbeya oleoides-Olea europaea community of the Taif Mountains) *Acacia etbaica, Dodonaea viscosa, Olea europaea*

Dominant species: (Barbeya oleoides-Olea europaea community of Asir Mountains) *Buddleja polystachya, Carrisa edulis, Celtis africana, Nuxia congesta, Maesa lanceolata, Tarchonanthus camphorates*

d. Evergreen Needle-leaved Woodlands. (Vegetation of highest part of the northern and southern Hijaz Mountains)

Dominant species of northern mountains: *Juniperus phoenicea, Artemisia seiberi, Astracantha echinatus* ssp. *arabicus, Tanacetum santolinioides, Launaea spinosa, Colutea istria, Eringium glomeratum, Prunus korshinskyi, Asperagus aphyllus, Astragalus sparsus*

Dominant species of Taif Mountains: *Juniperus procera, Euryops arabicus, Psiadia punctulata, Rhus retinorrhea*

Dominant species of Jabal Soodah: *Acacia gerrardii, A. seyal, Erica arborea, Juniperus procera, Lavandula dentata, Rumex nervosus, Rosa abyssinica*, *Otostegia fruticosa, Psiadia punctulata, Dodonaea angustifolia, Centaurothamnus maximus, Hypericum revolutum, Clutia myricoides, Myrsine africana, Pentas lanceolata, Carissa edulis*

Dominant species of the mountains of Jizan Province: *Juniperus procera, Acacia gerrardii, Euryops arabicus, Dodonaea angustifolia, Hypericum revolutum, Cordia abyssinica, Nuxia congesta, Rosa abyssinica*

e. Mixed formations of drought deciduous shrub lands, xeromorphic succulent shrub lands and open xeromorphic grasslands & very open xeromorphic semi-desert shrub lands. (East facing and north facing slopes

Dominant species: Vegetation of these areas are mainly dominated by succulent plants such as *Euphorbia* spp.*, Dracaena, Klenia* and *Aloe* along with *Acacia gerrardii, A. oerfota* and *A. etbaica*

Main features of forest cover in KSA

According to FAO global forest resources assessment, the KSA national definition of the different land categories is presented in Table 3 below

Table 3. Categories and definitions of different land uses

Box 1	
Category	Definition
Forest	Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use
Other wooded land	Land not classified as "Forest", spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5-10 percent, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use
Other land	All land that is not classified as "Forest" or "Other wooded land".
Other land with tree cover (Subordinated to "Other land")	Land classified as "Other land", spanning more than 0.5 hectares with a canopy cover of more than 10 percent of trees able to reach a height of 5 meters at maturity
Inland water bodies	Inland water bodies generally include major rivers, lakes and water reservoirs

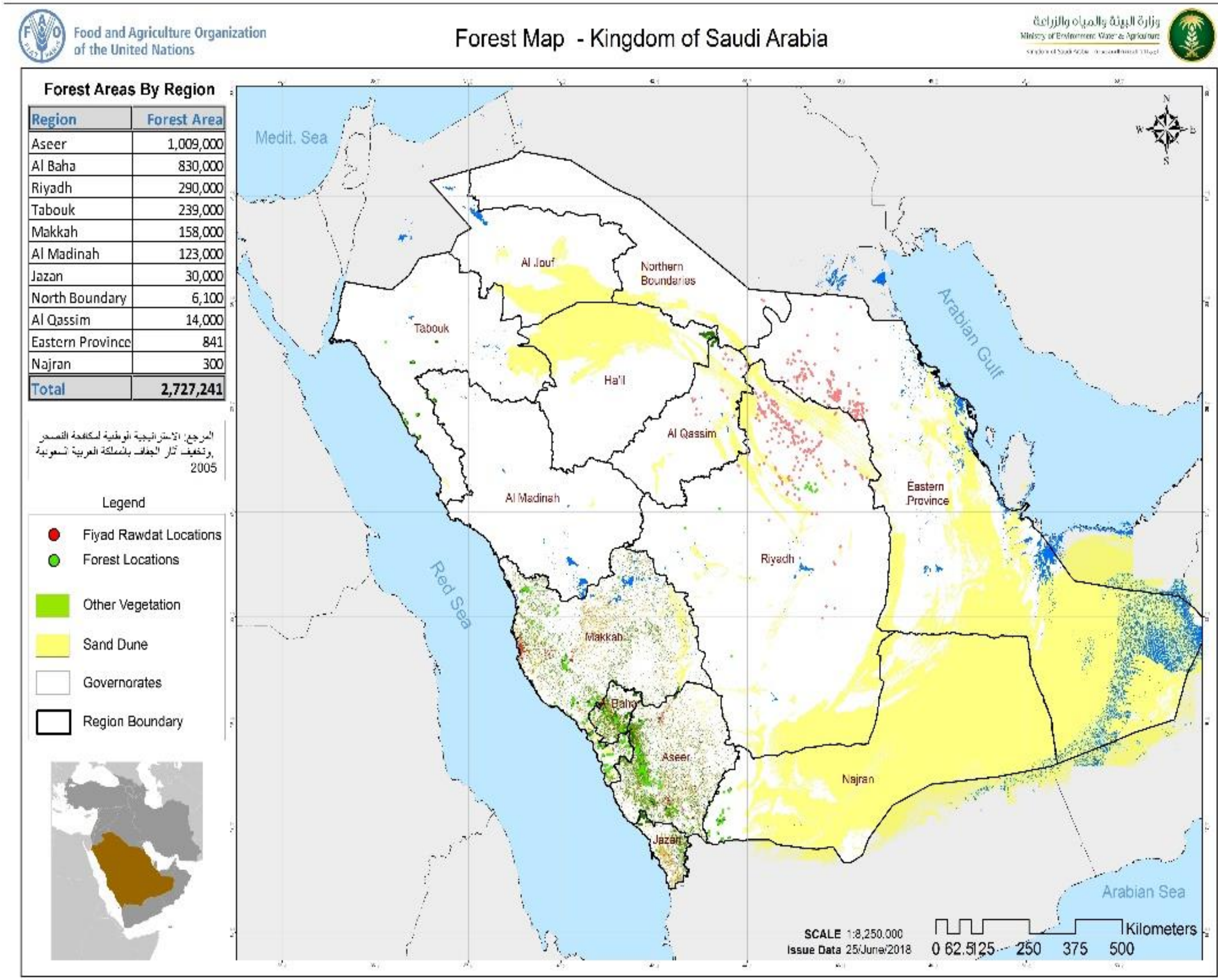
Source FRA, 2005, KSA

Forest Types and distribution

Most of the natural forests are located in the Southwest of the Kingdom regions, in mountainous areas with an elevation ranging from 1000 to 3,500 meter a.s.l. Administratively, the forest cover is distributed unevenly in the different regions as shown in Table 4 and Map 2.

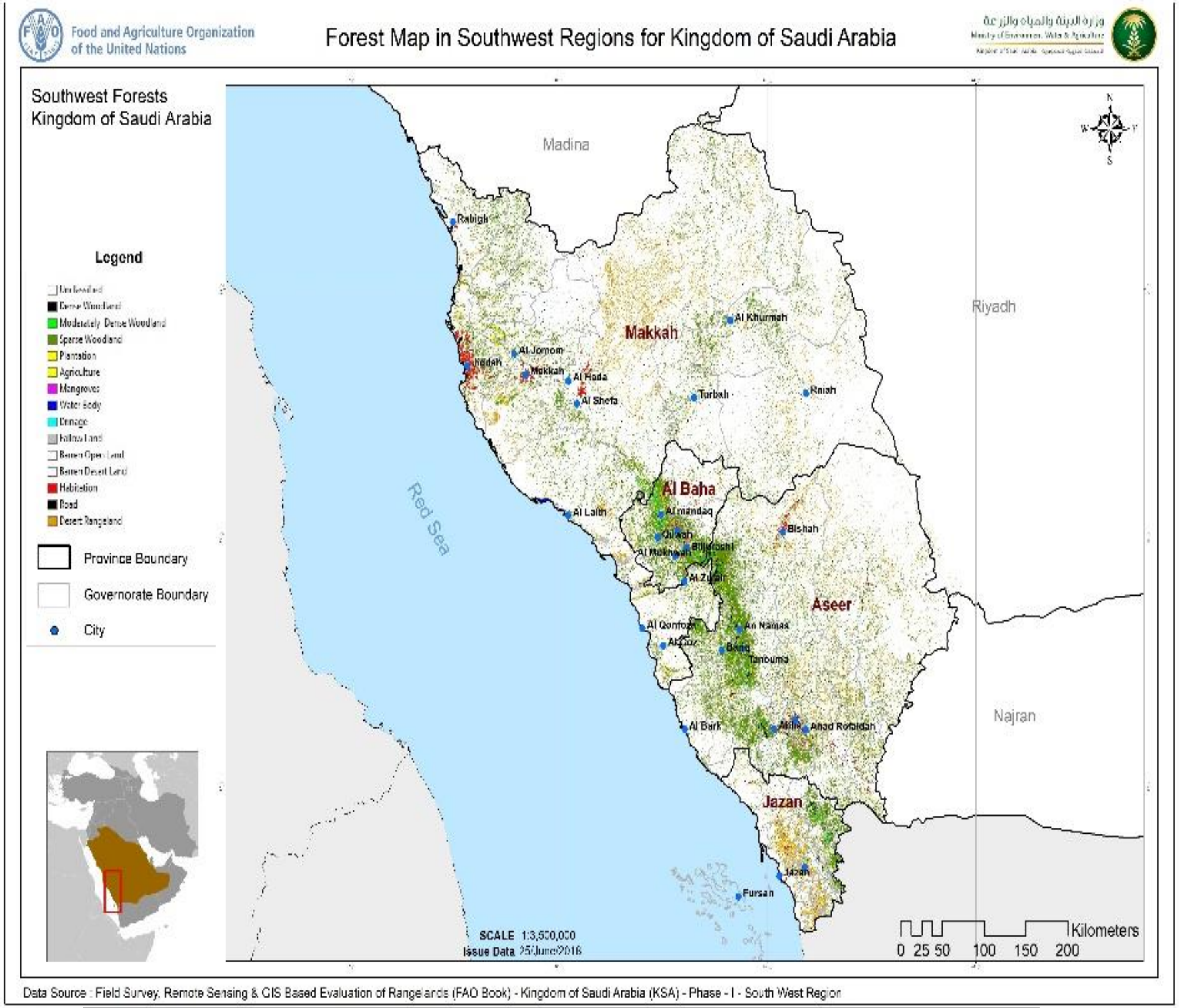
Most of the natural forests are found in the Southwest of the Kingdom where, mountainous areas extend from the Hejaz Mountains to the mountains of Asir in the south (map 3). Almost 37% of forest cover is found in Asir region and 30% in Al Baha region followed by Riyadh, Tabuk and Makah regions which constitute 10.6%, 8,8% and 5.8% of the total forest cover respectively. The Lowest proportions of forest cover are found in North and Najran regions The remainder of forest cover is found in valleys, Fayadh and Rawdhat that receive additional supplies of runoff water (about 280,000 ha) (Habib, 2018)

The heights of these mountains range between 1000 and 3,500 meters. The southwestern part of the Kingdom is characterized by important elevations extending from the Sarawat Mountains from Taif to the mountains of Fifa, Talan and Al-HaChar in the Jazan region to the south. The western slopes of the Sarawat Mountains are almost devoid of vegetation due to the severity of their decline.



Data Source : Field Survey, Remote Sensing & GIS Based Evaluation of Rangelands (FAO Book) - Kingdom of Saudi Arabia (KSA) - Phase - I - South West Region

Map 2. Distribution of forests in different regions in KSA



Map 3. Distribution of forest cover in Southwest regions

Mangrove forests also represent the most significant habitat found along the Saudi shores (both Red Sea and Arabian Gulf) forming important habitats and providing shelter and food for a wide array of marine life. Mangrove forests are found in the form of fragmented stands in many tidal areas on the Red Sea and the Arabian Gulf coast, south of latitude 26° north. They consist mainly of *Avicenia marina* trees. On the coast of the Red Sea, *Avicenia marina* is accompanied by *Rhizophora mucronata species*, while on the Saudi Arabian Gulf *Rhizophora mucronata* is very rare. They grow mostly at the end of the freshwater streams where the silt and organic material are carried out by the water runoff from the valleys to the shore of the Red Sea and the Gulf. The majority of the mangrove forests are found on the eastern coast of the Red sea between Jizan in the south and Dibain in the north. The estimated area of mangroves in KSA is 158000 ha (FRA,2020) on the Red Sea shore and on the Arabian Gulf. Mangrove ecosystems are limited along Arabian Gulf, and they are confined to the Damman area (Tarut Bay), with well-developed communities consisting of *Avicennia marina*, and in Gurmah Island (FAO website, 2020).

Primary and natural Forests

The natural dry forests in Saudi Arabia extend from Yemen territory in the south to Taif in the north. Forest Area in Saudi Arabia constitutes 1.3% of the total country with a total area 2,727, 241ha. More than 90% of the Kingdom's forests are natural and considered to be a unique ecosystem and plant genetic resource that needs to be conserved, protected, and developed where, 37% of the forests of KSA are primary forest (no indications of human activities**)** (Figure 1)

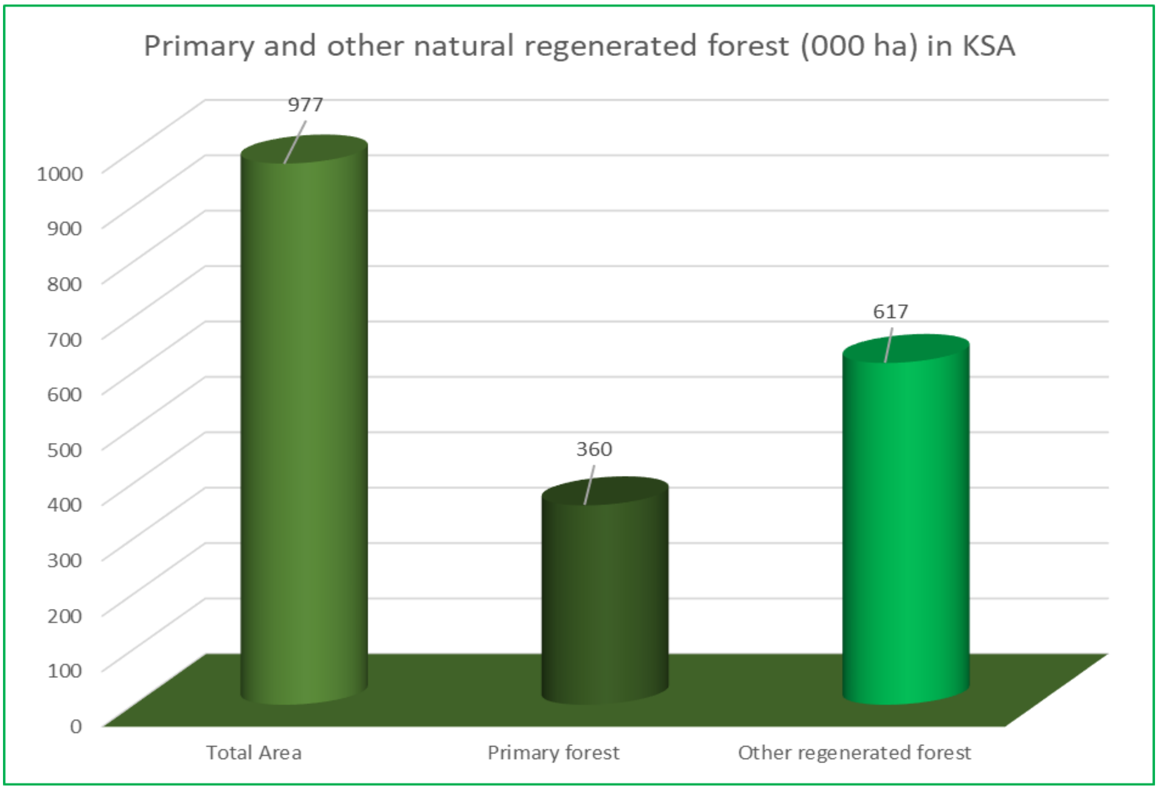


Figure 1. Primary and other regenerated forests in KSA

Forest cover change

Concepts of Deforestation and Forest Degradation

Definitions of deforestation and forest degradation are portrayed in Box 2.

Box 2	Deforestation and Forest Degradation

Deforestation (FAO 2001): The conversion of forest to another land use or the long-term reduction of the tree canopy cover below the minimum 10 percent threshold.

Explanatory note*: 1. Deforestation implies the long-term or permanent loss of forest cover and implies transformation into another land use. Such a loss can only be caused and maintained by a continued human induced or natural perturbation.*

2. It includes areas of forest converted to agriculture, pasture, water reservoirs and urban areas.

3. The term specifically excludes areas where the trees have been removed as a result of harvesting or logging, and where the forest is expected to regenerate naturally or with the aid of silvicultural measures

Forest Degradation (FAO 2001, 2006): Changes within the forest which negatively affect the structure or function of the stand or site, and thereby lower the capacity to supply products and/or services.

Explanatory note: *Takes different forms particularly in open forest formations deriving mainly from human activities such as overgrazing, overexploitation (for fuelwood or timber), repeated fires, or due to attacks by insects, diseases, plant parasites or other natural sources such as cyclones. In most cases, degradation does not show as a decrease in woody vegetation but rather as a gradual reduction of biomass, changes in species composition and soil degradation. Unsustainable logging practices can contribute to degradation if the extraction of mature trees is not accompanied with their regeneration or if the use of heavy machinery causes soil compaction or loss of productive forest area.*

As indicated by FRA, 2020 (Table 4 & 5) there was no significant change in forest cover in Saudi Arabia during the period 1990 and 2020. Degradation seems to be the main environmental problem affecting the KSA forest resource. The forestland in the southwestern region of Saudi Arabia is suffering from degradation characterized by poor regeneration of the main tree species, spreading of die-back on juniper trees, forest canopy and tree loss due to fires, forest understory loss, selective logging, and abandonment of the agricultural terrace systems. This degradation is caused by poor management of the forest resources with increasing grazing in forest land, droughts and climatic change, and the migration of rural people to towns in search of better livelihoods (El-Juhany, 2009).

Table 4. Area of forest and other wooded land and how has it changed over time in KSA

Categories	Area (000 hectares)					
	1990	2000	2005	2010	2015	2020
Forest	977	977	977	977	977	977
Other wooded land	959	959	959	959	959	959
Other land	213033	213033	213033	213033	213033	213033
Total	214969	214969	214969	214969	214969	214969.

Adopted from FRA, 2020

Table 5. Area of natural and other regenerated forest and how has it changed over time in KSA

Categories	Area (000 hectares)					
	1990	2000	2005	2010	2015	2020
Primary forest	360	360	360	360	360	360
Other naturally regenerated forest	716	716	716	716	716	716
Other land	977.00	977.00	977.00	977.00	977.00	977.00

Adopted from FRA, 2020

Ecologically, seven types of forest are identified in the Kingdom as described in the Table 6 below

Table 6. Ecological type of forest in KSA

Ecosystems	Tree species	Area
1. Juniperus Forest	*Juniperus species, Olea chrysophylla, Asparagus Rosa abyssinica, Euphorbia spp. Lactuca spp, Andropogon distachyos and Schemperiana*	Hijaz Mountains, Taif, Asir, Baha
2. Olea Forest	*Olea chrysophylla, Jasminium spp., Hypoestes forsskalii, Terconenthus cooperators, Pistacia palaestina, Rhus coriaria, Capanula edulis, Acacia ethbaica, Acacia flora and Acacia asak*	Areas with a height between 1500 and 2000 meters
3. Deciduous forests	*Acacia hamulosa, Acacia ethbaica, Acacia asak, Commiphora opobalsamum, Dodonea viscosa and Pseudo arabica*	Low-altitude forests
4. Semi-warm forests	*Acacia tortilis, Acacia ehrenbergiana, Mareua crassifolia, Commiphora spp. And Salvadora persica*	Cliffs and valleys of the Sarawat Mountains and Tehama to the Red Sea coast.
5. Rawdhat and Valleys Forests	*Acacia spp., Tamarix spp., Ziziphus Spina-christi, Salvadore persica, and Haloxylon persicum*	The banks of the valleys and in the Rawdhat and Fayyad throughout the Kingdom
6. Plantation	*Acacia spp., Tamarix spp., Ziziphus Spina-christi, Salvadore persica and Haloxylon persicum*	The banks of the valleys and the rivers and Fayyad and throughout the Kingdom
7. Mangrove forest	*Avecinia marina and Rizophora spp.,*	Red Sea and the Arabian Gulf coast,

Adopted from Habib, 2018. The Current Situation of Forest Resources in Saudi Arabia

Based on statistical Indicators on Agriculture in the Kingdom of Saudi Arabia 2014 report, the total cultivable area in KSA is 48 899 000 hectares and forest area including other wooded land estimated at 2 700 000 hectares and Pasture area at 170 000 000 hectares. The percentage of forest cover in the Kingdom is estimated at 1.3 %. According to FRA, 2020, the total area of forest in KSA is 977,455 ha, while the total area of other wooded land (OWL) is estimated at 959,460 ha and the total area of mangrove and other wooded land with mangroves estimated at 158,000 ha. The growing stock density per hectare was estimated at 8.40 and 5 m^3/ha for Forest and Other Wooded Land respectively.

The KSA total tree cover biomass was estimated at 46.78 million metric tons including above, below ground biomass and dead wood (Table 8)

Table 7. Forest Biomass in KSA

Categories	**Biomass (t/ha)**			
	Above ground biomass	Below ground biomass	Dead Wood	Total
Naturally regenerated forest	26.61	8.63	1.76	37
Other wooded land	6.7	1.88	1.2	9.78
Total	33.31	10.51	2.96	46.78

Adopted from FRA, 2015 and FRA 2020

It can be concluded that:

- Owing to the prevailing arid conditions of the Kingdom, forests mostly comprise open woodlands and lands with scattered trees and xerophytic shrubs. However, in the highlands, temperate and moist forests are found.
- Saudi Arabia is among the world's low forest cover countries (1.3% of its total area).
- With only 0.07ha of forest per capita against a world average of 0.69 ha, KSA is comparatively forest-poor, and the high population growth rate is pushing the figure further down in the future.
- Wood fuel show an increasing trend from 1990 to 2020 and constitutes a very high percentage of total wood removals (almost 100%)
- KSA average biomass per ha is low at 46.78 t/ha compared with the world average of 139 t/ha.
- KSA fares poorly in terms of total carbon forest area. This is made worse by the fact that KSA is still losing an area of forest through degradation which seems to be dominant.
- While many developing countries show a net increase in forest cover during the period 1990 -2015, KSA forest cover did not show any increase indicating a low rate of afforestation and rehabilitation.

Role of forest in KSA

The importance of forests and trees is widely recognized. Forests and trees fulfill extremely important social, economic, and environmental roles. They are crucial to land stabilization, watershed protection, desertification control, sand dune fixation, windbreaks, erosion control, agroforestry, soil fertility restoration and microclimate mitigation. They are also important sources of woody and non-woody forest products (NWFPs) as well as fodder for domestic animals. In addition, they are important habitats for wildlife and flora. Many communities derive their livelihoods from the wide range of forest goods and services that forests provide in rural Saudi Arabia.

The orest ecosystem in the KSA is important in protecting the soil from water and wind erosion. Forest also helps in distributing water, controlling its flow, and consequently the increased moisture in the soil and recharging groundwater aquifers. In addition, forests have economic, recreational, scenic, touristic, and climatic moderating values (Johannesburg Summit, 2002).

The juniper woodlands in KSA have special importance to local communities providing woody construction materials, firewood, grazing land, and bee habitats, source of medicine, relaxation, scenic and cultural areas other benefits.

Wood fuel and fodder are the most important direct forest products in KSA utilized by people and animals. Non-wood forest products provided include aromatic and medicinal plants, bee keeping, pollution reduction, desertification control, increase agriculture productivity and protection of infrastructure such as Dams, cities, roads etc.

Forest woody products

The total annual wood removal mainly as fuelwood as estimated by FRA ,2015 and 2020 range from 11,896,000 m^3 in 1990 to 31,167,000 m^3 in 2020 (Table 8). The trend of fuelwood removal showed an increasing rate during the period 1990 – 2015 (Figure 2)

Table 8. Forest production and how has it changed over time.

Categories	Total wood removals (1000 m^3)						
	1990	1995	2000	2005	2010	2015	2020
Forest & other wooded land	118.96	143.47	178.59	212.69	247.43	279.55	311.67

Adopted from FRA, 2015 & 2020

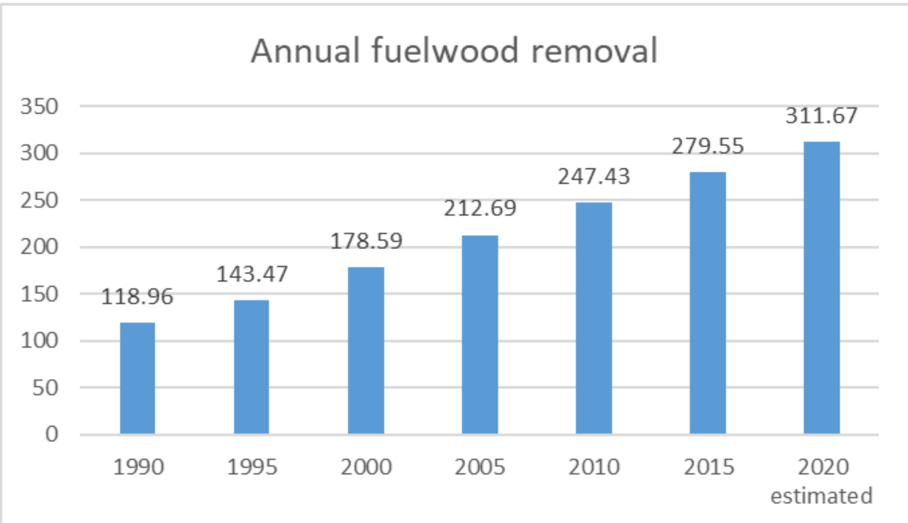


Figure 2. Trend of fuel wood produced by KSA forest during the period 1990-2020 (1000 m3)

Main Non-Wood Forest Products (NWFPs)

The main non-wood forest products (NWFP) of Saudi Arabia are fodder and medicinal plants. Forests in KSA are mainly managed as protective rather than productive forests. Hence, the main purpose of forests is the utilization of NWFP rather than on wood products. It is estimated that more than 300 plant species are used for medicinal purposes, fodder and for honey production. Moreover, forests in KSA play a very important role in climate change mitigation through carbon removal (sequestration) and carbon storage.

Carbon

Forest resource in KSA plays a very important role and contribute to global climate change mitigation through carbon dioxide removal from the atmosphere (carbon sequestration) and also as a carbon sink through carbon storage in the living tree, dead wood and in soil under the forest. According to FRA, 2020 the total carbon removal and storage in KSA forests is estimated at 50.78 metric tons per hectare (table 9)

Table 9. Carbon removal and storage under KSA forest resource

Categories	Carbon (ton/ha)
Carbon above ground	12.51
Carbon below ground	4.06
Soil carbon	34.21
Total	50.78

Adopted from FRA, 2020

Fodder

Forest and woodlands in KSA are mainly used for grazing where, branches of trees such as Acacia and Zisyphus are lopped and used as fodder (Kishal, 1985). Forests in Saudi Arabia are the main source of fodder for animals. Goats and sheep are the most important forest grazing animals in the Kingdom particularly in, Asir, Baha, Jazan and Makkah regions where, about 51.3% of goats and 25.1% Sheep are found (table 10)

Table 10. Forage production in Southwest Forest area

Forest types	Area (ha)	Forage unit (Kg DM/ha)	Production of forage (Kg DM)	Forest Carrying capacity (Animal Unit/year)
Natural forests	977,000	200	195,400,000	488,500
Other wooded land	1,117,000	100	111,700,000	279,250
Total	2,094,000		307,100,000	767,750

Source Habib, 2018

Medicines

Using medicinal plants is well known and common among the people in Saudi Arabia. Herbal medicine has been inherited from old tribes and traditionally used among people. A survey done in King Abdul Aziz City for Science and Technology revealed that 300 species are used in traditional medicine in Saudi Arabia (Al Moussa, 1999). Table 11 below shows some of important medicinal plants provided by forest ecosystem in KSA

Table 11. The most important medicinal plants in Saudi Arabia

NAME	HABITAT
Acacia Arabica	Middle Region
Balanites aegytiaca	South of Hijaz
Azadirachta indica	South of Hijaz and Najd
Acacia seyal	Middle area and south of Hijaz
Tamarix aphylla	North area, Najd and Hijaz
Alaoe vera	South of Hijaz and all the southern area
Delonix elata	Hijaz and all the southern area
Datura metel	All over the kingdom
Nigella sativa	North of Hijaz

Source: Al Moussa (1999)

Honey and bees wax

Beekeeping is very common in Saudi Arabian forests across the country. The people in KSA recognized important bee plants such as Schanginia hortensis, Blepharis ciliaris, Lavandula spp., Ziziphus spp. and Acacia asak.

Taif, Baha, and Asir mountain regions in the Southwest of the Kingdom are the most suitable areas for keeping bees in Saudi Arabia. These areas comprise 762,474 acres of forests with an altitude of 900–3700 meters. Temperatures in summer and winter in these regions range from 20°–28° C and 9°–14° C, respectively. During winter, beekeepers take their bees down to Tehama, a warm coastal region harboring several rich pollen plants that help beekeepers to increase the number of their hives through uncontrolled swarming. " Sidir" is the best quality honey produced in Saudi Arabia comes from Zizyphus tree. The government is establishing companies to produce and market this type of honey inside and outside the country.

Beekeeping, considered as an environmentally friendly practice, found in all regions of KSA. The Southern region, e.g., Taif, Baha, Aseer, and Jizan, is noted to be of good honey production. Other areas identified, for beekeeping include Madinah, Riyadh, Makkah, and Hail. In most cases, income from beekeeping contributing to approximately 30% of the total yearly income of farmers and plays an important role in the diversification of incomes for the rural sector.

Mangrove goods and services

There are extensive mangrove stands in the Red Sea and Arabian Gulf, especially in the southern Red Sea. Mangroves are an extremely important form of coastal vegetation. Their extensive root systems stabilize sediments and protect the coastline, and they enhance the overall biodiversity of marine ecosystems by providing shelter for an array of marine animals, birds and the juveniles of important fish and crustaceans (Almahasheer, *et. al,* 2016). Mangroves are in KSA along Red Sea and Arabian Gulf coasts, not only providing food and shelter for wetland animals, but also protecting against erosion and extreme weather. They play important role as nurseries and as carbon sinks. The dead leaves and branches of mangroves are a source of food within the mangrove ecosystem and offshore, such as in shrimp communities. Mangroves can effectively treat effluents from shrimp ponds by removing excess nutrients and suspended solids from water, enhance their productivity and support coastal fisheries (Phillips, 1995; Boyd, 1997 & Macintosh, 1998), and in turn, prevent pond soil erosion (Gautier, 2002). Semi- intensive shrimp production depends on the use of artificial feed in the form of pellets which is broadcast onto the surface of the water to supply nutrients necessary for shrimp growth. Unconsumed feed, shrimp excretion products, fecal wastes and nutrients released from the breakdown of excess feed can raise the nutrient level well above normal, creating an ideal environment for algal blooms to form in the Red Sea waters. Although many species of algae can benefit from increased nutrient supply, several species are harmful to fish and invertebrates and even to humans by producing harmful toxins. However, water discharged from shrimp ponds was observed to have a positive impact on the growth of *A. marina* seedlings planted on the sides of the farm drainage canals.

Drivers of Deforestation and Forest Degradation in KSA

Forest Degradation and deforestation

Forest degradation refers to changes within the forest class (e. g. from closed to open forest) which negatively affect the stand or site and, in particular, lower the production capacity. Thus, degradation is not reflected in the estimates of deforestation" (FAO, 1995). Forest degradation goes back to the early history of humankind.

The degradation involves the loss of ecosystem services or changes in species composition due to various factors including overexploitation, plant parasites, exotic species invasion, pollution, or fires, while deforestation involves the conversion of forest to another type of land cover (Sasaki and Putz, 2008). It is difficult to separate the causes from the effects of deforestation and forest degradation. Some direct causes of deforestation are land clearances for agriculture (including shifting cultivation), other land use changes including unplanned urbanization, land transfers, different forms of encroachments, over-grazing, uncontrolled and wasteful logging, illegal felling, and excessive fuelwood collection. In most cases, degradation does not show as a decrease in woody vegetation but rather as a gradual reduction of biomass, changes in species composition and soil degradation (Jinlong, 2004). Forest degradation often has different driving forces than deforestation. More important, forests can remain degraded for a long time without becoming deforested (Murdiyarso et al., 2008).

Based on many researchers such as El-Juhany, 2009, the area of forestland in southwest Saudi Arabia has a long history of overexploitation and degradation. So that most forests are now classified as other wooded land, but there is still a small percentage of closed forests in the hills and mountains (ACSAD, 2003). At present, there are indications of forestland degradation in various parts of the region.

Many researchers such as AlShomrany (1980) stated that excessive deforestation in the region was clear and can be attributed to various causes. The most obvious indications of forestland degradation in the southwestern region of Saudi Arabia are lack of natural regeneration of the main forest species, a high proportion of irregular trees, deteriorated trees, dead and dying trees, soil erosion, abandoned and destroyed agriculture terraces, die-back, fire, free grazing, alien species, insect outbreak, loss of biodiversity, urbanization and increase in monkeys and unregulated tourism.

Extensive decline has been reported in the mountain juniper woodlands of Arabia. In these areas, the decline is characterized by dieback at the lower altitudinal ranges of the woodlands and is a matter of concern. Available evidence indicates drought and/or climatological causes in addition to old age without removing dried branches for fuelwood (NCWCD, 2005).

Aref and El-Juhany (2000) mentioned that the main problems that are facing the forests in the southwestern region of Saudi Arabia at present are the loss of environmental equilibrium as a result of changes made in the natural streams caused by building roads, declining biodiversity due to use the forests as parks that forced many of the wild animals to escape and others (like monkeys) to increase with increasing the wastes and, finally decreasing the area of these forests as a result of the random expanding in constructional and agricultural activities and fires. Barth and Strunk (2000) reported that the trees in Al-Soudah Family Park in Asser Mountains show obvious signs of degradation for some years and inseveral areas within the family park more than 50% of the trees are already dead or extremely damaged and degradation processes may have been initiated a long time ago by grazing activities. Harsh environmental conditions, felling of trees and shrubs, urban expansion in forest areas, high cost of re-forestation of areas which had lost their natural vegetation cover and shortage of forestry specialists are the most important problems facing the development and protection of the forests in Saudi Arabia (Johannesburg Summit, 2002, ACSAD,2003)

Degradation of the Mangrove ecosystem

Environmental conditions in the Red Sea and Arabian Gulf, such as temperature and salinity, are near the upper limits for mangrove existence, which makes them very sensitive to disturbance and can hinder their ability to recover.

Mangroves are prone to degradation and removal from a multitude of developmental and exploitative activities. They are destroyed by landfilling and cleared for the construction of shrimp ponds. In coastal areas where the human population is increasing rapidly, mangroves are cut for firewood and construction. Grazing by camels reduces the height of mangrove trees, their productivity, and their reproductive capacity. The damming of rivers and wadis has reduced natural freshwater inputs to the coast, thus degrading mangrove stands. Causeways constructed across bays have reduced the tidal exchange of seawater leading to extensive mangrove death. Degradation of mangroves has far-reaching impacts, including threatening important populations of fish and crustaceans, and the other marine mammals and birds that rely on mangroves. These impacts are compounded by a lack of awareness about the importance of mangroves in the coastal and marine environments, especially the relationship between mangroves and fisheries, and by the limited use of environmental assessment procedures (PERSGA, 2004).

Rehabilitation and Restoration of Degraded forestland in Saudi Arabia

According to the above information and data, degradation is the most important problem affecting forests in KSA as compared to deforestation. Degradation of forests in the southwestern region of Saudi Arabia and the rest of the kingdom has become a serious threat to this unique ecosystem. Actions must be taken soon to initiate systematic rehabilitation and restoration efforts.

Rehabilitation and restoration efforts within the forestry sector are founded in the *Saudi Vision 2030, the National Transition Program 2020 and the National Environment strategy. Some of the key milestones include:*

- Adoption of a new organization structure where the Ministry of Agriculture changed to the Ministry of Environment, Water and Agriculture, and adopted a transitional organizational structure of the Ministry after the integration of the sectors of environment, water and agriculture.
- Saudi Vision 2030 emphasizes on the protection of the environment highlighting that "preserving our environment and its natural components is our religious, ethical and humanitarian duty and our responsibility towards future generations and the basic elements of the quality of our lives".
- Development of environmental initiatives within the framework of the National Transition Program includes rehabilitation and development of national parks, fostering sustainable development of forests, range land and entertainment, controlling desertification and rehabilitating contaminated areas, awareness raising and establishing climate change center, monitoring mechanism for Strategic environmental assessment with more focus on developing marine and coastal environment.
- Would be necessary to bring in NCVC and mention relevant its strategic objectives – e.g., forest mandate, etc.

Assessment of afforestation activities implemented in KSA

Three successful afforestation projects were assessed by Dr. Habib in 2018 included:

1. Wadi Al-Dawassir (sandy area, green belt model)
2. Al-Ghat (mountainous area, an integrated project for national park and afforestation works using Acacia)
3. Al-Baha Janabeen forest (the rehabilitation of the terraces implemented in cooperation between the Ministry and FAO

1. **Wadi Al Dawasir afforestation project in Al-Qounfoda Governorate, Makkah Region**

The project's aim is to create a pilot plantation for the areas of Tehama and adjacent areas. The site is located at Wadi Hili, one kilometer from Hili Dam about 400 km from Jeddah and 70 km from Qounfoda town.

Characteristics of the site

The Land is owned by the government relatively flat plain with minor gradient and undulated scattered sand dunes at certain locations, Soils are sandy on the surface and show deeper sandy loam. The total afforested area is 656 Ha of arid climate with an annual rain of less than 150mm with a mean temperature of 21^{o} C for the coolest month (January) and 33^{o}C for the hottest months (July). The dominant species include *Panicum pennisetum, Leptadenia pyrotechnica, Lycium shawii, Acacia ehrenbergiana, Acacia tortilis, Acacia asac, Euphorbia cactus, E. triaculeata, Commiphora sp., Propsopis sp, Ziziphus spina-christi.* Agriculture is rain fed with sorghum, millet, sesame, and cowpea as the main crops. Spate irrigation is practiced, and animals are grazed in the open area.

Tree planting assessment

There were no previous experiments orexperiences of tree planting in the area. Farmers use*Conocarpu*s (Damas) and *Salvadora persica* (Arak tree) as live hedges, where Arak proved to be an excellent belt for protection against sand dunes movement as it is the most drought tolerant tree species in the area. For Arak tree farmers normally use simple cutting from abundant naturally growing trees and *Conocarpus* seedlings are produced locally in private nurseries and available at affordable prices. No mother or plus trees were kept for seed collection and the nursery is about 100 KM away.

Tree species Assessment

Assessment and review of the local plant species indicate the suitability of many tree species which are drought tolerant to be planted in the area. Suitable tree species include *Ziziphus spina-christi, Acacia ehrenbergiana, Acacia tortilis raddiana, Leptadenia pyrotechnica, Salvadora persica, Azadirachta indica and Acacia asak.*

Assessment of local community's Awareness

Community experience related to widespread wind erosion effects and their control of sand dune movement measures have shown some degree of farmers' awareness about the importance of afforestation (Habib, 2018)

2. **Rehabilitation of natural forest in the Kingdom: Case study of Al Janabeen Forest**

As part of the cooperation project between MoEWA and FAO (UTF/SAU/039/SAU), the rehabilitation project of the Janabeen forest was started in 2015. Al Janabeen forest is located in Biljurashi (Baha Region).

In addition to the planting works, the rehabilitation activities include, assisted natural regeneration, soil and water conservation, maintenance of new plantations, protection fencing, green belt, combatting desertification, pruning of trees, and cutting deadtrees.

Initial situation before intervention: Initially die back of *Juniperus procera*, grazing and fuelwood collection, and camping and entertainment activities were observed.

Activities carried out by the project include:

- ✓ Delineating and fencing of the targeted area
- ✓ Pruning of the dead parts of trees
- ✓ Removal of dead trees
- ✓ Construction of water harvesting structures in the gulley (stone and soil barriers for live trees)
- ✓ Planting of around 3,150 trees seedlings

Theassessment was carried out in October 2015, at Al Janabeen site as a benchmark to compare the changes that occurred in the habitat, Landscape structure and species composition, vegetation cover, regeneration status and density before and after the rehabilitation process.

The findings indicated that,

- Slightly significant change especially in the richness and diversity of vegetation cover.
- Positive effect on natural regeneration of trees and shrubs.
- Some of the planted species are highly adapted to the harsh area condition.
- Species such as *Acacia origena* and *Dodonaea angustifolia* showed high survival rates of 93% and 75% respectively.
- Species such as *Dodonaea angustifolia, Olea europaea* and *Acacia origena* showed high levels of growth rate and vigor.

- *Juniperus procera and Cupressus sempervirens* show less growth rate and vigor.

In general, the natural regeneration was very deficient and far below the expected level. The assessment recommended improvement in regeneration techniques, soil preparation, water harvesting structures, seeding/ sowing, natural regeneration enhancement, plantation protection (grazing and fire) and tree pruning.

3. **Case Study of Taif Forests Makkah Region Saudi Arabia**

Evaluation and assessment made by Habib though Google Earth and it was concluded that, natural regeneration and resumption of vegetation is possible, despite having the following challenges.

- Limited water sources (low rainfall and lack of permanent natural water streams and rivers)
- Harsh climatic conditions
- Anthropogenic factor (illegal cutting, overgrazing)
- Lack of sufficient qualified foresters, technicians, and guards
- Lack scientific experience in seed and seedling technologies.
- Weak institutional and legal framework
- Lack of appropriate rehabilitation/restoration approach

Priorities in the field of studies related to the rehabilitation and sustainable management of forests as ranked by forestry department.

- National inventory of vegetation covers and study of the current situation.
- Establishment of a database and information system on forests and rangeland.
- Studying the seeds content in the soil.
- Taxonomy of plants.
- Urban forests/Green belts studies.
- Study of the state of forests and rehabilitation requirements of degraded areas.
- Study juniper forests: state of degradation, causes of dieback, operational plan including estimated costs for rehabilitation.
- Study of the mountain terraces for promoting agroforestry and control of erosion.
- Assessment of rangeland and grazing areas degradation.
- A study on coastal afforestation area of the Kingdom and saline-tolerant species.
- Cost of degradation due to desertification.
- The study of sabkhat for the purpose of planting salt tolerant plants.
- Study on endangered plants, saving program.
- Study on invasive plants.
- A study on the uses of treated water in irrigation for afforestation.

Recommendation as related to forest rehabilitation lesson learned and best practices

Based on best practices and lessons learned, some important pre-requisites that should be ensured before starting any rehabilitation activities for restoring forestland successfully. These comprise clear assessment of the degradation in terms of extent, forms, and severity; organizing awareness raising activities to develop the understanding of the land and vegetation degradation issues; and increasing awareness of the linkages between ecosystems and other sectors (ACSAD, 2003).

Based on the information reviewed, the following points may be useful to take into consideration for successful rehabilitation actions in KSA:

- Establish an independent body to be responsible for planning, supervising, evaluating, and monitoring rehabilitation actions. Al-Katly (2008) recommended the establishment of a national authority to care for and develop the forests of Saudi Arabia.
- Create awareness of the multiple values and services of the forestland and the negative impacts of forestland degradation. Raising awareness for the public that supports rehabilitation activities. Tailoring rehabilitation to the needs of the local community and minimizing conflicts of interest between stakeholders.
- Invite stakeholders and relevant forest-related agencies to participate in the activities as partners. It must be emphasized that rehabilitation objectives must be set with the involvement of, at least, the primary stakeholders and have their full agreement.
- Encourage scientific evidence in all disciplines related to forests, forestland and their conservation and rehabilitation.

As a reference, to rehabilitate mountain areas in China, Wenhua (2004) suggested conducting research on topics such as the basic theory underpinning sustainable forestry development, forests and the environment, biodiversity, techniques for intensive plantation management, techniques for the efficient utilization of forest resources, biological technology, remote-sensing technology, and social forestry. Research may offer significant breakthroughs that will help overcome the many constraints to the process of rehabilitating and/or restoring degraded forest ecosystem (CFNR AKECU, 2001)

- Stop the causes of degradation by preventing grazing, fire, hunting, and controlling human access to the forests. In almost all situations protection from grazing, fires and exploitation, sometimes in conjunction with soil conservation work, will ensure the recovery of some vegetative cover (United Nations Commission on Sustainable Development, 1998).
- Use native species in the reforestation process, where appropriate and include regeneration of degraded forest species. Facilitating natural regeneration through measures such as protection from chronic disturbance, site stabilization or water management can play an important role in the rehabilitation of degraded forest land (ITTO, 2002).
- Sustainable Forest Management (SFM) should be considered as a comprehensive policy. Proper management systems can prevent cutting and prevent forest fires while also promoting afforestation practices, rehabilitating watersheds, and conserving forest goods and services (JCEDAR, 2007).
- Social concerns should not be neglected in forest rehabilitation. With the general trend towards better integration of social concerns in natural resource management, in the forest sector, more integrated and holistic systems that integrate social dimension are needed (FLR, 2005).
- Education and training of forest sector employees must be given greater focus.

In addressing the issue of forest degradation and restoration in China, recommendation was made to training forestry personnel and human resources (Wenhua, 2004).

- Policy interventions, including that to support research on technologies, will be needed to increase the attractiveness and profitability of forest restoration. The application of technological development is one of the factors determining the potential development of degraded forests (ITTO, 2002).
- Cooperation with the international, regional, and national organizations that are working in forestry and other related fields is very important to exchange information and experience to enhance the quality and outreach of actions.
- Involvement of the national scientific institutions in the different phases of rehabilitation projects should be emphasized to enhance the quality of technical processes.
- Collaborate with the local community to improve resource management with scientific input and technical backstopping to communicate the results to a wider research community and particularly to decision makers (Schreier et al., 1998).
- Ensure that causes of degradation are understood and addressed (and not just symptoms).
- Encourage learning and adaptation in the management of programs.

Part three

FSR Analysis and Results

Stakeholder's analysis and mapping

Stakeholder analysis enables the systematic assessment of interests, influences, and roles, and the examination of relationships between stakeholders (Reed et al., 2009). In natural resource management, stakeholder analysis represented a particularly valuable tool since typically a wide range of stakeholders have an interest in the same resource for different purposes (Reed et al., 2009).

It is essential to understand the different perspectives of the various actors involved and to specify who has an interest in the resource base and the goods and services it provides, to what level, and why (Reed et al., 2009).
For this forestry sector Review, Stakeholder Mapping and Analysis tools developed by FAO in 2010 were used to identify and assess the key stakeholders and their potential roles and/or relationships with the forestry sector and management (FAO,2012) and Millennium Ecosystem Services was adopted and used for stakeholder's analysis.

The stakeholder analysis consisted of identification of related stakeholders and assessing their role, actions, interest, and influence on the KSA forest sector. The process present stakeholder analysis/mapping framework for forests resource development and conservation in KSA.

Stakeholder identification

In this study, an exploratory qualitative approach was adopted to identify the stakeholders with an interest in forest ecosystem services, goods, and health and to analyze their particular stakes and roles.
Stakeholders were identified through various methods, including documentary reviews, related formal staff interview, expert interviews, and focus group discussions. The documentary review includes a key word analysis of official websites of ministries, institutions, and organizations (Duggan *et al*., 2013), and a stakeholder-led identification, based on expert and formal staff interviews (Savin-Baden and Howell-Major, 2013). Interviews were conducted either by telephone, online group discussion or via emails.

Preliminary list was drawn up of stakeholders with a general stake in KSA forests. It was based on a list of stakeholders compiled by many researchers (Habib, 2018, Laban, 2018), and then more stakeholders were iteratively added from various other sources throughout the primary and secondary data collection. Such work resulted in stakeholders, comprising a range of governmental, and non-governmental stakeholder. Preliminary list includes the following stakeholders.

- Ministry of Environment, Water and Agriculture
- Ministry of Education,
- Minister of Energy, Industry and Mineral Resources
- Ministry of Media
- Ministry of Economics and Planning
- Ministry of Interior
- Ministry of Defense,
- Ministry of Justice

- Ministry of Finance
- Universities and Research Centers
- Private Sector
- Local Community
- Civil Organization
- Un Agencies (FAO, UNDP, UNEP & IFAD)

Stakeholder Analysis

The main stakeholder identification process categorized stakeholders in three main groups (Table 12)

Table 12. Summary of multi-sectoral stakeholders with potential interest in KSA Forest sector

Government	**Non-Governmental and intergovernmental Organizations**	**Private Sector**
• Ministries • Municipalities • Education and Research Organizations	• National and Local Environmental NGOs, NPOs • International NGOs – UN Agencies • Community based organizations • Cooperative & Associations	• Companies involved in Forest rehabilitation. • Companies involved in Eco tourism.

Table 13. summarizes the findings which groups the identified stakeholder profiles into primary, secondary, and secondary low depending on their mandate, roles and way of engagement of different stakeholders. Key stakeholders, their role in provision, regulating, cultural forest ecosystem goods & services and the degree of their influence was presented in Annex1

Table 13. Categorization of identified stakeholders

Stakeholder	Primary/ Secondary	Category	Proposed way for engagement
Ministry of Environment, Water and Agriculture (at national, regional and local level), Ministry of Education, Universities and Research Centers, Private Sector, Local Community, Civil Organization and Un Agencies (FAO, UNDP & IFAD)	Primary (H)	Provider (goods, services, cultural) regulators, direct contributor to conservation and sustainability	Partnership, consultation coordination, information sharing on lesson learned and best practices
Minister of Energy, Industry and Mineral Resources and Ministry of Media	Secondary (M)	Provider of alternative energy and contributor to conservation of the ecosystem Provider of tools for awareness and publicity and in direct contributor to conservation and sustainability	Awareness raising, information sharing (meetings, workshop, seminars and awareness raising technical sessions)
Ministry of Economics and Planning, Ministry of Interior, Ministry of Defense, Ministry of Justice and Ministry of Finance	Secondary (Low)	In direct contributor to protection and conservation through legalization, legislation, implementation of laws and Management and control of the country resources	Awareness raising sessions, Consultation and feedback information sharing

Stakeholder Conclusions and Recommendations

Fourteen (14) prominent stakeholders were perceived as key players by the interviewees in KSA forestry sector including public and the private domain from the national to the local level.

The analysis shows that,

- ✓ The analysis reflected a range of multiple primary and secondary stakeholders with diverse interests in forest goods and services and diverse roles.
- ✓ 14 stakeholders who varied considerably in their significance and role in forestry sector were listed.
- ✓ The analysis indicated that, 7 out of 14 considered as primary stakeholders (high degree of influence) and seven as secondary (medium and low degree of influence)
- ✓ The analysis showed that the powers of secondary stakeholders is due to their involvement in policy and legislation development & implementation, control of finance and to their control over the actual management of country resources.
- ✓ Private sector was emerged as one of the most promised important stakeholders in KSA forestry sector.
- ✓ Local communities, as main users of forest ecosystem goods and services, appeared to be not only beneficiaries but also an important contributor to provision of cultural benefits and to the sustainability of ecosystem goods and services.
- ✓ The analysis reflected the importance of the efforts to be provided by the international community (UN agencies) as main stakeholder to contribute to conservation and sustainability of forest ecosystem in KSA.

Recommendation

- Collaborations and synergies between key stakeholders considered to be crucial to ensure protection, conservation and sustainability of forest ecosystem services and goods in KSA.
- New forestry related partnerships are essential at the national, regional, and local levels, involving informal identified stakeholder through an effective participatory approach.
- The scope of forestry in KSA should be widened considerably in the future to involve more stakeholders with a direct or indirect stake in forest ecosystem's goods and services.
- Such situation indicated that careful multiple objectives forest management planning is required where, adoption of comprehensive stakeholder management framework to be considered as strategic management guidance for future forestry intervention in KSA.

SWOT Results

Data and information gathered was aggregated and analyzed to identify the strengths, weaknesses, opportunities and threats for forest development in KSA. SWOT analysis, including both, internal factors (strength and weakness) and external factors (opportunities and threats). SWOT analysis clearly show several limitations and problems with governance and management of forestry sector. SWOT also provides a basic frame within which an analysis of the strategic forest sector planning can be performed.

The SWOT's results are presented in table 14 below.

Table 14: SWOT Analysis

	STRENGTHS	**WEAKNESSES**
Internal factors	• Natural forest and land resources: forest area, & provision of woody (WFP) and non woody forest products (NWFPs). • Established national center for vegetation cover and combating desertification. • Continuity of financial resources and government efforts • Hima system (protected areas) as traditional forest reservation system • Environmental police • Political commitment to environmental conservation • Good knowledge about environmental challenges	• Weak governance (institutional and legal frameworks) • Lack of sustainable forest management system & practice • Lack of the participation of local communities and stakeholders • Lack of capital, qualified human resource, and equipment's • Difficulty in controlling of illegal logging. • Lack of reliable forest data base to maintain and manage the rare, threatened or endangered species and their habitats. • Lack of specialized forestry education. • Lack of cross-sectoral communication. • Poor knowledge about forest product demand and supply.
	OPPORTUNITIES	**THREATS**

External factors	• Political will and support • Ongoing environmental reform and interventions • Needs for WFP & NWFPs • Low utilization level of woody products • Pilot sustainable forest management projects • Availability of modern and advance technologies and approaches • Diversification of forest products • Growing Eco-tourism business • Growing KSA economy and availability of other energy alternatives	• Inadequate administrative and human capacity • Conflicts with local community's rights and privileges • More pressure on forest resource (WFPs) • Weak monitoring and evaluation (M&E) system • Lack of coordination & harmonization with other sectors and inter sectoral planning (Policies% Intervention) • Exclusion of local community and private sector

Best practices and benchmarking analysis

Summary of international best practices and benchmarks and related KSA gaps and weakness identified are presented in table 15 below

Table 15. Best Practice and benchmarks and Gap matrix

Best Practice	Best Practices Reference	Criteria as related to KSA	KSA (Gap and weakness)
1. Forestry sector review	• FAO, 2019. Forestry sector review: Pakistan • Ministry of Environment, Forest and Climate Change, 2017. Ethiopia Forest Sector Review • FAO, 2015. Analysis of the Forest Sector in Bosnia and Herzegovina • FAO, 2008. Asia-Pacific Forestry Commission, 2008. Re-inventing forestry agencies: Experiences of institutional restructuring in Asia and the Pacific • GTZ, 2010. Forestry Sector Analysis: Republic of Tajikistan • Ministry of Environment, Forest and Climate Change (MEFCC), 2018. National Forest Sector Development, Ethiopia, Situation analysis • World Bank, 2004. Forestry Sector Review: Mongolia • World Bank, 2001.Turkey Forestry Sector Review Report No. 22458-TU • Ben N. Donkor and Richard P. Vlosky, 2003. A Review of the Forestry Sector in Ghana	• Similarities in - Ecology and environment - Climate and topography - Forestry and - Environmental challenges and problems • Successful practices and lesson learned in Sector reform: • Best Approach and methodology • Best Stakeholder involvement approach	• Forest resources in KSA are degraded at a much fast rate than they are being rehabilitated. • limited forest resources are under intense pressure. • Lack of framework for implementing a sustainable forest management • Forest sector under-resourced (qualified personnel, budget, equipment). • Weak forest management, limited forest resources, high demand for forest services • Weak forestry institution and poor governance on forest degradation and deforestation. • Serious attention is being given to addressing forest sector concerns at high levels in the government. • Need for more investment and greater political commitment to support investment and regulation

	• Fowler, M., abbott, P., akroyd, S., channon, J., and dodd, S. (2011). Forest Sector Public Expenditure Reviews: Review and guidance note, Program on Forests (PRoFoR), washington dc. • Mark Anthony M. Ramirez Amy M. Lecciones Xyrus Godfrey B. Capiña, 2019. Social Forestry in the ASEAN Region: Gaps and Strategic Interventions		for the forestry sector
2. Forest policy and legal framework	• FAO, 2005. Best practices for improving law compliance in the forestry sector, FAO FORESTRY PAPER 145 • FAO,2010. Developing effective forest policy, A guide, forestry paper 161 • FAO & ITTO, 2009. A POLICY BRIEF: Forest governance and climate-change mitigation • FAO, 2008. Asia-Pacific Forestry Commission, 2008. Re-inventing forestry agencies: Experiences of institutional restructuring in Asia and the Pacific • Paul Mwari Maina, 2018. Impact of poor governance on deforestation in Africa, conference, paper • A.P. GAUTAM, G.P. SHIVAKOTI and E.L. WEBB , 2004.A review of forest policies, institutions, and changes in the resource condition in Nepal, International Forestry Review 6(2), • Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet), 2017. Baseline review and gap assessment	• Similarities in Forestry and environmental challenges and problems • Successful practices and lesson learned in policy & legal framework reform - Approach and methodology - policy & laws formunlation - Policy and law implementation	• No specific legislation dedicated to the establishment and management of forest (specific policy and law) • Environmental protection and conservation in KSA require adoption of appropriate policies, legal, institutional and economic frameworks. • Anthropogenic and non-anthropogenic pressures continue to severely affect forest resources.

	on forestry strategic planning in Asia-Pacific economies • NIRAS, 2016. Forest Policy, Legal and Institutional Framework. National REDD+ Strategy for Liberia • UN REDD Programme, 2013. Final recommendations to enact legal reforms for REDD+ implementation in Kenya , issue no 3 • World Bank, 2007. Forest law and sustainable development: Addressing Contemporary Challenges Through Legal Reform • Kohler, Volker; Schmithüsen, Franz Josef, 2004. Comparative analysis of forest laws in 12 sub-Saharan African countries		
3. Forest institutional framework	• FAO, 2008. Re-inventing forestry agencies: Experiences of China • FAO, 2008. Re-inventing forestry agencies: Institutional restructuring of forestry agencies in Vietnam since 1994 • FAO, 2008. Re-inventing forestry agencies: Experiences of Philippines • FAO, 2008. Institutional restructuring, reform and other changes within New Zeeland forestry Sector since 1986 • FAO, 2008. Institutional innovation to support community forestry in Nepal • FAO, 2008. Institutional restructuring in Sarawak, Malaysia • FAO, 2008. RE-Inventing the United States Forest Service: Evolution from Custodial	• Similarities in - Ecology and environment - forest cover and distribution - Administrative organization - Environmental Institutional challenges and problems • Successful practices - Organizational structure - Decentralization - Human resource &	• low status Institutional structure and minimal training limits forestry sector actors from performing its functions. • Lack of forestry department organizational structure and lack of its mandate and functions • Forestry department functions and responsibilities come under higher institutional level (planning, supervising and protection of forest resources) • Need for strong and capable forestry

	Management, to Production Forestry, to Ecosystem Management	capacity building	institutions to address land and environmental conservation, combating desertification, increasing vegetation cover, reducing degraded areas, sustainable forest management. • Forest Department is facing additional responsibilities that will require a major restructuring and reforming of its organization

FAO approaches to assess the capacity of forestry sector at policy level

Quick review survey of forestry sector social, economic policy and legal framework was conducted using a tool adopted from FAO, approaches to capacity development in programming (LM2): Tool 6. The tool is an analytical tool which complement those that are proposed in the FAO CPF Guidelines and in the FAO Project Cycle Practical Guidance. These tools focus particularly on assessing capacities at the policy, organizational and individual levels and within the context of the broader political economy, institutions, and stakeholders.

The assessment is basically a discussion with key national stakeholders on major capacity issues, perceptions and suggestions at different levels. These kinds of assessments and discussions can help involved parties make progress in capacity development contribute to the development of skills and create champions for change. Results of the assessment and needed action for development illustrated in table 16 below.

Table 16: Results of assessment and development actions

CAPACITY AREA	Results of the assessment	Identified development actions
A. WIDER CONTEXT INFLUENCING POLICY-MAKING	The policy to be adopted by government at high levels so as to demonstrate commitment and guide authorities in its implementation. Views of stakeholders considered to ensure their commitment to both the policy and its implementation.	Review of related policies to ensure all policies endorsed by government high level and different stakeholder interest and view are considered
A.1 Specific Forest Policy in place	No specific National Forest Policy (NFP) exist	Participatory policy development process to be initiated to formulate a NFP that provide key strategic guidance for forestry practice, institutional arrangement, implementation and coordination with another sector
A.2 Endorsement of National Forest Policy	Need for political commitment to ensure effective implementation	NFP to be endorsed by as high as possible government level
A.3 Specific Forest law in place	No specific forest Law exist	Specific forest law to be developed based on a policy vision or goals and issued to specify rights and duties and enable dispute settlement and applied nationally across all regions
A.3: Compliance of policies and law is high	Compliance with policies and law in KSA is high in general but not in forestry sector	Forest institution to be mandate by forest law with Forest protection system including forest guards, environmental police, and awareness and enforcement supported by tribal and traditional leaders.
B. SECTOR RESOURCES, BUDGET ALLOCATION	At the present, budget is policy driven, allocated and executed as	Forestry sector budget to be planed as required by the sector reform and

MECHANISMS AND PUBLIC FINANCIAL MANAGEMENT	planned by sectors, match sectors plan, timely available and transparently allocated and transferred	annual technical programs
C.FACTORS INFLUENCING ORGANIZATIONAL CAPACITY	Weak institutional framework, limited financial and qualified human resources	Institutional reform/restructuring to ensure technical presence at all levels, capacity building including related education and research,
D.WIDER FRAMEWORK FOR ACCOUNTABILITY AND MONITORING	As a part of MoEWA, audits and high-level oversight effective, good monitoring, civil society not involved in monitoring and institutions are sensitive to complaints	Ongoing accountability and Monitoring system to be followed in forestry sector as a part of MoEWA
E. NETWORKING AND RELATIONS WITH CRITICAL STAKEHOLDERS, INCLUDING DEVELOPMENT PARTNERS	Limited networking with stakeholder, limited tradition for formal and informal consultation, good cooperation between public sectors institutions and organization and limited staff network across organization due to limited number of qualified staff	Establishment of inter-sectoral coordination, cooperation, and collaboration. Establish mechanism to ensure effective networking and consultation across all stakeholders.
F. OTHER		
F1. Forest resource Management Performed properly	Lack of sustainable forest management planning and absence of specific forest working plans	Adoption of participatory forest management planning approach Preparation of specific forest working plans at local level
F2. Forestry Education and Research	Lack of specialized institutions and lack of long-term plans and agenda	At least one faculty of forestry {where?} and establishment of a Forestry Research Centre

Adopted from FAO approaches to capacity development in programming: Processes and Tools, LM2 - Tool 6.

Conclusions and Recommendation

Conclusions

- ✓ The forest sector in KSA has remained weak in delivering environmental, social, and economic contributions to the overall development of the country.
- ✓ No regular national forest inventory was conducted for continuous monitoring and assessment of forest resources which is a first step to improve understanding of the sector and forest planning for SFM.
- ✓ The forest sector in KSA is characterized by the dominance of government investments with very limited or no contribution from the local community and private sector in forest development.
- ✓ Collaboration, cooperation and coordination among relevant sectors (e.g. forestry, agriculture, mining, etc.) have been very weak.

- ✓ The forestry sector has been treated as low-value resources, shaped by top-down government control and dominance of political targets over the socioeconomic and environmental needs of local communities.
- ✓ The forestry sector suffers from the weak institutional structure that has resulted in a limited capacity to engage in sustainable forest resource management.
- ✓ KSA forest sector goals and vision are not properly defined due to a lack of specific national forest policy.
- ✓ While compliance with policies and lawsin KSA is high, it is not the case in the forestry sector due to a lack of proper forest protection system and specific forest law.
- ✓ Key national forest staff and experts are not available.
- ✓ The key challenge for forest organizations is the strong presence at the different national, regional levels.
- ✓ There is an urgent need to have institutions which are responsive to local, national, and global demands for forest goods and services. KSA has also to respond to international environment and biodiversity conservation commitments,
- ✓ Poor human resource capacity is one of the most challenging issues. Forestry institutions are understaffed, and staff lack experience and skills with most of the professionals working at the management level.
- ✓ Lack of proper forest management planning approach and absence of specific forest management working plan.
- ✓ Lack of specialized forestry education and research institutions.
- ✓ Lack of short- and long-term research vision and agenda with the forestry sector.

Recommendations

- ✓ Based on results obtained from the current situation analysis and secondary information review, it is recommended that a process be initiated to reform the forestry sector from the national to the local level to remove the identified limitations and problems, so that the sector can promote, technical performance stability, improve forest resource management and leading toward the livelihood improvement.
- ✓ The prospect of institutional reform should be considered as one of the main factors for improving the forestry sector governance at the local and national levels in KSA.
- ✓ In addition to the adoption of high standards of forest conservation and management, action related to public accountability, local participation, and private sector development should be a part of the new forestry institution mandate.
- ✓ Establish dedicated institutions dealing with forestry at the national level with branches at regional and local levels with cascaded structures reaching the grassroots level.
- ✓ Supportive legal framework to be developed (specific national forest policy and law) through a comprehensive consultation and participatory approaches and adoption of the forest protection system within the forestry institution.
- ✓ Specialized forestry education and research to be established/inserted within existing universities and research centers.

- ✓ Investment to be directed to Improve multipurpose management of forest resources and to invest in reforestation/afforestation and restoration of existing degraded forest land with special emphasis on community-based and private sector efforts.
- ✓ Establishment of national forest inventory system for continuous monitoring and assessment of forest resources in KSA
- ✓ Formulate and adopt long-term national forest program including sector reform, Rehabilitation and sustainable management of the forest resource, utilization, financial allocation, technical and extension services, capacity building, and research supportive program.

Forestry legal and institutional framework analysis

Forestry policy and legal framework

Overview of related Forestry legal framework in KSA

The ecosystems in the Kingdom are very fragile due to the Kingdom's geographical location, climate, coasts and sea, which require utmost care to sustain the services they provide for the well-being of humans and sustainable development. Since the 1990s, the Kingdom has sought to include environmental protection and conservation of natural resources within its national sustainable development strategies and plans and begun the transfer of sustainable development from theory to practical reality. Various economic and social development plans include items related to environmental protection and conservation and development of natural resources policies (GAMEP, 2017)

Rules and Policies

Basic Rule of Governance for the Kingdom of Saudi Arabia

The basic Rule of Governance for the Kingdom of Saudi Arabia contains some basic provisions regarding natural resources and establishes a right to live in a healthy environment. Article 32 of the Basic Rule of Governance for the Kingdom of Saudi Arabia states, "The State shall endeavor to preserve, protect, develop the environment and prevent its pollution."

Forest Policy

Forests resource in KSA contribute to human well-being, in terms of environmental protection, energy, food, fodder, climate change mitigation, biodiversity and water conservation. There is no national forest policy (NFP) in KSA and there is an urgent need to formulate a national forest policy that provides direction on how forest resource in KSA will be sustainably managed, monitored and reported and how Saudi people derives optimal benefit from their forest resources. In KSA now, environmental forest functions have attracted increasing attention mainly in relation to the protection of biodiversity, climate change, desertification control and other forest goods and services.

Main legislation that contribute directly to forest governance

- **Environmental Code 2002:**

Environmental Act No. 193, promulgated by Royal Decree No. M/34 of 2001

Objective: To protect the environment and conserve biodiversity in the Kingdom

Aims essentially to enhance the balanced environmental activities, to take care of the environment, conservation of natural resources and promoting environmental awareness in society. The ultimate achievement is the implementation of the sustainable development concept, which is a paramount goal for all nations, by all government sectors while preparing their overall development planning.

The first comprehensive Saudi Arabian national environmental legislation was enacted on September 24, 2001 in the form of the General Environmental Regulation, Council of Ministers Resolution No. 193. It entered into force on October 31, 2002, and its Implementing Rules were published on September 30, 2003.

Rules for implementation of environmental regulations aimed at setting forth the procedures, ground and basis for regulating all actions having impact on the environment, in addition to the coordination of response operations, pollution control, protection of natural resources and programs for related investment funds. It includes the types of environmental violations and appropriate penalties for protecting human health from pollution both at present and in the future.

Gaps and weakness

- Lack of consideration of the international obligations that the Kingdom committed as a result of the international environmental conventions signed and ratified by KSA after the issuance of the Law in 2002
- Limited opportunity for participation of the community and other stakeholder in environmental protection and environmental decision-making
- Lack of specialized courts to deal with environmental issues, the emphasis on the method of command and control in the field of environmental management, targeting environmental compliance without encouraging excellence in environmental performance.
- The lack of trained human resources and strong institutions, due to the poor training of staff working in the field of forestry.

- **The Forest and Range Act 2004**

Objectives**:** To ensure the conservation and rational exploitation of the forests and rangelands

The Forest and Range Act aims to protect ranges and forests, their land content, and the regulation of their use. Among other things, the Act forbids the cutting of trees, shrubs, saplings, or the utilization of their products without prior approval. Consists of Five Chapters: General Provisions, Forest Conservation and Development, Investment, Prohibitions, Penalty & punishment

Article 1: Definitions & clarify the terms in the Act, Articles 6, 7 and 8: Afforestation in public and village forest lands, Articles 9, 10 and 11: Rational exploitation of the forest products, Article 12: Actions prohibited in the forests.

Main feature

- Mandated the Ministry of Agriculture for supervision and organization of investment, development and protection of forest and Range resources.
- Forestland definition: remains a forest land even when the forest cover and trees removed.
- Coordinate with the Council of Regions to identify forests and pastures Reserves.
- Guard and seizure of forest and pasture offenses.
- Establishment of organizations to involve enterprises, companies, bodies and the community in the management of forests and pasture reserves.
- Provision of seedlings.
- Annual planning for grazing and determination of proper grazing method and systems
- The possibility of licensing Saudi, non-Saudi and mixed companies to invest in forests and establish activities.
- Prohibited Actions: such as damage and wood cutting, soil transfer and removal, throwing or burning waste and contaminants, establishment of permanent facilities without the approval from the Ministry.
- The charges against forest offences such as transport and trade of public forest resources without a license, damage to trees and illegal cuttings, soil transfer.

Gaps and weakness

- Forest reservation (legal classification) and Revocation of reservation: Procedure, approval, compensation, and declaration (identification of rights and privileges of surrounding local community)
- Other Forest ownership and Management and utilization: Private Forest and Community Forest
- Prohibited actions outside forest reserve (tree cutting in general and specifically endangered and protected tree species) as a driver of deforestation and environmental degradation)
- Public Assistance in Forest protection (mainly fire) and involvement of local tribal leaders.
- The Act is not clear as to the possibility of private and community-owning forests or forest trees, whether planted or naturally growing.
- No provisions referring to the participation of the local community in forest management.
- Rights and privileges of surrounding Local communities in the forest especially for collection and use of NWFP
- Weak implementation specifically in Forest protection Guards and police

Forest Law

Since there is no specific forest law in KSA and the current gaps in KSA legislation in relation to forestry can be overcome by issuing a specific Forest Act.

Main legislation that contributes indirectly to forest governance

- **The National Commission for Wildlife Conservation and Development Act 6. 1986**

Objective: To conserve and develop wildlife in the Kingdom of Saudi Arabia.

Definitions (Article 2). b) Protected areas declaration procedures (Articles 3, 4 and 5). c) Protected areas management (Articles 6 and 7). d) Establishment of the guard force (rangers) (Article 8) e) Acts prohibited in the protected areas (Article 13).

- **The Wild Animals and Birds Hunting Act 1999**

Objective: To regulate the hunting of wild animals and birds; and to ensure the preservation of the nation's fauna by providing opportunities for wild animals and birds to breed

Definitions (Article 1) b) Issuing of hunting permits (Article 2) c) Acts prohibited by the Act (Article 4). d) Species that are protected from hunting (Article 5).

- **The Act on Trade in Endangered Wildlife Species and their Products2000**

Objective: To regulate the trade in wildlife and wildlife products by the system of import/export permits according to the rules of the Convention on International Trade of Species (CITES)

Definitions (Article 2). b) Trade in wildlife and its products is prohibited without the appropriate permit from the National Commission for Wildlife Conservation and Development (NCWCD) (Article 3). c) The NCWCD should issue a list of endangered species with the agreement of the Ministry of Agriculture (Article 4). d) A fee of SAR 50 should be collected, for the Treasury, for each permit issued (Article 5).

- **The Fishing Exploitation and Protection of Live Aquatic Resources in the Territorial Waters of Saudi Arabia Act 1987**

Objective: To ensure the rational utilization of live aquatic resources in the territorial waters of Saudi Arabia.

Fishing and diving practices (Articles 1, 2, 3 and 4). b) Preservation of living resources (Article 5). c) Acts prohibited in the Kingdom's coastal zone (Article 6).

- **The Uncultivated Land Act 1978**

Objective: To control and regulate land development activities

Interested people are given the right to invest in agricultural land according to cost/benefit analysis programs. The act places a limit on the maximum number of years that interested and eligible individuals can utilize the allocated lands. It also places a limit on the maximum acreage of land that can be utilized for these purposes.

Regional and International Conventions and Treaties ratified by KSA

There are few regional and international conventions ratified by KSA, such as major agreements adopted at the 1992 United Nations Conference on Environment and Development (UNCED).

i. **The Statement of Forest Principles and Agenda 21 (Rio de Janeiro, 1992**)

These principles are the guidelines to lead states towards a more sustainable forest management regime. Chapter 11 of such principles isdevoted to "Combating Desertification", through:

- Sustaining the multiple roles and functions of all forests.

- Enhancing the protection and conservation of all forests and rehabilitation of degraded areas through afforestation, reforestation, and other rehabilitative means.
- Encouraging efficient utilization and assessment techniques to recover the full value of the goods and services provided by forests.

ii. **The United Nations Convention to Combat Desertification (UNCCD) (1994)** and the New UNCCD (2018 - 2030) Strategic Framework

KSA ratified the UNCCD. The Convention addresses specifically the arid, semiarid and dry sub-humid areas. The convention was signed by KSA in 1997.

iii. **The Convention on Biological Diversity (CBD) (1992)**

The Convention on Biological Diversity (CBD) was adopted in 1992 and contains several provisions that include conservation of biological diversity, sustainable use of biodiversity components, fair and equitable sharing of the benefits deriving from the utilization of genetic resources and integrating conservation and sustainable use of biodiversity in decision-making.
KSA ratified the CBD in 1992 and prepared the National Biodiversity Strategy and Action Plan. Under the CBD, KSA signed up to the Aichi principles.

iv. **The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973)**

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was signed in by KSA. Its main objectives are:

i. strengthening international protection of endangered species by managing international trade therein.
ii. Ensuring that commercially exploited species, which are not currently threatened, do not become endangered.
iii. Biosafety Protocol (1999) The Biosafety Protocol (1999) deals with the handling, import, export and utilization of GMOs by developing a legal framework for their management.

v. The United Nations Framework Convention on Climate Change (UNFCCC)

Deals with the management of natural resources and ecosystems, including forests, which might contribute to tackling climate change. KSA is a party to the UNFCCC
The Kyoto Protocol (1997): The Kyoto Protocol (1997) has the objective to stabilize atmospheric concentrations of GHG. It allows mobilizing investments for low-carbon development projects, including forest ones (afforestation and reforestation).

Paris Agreement: The Paris Agreement builds on the Climate Change Convention and its objectives and is an ambitious initiative to combat climate change and adapt to its effects, with enhanced support to help developing countries to do so. KSA signed the agreement and is planning programs including increasing efforts to reduce emissions from degradation and deforestation, support for afforestation programs and reforestation.

Moreover, the Kingdom has signed and/or ratified many international and regional conventions and protocols that are relevant to the protection of the environment, among which are the following:

- Basel Convention on Trans-Boundary Movement of Hazardous Waste
- Kuwait Regional Agreement for Cooperation on Protection of Marine Environment from Pollution and the regional cooperation protocols for combatting marine pollution by oil and other harmful substances in emergencies.
- The Regional Agreement for Protection of the Red Sea and Gulf of Aden and its complimentary Protocol on Regional Cooperation for Combatting Pollution by Oil and other Harmful Substances in emergency Situations.
- The Protocol on Marine Pollution due to Exploration and Exploitation of the Continental Shelf in the Arabian Gulf Sea area.
- Protocol on Protection of Marine Environment from Land-based Sources (Arabian Gulf).
- Agreement on Conservation of Migratory Wildlife
- Vienna Convention (and its protocol) on Protection of Ozone Layer.

Moreover, KSA is committed to achieving the SDGs, and the Forest Department is particularly committed to SDG target 15.2 on sustainable forest management. In addition to these, Saudi Arabia supports and works with regional and international organizations that are concerned with the protection of the environment and conservation of natural resources, such as the United Nations Environment Program, World Health organization, United Nations Food and Agriculture Organization, World Meteorological Organization (WMO), UNESCO, the Regional Organization for Protection of Marine Environment, Program of the Environment of the Red Sea and Gulf of Aden (PERSGA), the relevant organizations working under the Arab League and the Gulf Cooperation Council as National Environmental Code

Recommendation

I. National Forest Programme and National Forest Policy (NFP)

Development of a comprehensive National Forest Programme, as described by FAO in this booklet: https://www.fao.org/3/i2623e/i2623e00.pdf and it is recommended that a National Forest Policy be developed and approved by the KSA government to provide a framework within which forest resources can be sustainably managed, conserved and protected. The following are the main issues identified to be considered when developing KSA national forest policy:

- National forest policy will be a negotiated agreement among stakeholders with a common vision and goals for KSA forests and trees. It will provide key strategic guidance and will be easy for a broad spectrum of stakeholders to understand.
- Forest policy goals need to address main societal issues and be closely aligned with the country's development goals. All concerned sectors and stakeholders must be involved in defining and achieving these goals. Such a scope requires a broad perspective of land use and natural resource management. International commitments including the SDGs should also be taken into account.

- Initiating a policy requires a good understanding of the national context, the ability to secure support from high levels of government and key stakeholders, and an accurate assessment of the right time to establish the process.
- Proper preparation is important, including communication and capacity building, leadership support and sound information on the status and future trends of forests and social, political, economic, environmental, and technological factors that determine their use.
- Participation of key stakeholders at national and subnational levels throughout the process is key, as is joint ownership of the resulting policy and shared responsibility for policy implementation.
- Drafting forest policy is about accommodating different interests on how to use and protect forests, interests that sometimes conflict. Reaching compromises requires good negotiation and facilitation skills rather than technical knowledge only.
- Policies that work in practice need to be designed with implementation in mind. This requires agreement on the approach and on responsibilities as well as flexibility on the methods to achieve objectives. It also needs an understanding of funding and re-aligning legal and institutional frameworks with the new or amended policy.
- Strong and professional communication from the outset and the building of sufficient capacity for those participating in policy development and implementation are crucial for success. A forest policy that is neither well known nor understood has little impact.
- The new forest policy and a strategy to put it into practice should be adopted by the government at high levels to demonstrate commitment and guide authorities in its implementation. Non-governmental stakeholders should likewise express their commitment to both the policy and its implementation.
- Forest policy should guide daily practice. An institutional arrangement that promotes and facilitates continuous dialogue is essential for effective implementation, operational fine-tuning, coordination with other policies, integration of new initiatives and adaptation over time.

II. Forest Law

On the legal reforms to strengthen the forestry sector, it is recommended that, the current gaps in KSA legislation about forestry can be overcome by issuing a specific Forest Act after the development of NFP.

The specific Forest Act should address the above-mentioned gaps and weaknesses and then consider the following issues.

Provide Institutional Support to the proposed forest institution.

- The Act spells out the Forest institution's objectives, competence and authority, and administrative hierarchy.
- Structure and functions of the institutions responsible for the administration of the forestry sector.
- The Act should empower the forest institution with necessary competence and authority including the authority for providing technical supervision for forestry sectors; training and qualifying

technical staff in the field of forests; dissemination of awareness in matters of forests and natural resources.

- Increasing the forests and natural resources areas by reserving identified % of the total area of the country.
- Coordinating efforts with the competent authorities in matters relating to land use and land investment

Provide legal support for

- Allocation of a small percentage of agribusiness land for agroforestry and tree planting as shelterbelts and wind breaks
- Tree planting outside forest reserves (mainly governmental institutions)
- Tree planting for climate change mitigation (mainly companies contributed to the Kingdom's national emission)

General Recommendation:

There is a clear need to update the **Environmental Code 2002** and other existing related environmental Acts and Law to accommodate the international KSA obligation and stakeholder participation.

Institutional and human resource framework

In all countries where forests are a notable resource for environmental protection, rural livelihoods, harvesting woody and non-woody forest products (NWFPs), biodiversity conservation, and carbon sequestration, there should be strong commitment to ensure that the forest sector is well managed and is able to sustainably deliver the desired development outcomes. The aim of this section of the review is to provide an overview of forest sector organizations and to identify possible reform opportunities and provide strategic guidance on future effective institutional performance to meet the objective of environmentally sustainable forest management.

Forestry Organizational structure

Historically, the forest department came under the Ministry of Environment, Water and Agriculture (MoEWA. The Ministry of Environment, Water and Agriculture was responsible for environment protection, conservation and management and was established vide the Royal Decree No. (A/133) dated 07/05/2016. The ministry had a centralized governance structure which was operationalized through six Agencies namely the Environment Agency, the Water Agency, the Agriculture Agency, the Land and Survey Agency, the Planning and Institutional Excellency Agency, and the Economic Affairs and Investments Agency. MoEWA was mandated for overseeing, developing, and managing rangeland, forest and national parks and was responsible for the development and preparation of policies, strategies, environmental legislation, awareness programs, environmental studies and research.

Figure 3 shows different lines of authority at national level where, each of the offices in the structure had at least a person in charge with clearly defined functions and job descriptions. The Environment Agency was led by Under Secretary and then General Directorate for Biodiversity & Combating Desertification under which the Forestry Department established.

At the regional level the interests of the Ministry of Environment, Water and Agriculture was administered by the Ministry branch through the General Directorate of Agricultural Affairs. It used to be supported by the several administration units such as Department of National Parks, Livestock, (figure 4) below.

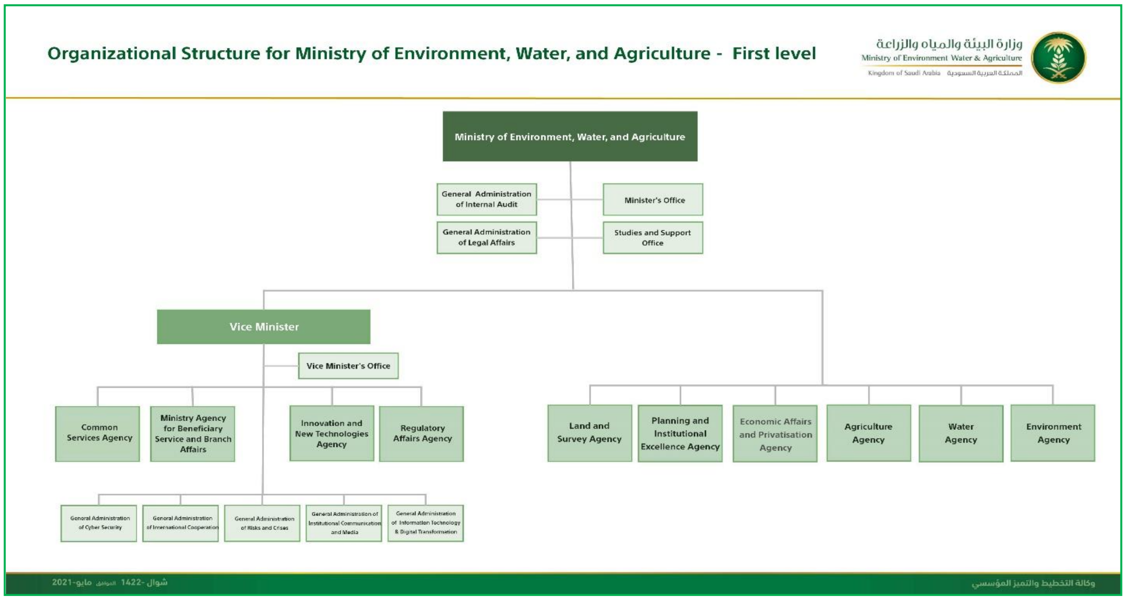
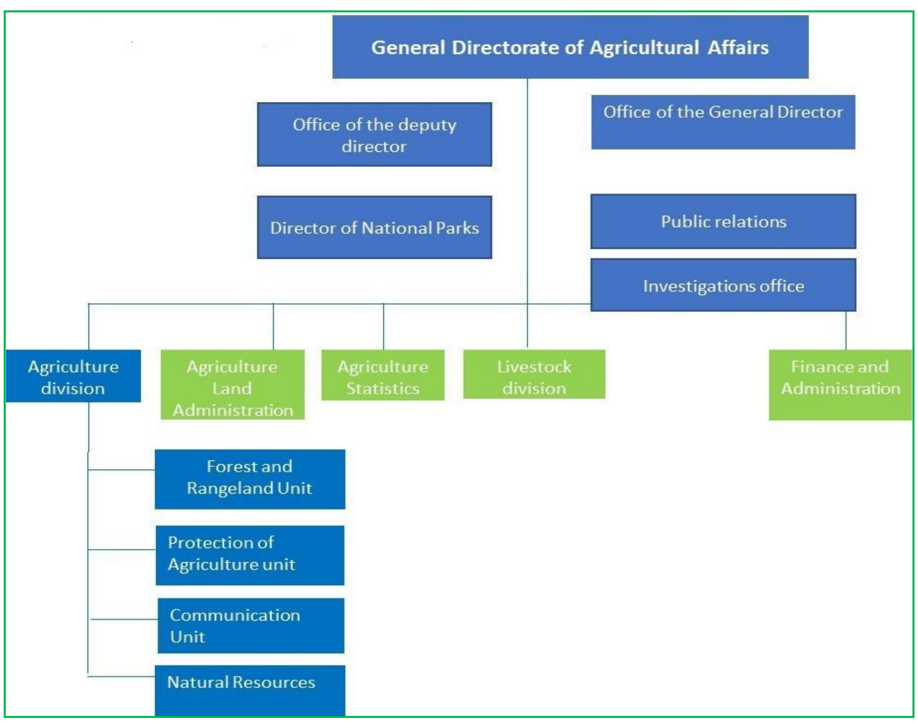


Figure 3. Organizational structure of the Ministry of Environment, Water and Agriculture at National level



The Environment Agency

Figure 4. Organizational structure of the General Directorate of Agriculture at Regional level

The office of the Environment Agency is a recent establishment under ministerial resolution No. 115/1/1438 dated February 16, 2017. The office is tasked overseeing, developing, and managing rangelands, forests, and national parks. The specific functions of the office are

- Supervising and following up on meteorological activities.
- Preserving environmental systems and biodiversity.
- Supervising, developing and sustainably managing forests, pastures and national parks;
- Preparing plans and programs for adapting toclimate change in cooperation with the concerned authorities to curb the effects of climate change.
- Combating desertification and protecting the marine and coastal environment.
- Activating partnerships with environmental associations and activists.
- Building cooperation channels with the universities and research centers concerned with the environment.
- Taking part in, and following up, environmental agreements.
- Initiating regional and international cooperation in the fields related to the environment sector.
- Achieving optimal investment of water resources through rationalization and use of treated water and renewable water resources.
- Building a full-fledged project for waste management; and
- Protecting beaches and natural reserves.

The General Directorate for Biodiversity and Combating Desertification at the national level is mandated to:

- Review policies, legislation, regulations, strategies, and regulatory frameworks related to biodiversity, forests, pastures, national parks and combating desertification.
- Review proposed biodiversity plans, mechanisms, forests, rangeland, national parks and desertification control.
- Review and ensure the appropriateness and effectiveness of programs and procedures for the implementation of biodiversity strategies and plans forforests, rangeland, national parks and desertification control.
- Review studies and research on wildlife, rangelands, forests and national parks and combat desertification
- Supervise the procedures for the conservation, control and development of rangeland and public forests and sustainable environmental management and the organization of their exploitation.

The General Directorate for Biodiversity and Combating Desertification under Environment Agency was responsible for the management of forest, rangeland and national parks through the departments of Forest, Rangeland and National Parks. The Forest Department has the mandate and responsibility of ensuring that the forest resources are well managed for the environmental, economic and social benefits of the Kingdom.

Recent institutional reforms

Recently (2019) Saudi Arabia established an environment fund and environment centers were inaugurated as part of the country's sustainability strategy and efforts to ensure the protection of its environment and ecosystems. These five centers are:

I. **The National Center for Vegetation Cover** Development and Combating Desertification (NCVC) aims to develop and manage national parks, develop and rehabilitate vegetation cover in forests and rangelands, protect local endangered plant species, combat desertification, in addition to conducting studies and supporting research related to vegetation.
II. **The National Center for Environmental Compliance** is concerned with monitoring the environmental compliance of all establishments that have an impact on the environment in all development sectors, supervising programs for monitoring sources of environmental pollution in addition to approving environmental impact studies, issuing environmental licenses for all development projects, and inspecting installations.
III. **The National Center for Wildlife Development** included supervising programs related to the protection and development of wildlife and biological diversity, as well as planning and managing protected areas and managing centers for the breeding and resettlement of endangered animals.
IV. **The National Center for Meteorology** will monitor weather and climate conditions, prepare forecasts, provide airports, ports and other bodies with data and weather forecasts, and operate weather monitoring stations in the Kingdom's regions.
V. **The National Center for Waste Management** will organize the waste management sector to improve the quality of services, enhance the level of capabilities and competencies, enhance the economic sustainability of the sector by stimulating investment and maximizing the participation of the private sector, reduce waste disposal in landfills by stimulating the use of best practices in resource recovery techniques.

T**he** strategic objectives of the National Centre for Vegetation Cover Development and Combating desertification are.

- Desertification monitoring and mitigation programs and treaties
- Sustainably manage forests and mitigate the effects of anthropogenic and natural threats.
- Regulate and sustainably manage rangelands, preserve plant diversity, and rehabilitate degraded rangelands.
- Build a knowledge base and set adequate incentives to support innovation and use of modern techniques in the field of vegetation cover and combatting desertification.
- Strengthen partnerships with local communities and the private sector to support the development of vegetation cover and associated economic activities.
- Sustainably manage and develop the infrastructure and conserve natural ecosystems of national parks.

- Build human and technical capabilities in the field of vegetation cover and combatting desertification.

General Directorate of Forests - GDF

The National Center for Vegetation Cover Development and Combating Desertification (NCVC) under which the General Directorate of Forests currently lies, was established with the approval of the Council of Ministers in March 2019, after the abolition of the General Authority of Meteorology and environmental protection.

The General Directorate of Forests (GDF) is one of the departments of the National Center for Vegetation Cover Development and Combating Desertification established at the national level and provided with fifteen officers and consultants. The current organizational structure of the center is illustrated in the figure below.

The Strategic objectives of the GDF are:

- Preparing and implementing a national plan for sustainable forest management
- Preparation and implementation of the national forest strategy
- Create a digital database and update forest classifications and data when needed.
- Development of forest areas with all their environments and plant genetic resources.
- Capacity building, education and awareness raising, training and awareness raising in the field of forestry.
- Partnerships with relevant authorities and the preparation of reports and studies
- Regulating and promoting investment in forest area
- Rehabilitation and development of forests and the development of emergency preparedness plans for forest protection

Structure of the NCVC and GDF is illustrated in figure 5 below.

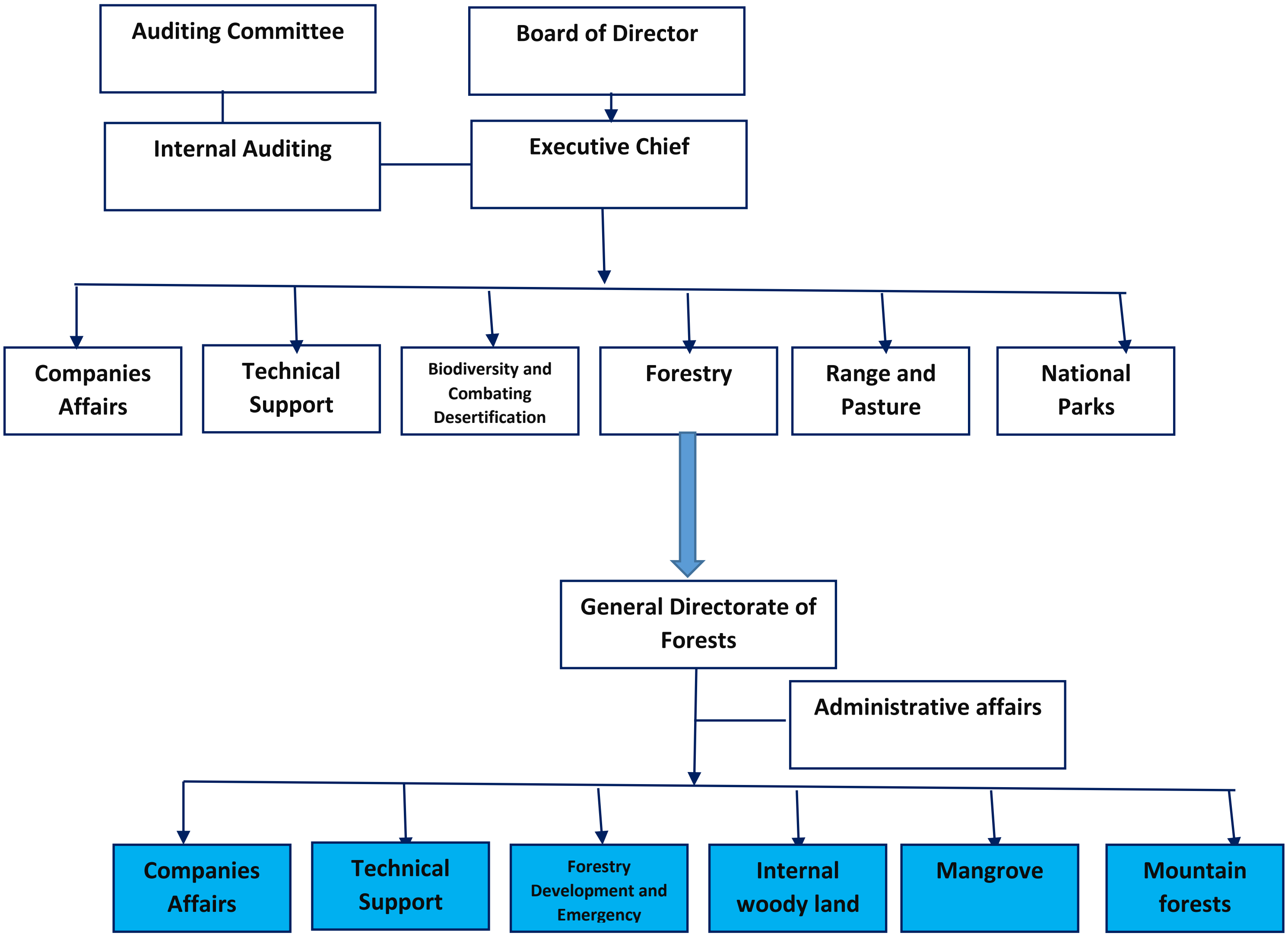


Figure 5. NCVC and GDF organizational structures

It can be concluded that, historically, the forest department had a lean structure with administration units with limited qualified staff that had gaps and weakness with no clarity of vertical accountability reporting lines. After the establishment of NCVC the situation was improved where forest department upgraded to General Directorate of Forest with a clear mandate and provided with more staff and facilities.

Gaps and weaknesses

In addition to gaps, challenges and problems identified by the situation analysis, benchmarking, several brainstorming and discussions sessions between FAO Forestry team and the GDF were conducted where the following gaps and weaknesses were identified:

i. The current Institutional framework did not consider the specificities of public domain management, which covers about 2.7 million hectares of forest and oversees the protection of the country against desertification.
ii. Tasks assigned to the authority responsible for forests are multidisciplinary, combining technical, legal, social, economic and administrative aspects.
iii. Forest management, conservation and forest protection have been always the responsibility of low-level and low-profile institutions or resulting into conflicting priorities (e.g. under the Ministry of Agriculture during periods when large areas of forest reserves were converted to agriculture)
iv. The forestry institution in KSA is poorly developed to supervise, manage, and protect the country's forest resources and co-management of forests with local communities in comparison to many other countries in the region.
v. Lack of proper forestry department organizational structure and lack of a legal framework to support its mandate and functions.
vi. Forestry department functions and responsibilities come under higher institutional level (planning, supervising and protection of forest resources) compared with the bulk of the forestry technical needed at the regional and local level.
vii. Importance of forest resources and its role in KSA and the importance of its specific institutions not recognized and well considered.
viii. Historically forestry institution in KSA has little control over forest resources where, not a single forest has a proper valid management plan.
ix. These weaknesses and gaps have the potential to hinder forestry issues being addressed during the past, present and in the future.

Human Resources

The total number of the MoEWA staff is 14,231 but at the National Ministry level, the human resource in the Forest Department staff was consisted of a director and sixteen officers, it constitutes less than one percent (1%) of the MoEWA human resources.

At the regional and local levels there is no specific forestry staff and the Ministry of Environment, Water and Agriculture, including the forestry sector are managed by General Directorate for Agriculture Affairs in all 13 administrative regions or 1-2 NCVC staff. At Governorates level: managed by the Directorate of Agriculture (125 Governorates)

At the Markaz level, supported by the Directorate General of Agriculture Affairs comprises the Livestock, Agricultural Land Management, Irrigation, Department of Agricultural Development and Statistics, Management of the National Park, Department of Agriculture Department of Administration and Finance.

Gaps and weaknesses

Human resources supportive capacity limitation and challenges

- Lack of qualified foresters at the national, regional, Governorates, Centers and District local level
- Shortage of forest guards at the local level (sometimes private sector contracted for forest guarding and protection)
- Lack of supportive infrastructure, tools and equipment for forests development and protection
- Lack of communication and extension systems
- Forest Department at regional and local levels do not have forest equipment and means, as well as the absence of special machines for forestry, communications and equipment for primary fire intervention and other infrastructure for forest development and protection.

Proposed Forest Institution

The proposed forest institution is based on the administrative set up of KSA. 13 regions (also known as province - Manateq) are divided in to 136 governorate (Mahafazat) and 1347 Municipality (Marakiz) then into villages (Quras) and neighbor (Ahya) (Table 17 and Figure 6) below.

Table 17. Proposed Forest institution levels, role, and responsibility

Level	Description, role, and responsibility
The National level: **Central Public Institution (General Directorate of Forests under NCVC)**	Being the headquarters, the Forest Institution will be responsible for overall supervision of forest resources in KSA, coordination and integration of all forestry activities performed by the Regions; formulation of national forest programme and plans in close collaboration & coordination with the Regions. *Proposed structure at National level* I. Director General Forests (DG) and its affiliated units (national level) II. Administrative affairs III. Central administrations
The Regional/Province (Manatiq) level: Regional forestry Administration	The Forest institution should have a strong presence in all regions. The boundaries of Regional Level conform in all cases with the administrative boundaries of the Region. Technical Administration for development of Forest Management Plan, Resource assessment at the region, survey and inventory, monitoring and evaluation of implemented forest activities in the region. *Proposed structure at regional level* I. Regional Technical Sector II. Forest inventory, planning unit III. GIS and Remote sensing unit IV. Monitoring and evaluation unit
The Governorate	Every Region administration is divided into Governorate/ Mahafazat to form yet

(Mahafazat) level:) **District forest Administration**	another intermediate administrative entity. *Proposed structure at Governorate (Mahafazat) level* • Forest protection, development, execution and enforcement office • Seeds and seedling production, • Forestry extension, social mobilization unit • Statistic and information and data collection and data management unit

At the national level, the General Directorate of Forests would comprise five General Administrations as follows:

General Administration for forest management

The objective of the forest management administration is to accelerate the conservation, protection and promotion of forests and ensure that forests are managed on sustainable basis. Its responsibilities would include:

- Conduct National Forest inventory, national forest monitoring system and preparation of SFM plans.
- Nation-wide forest conservation in coordination with the Regional Technical Administration.
- National Forest Inventory is responsible for the generation of forest data through inventory, mapping, remote sensing, cartography, etc.
- Promoting integrated and sustainable forest management, ensuring proper forest management based on Forest Management Plans (FMP) for every forest unit under NCVC/GDF administration.
- Also responsible for reviewing management plans prepared by the regional Technical Sectors and submitting them for final approval.

General Administration for Afforestation/Reforestation

The objective of the afforestation/Reforestation administration includes the following:

- Prepare a national afforestation Programme in close coordination with the Regional Technical sector.
- Monitor the annual afforestation Programme and evaluate the performance of the different silvicultural operations.
- Determine the annual national needs of seeds, seedlings and assess the performance of the region and district about seed collection in terms of quality, quantity, and suitability of the sources to the requirements of appointed areas, ensuring storage of seeds in a proper manner.

General Administration for Planning

The objective of the planning administration includes the following:

- Formulation of all Forestry development plans; keeping and retrieval of technical data; production of the annual report; devising strategies for the forestry sector; planning for staff career development; coordination of international projects.
- Identification, formulation and follow-up of the forestry sector development projects and conducting feasibility studies to that effect; layout, execution and follow-up of the development budget; monitor, evaluate and produce reports on forestry project.
- Evaluating the performance of work plans and budgets by continuous monitoring of the implementation progress

- Assessment of training needs, Devising Forestry training Programme, both short and long, and monitor its implementation.

General Administration for Forestry Extension Services and Information

The objective of this administration includes the following.

- Promotes forestry activities carried out by the forestry institution and other stakeholders.
- Long term effort to persuade people to plant their own trees.
- Formulate the national extension policies and programs.

General Administration for financial and human resource Affairs

- Financial Affairs
- Human resource Affair and capacity buildings

At the regional (Manatiq) level

The proposed forestry department structure is Regional Technical Sectors

This is purely technical sector responsible for forest management at different regions in KSA.

- Forest Data base for each region
- Survey, mapping and demarcation of forests in the region
- Forest resource assessment (Forest inventory, socio economic and environmental survey)
- Preparation of forest management/working plans
- Scientific and technical report on forest health, ecology …etc.

Governorate (Mahafazat) level

The set up are located at the Governorate level, and they usually conform to the administrative boundaries of Governorate Level Administration. It is the basic operational unit and generally established according to required technical criteria.

Mandated for the management of specific forest resources and performs the following main functions.

- Coordinate and give due support to the forestry sector in the district.
- Liaise forestry activities with the overall Districts programs.
- Manage forestry resources.
- Provide technical and logistical support to forest Circles.
- Supervise implementation of technical operations
- Contribute to national forestry planning.
- implementation of work plans operations (rehabilitation, restoration and conservation)
- Protection of the forest's resources from illegal felling and fires within the Circle boundary
- Seeds collection & Seedlings production
- Forest extension (local community, farmers, pastoralists ...etc.)

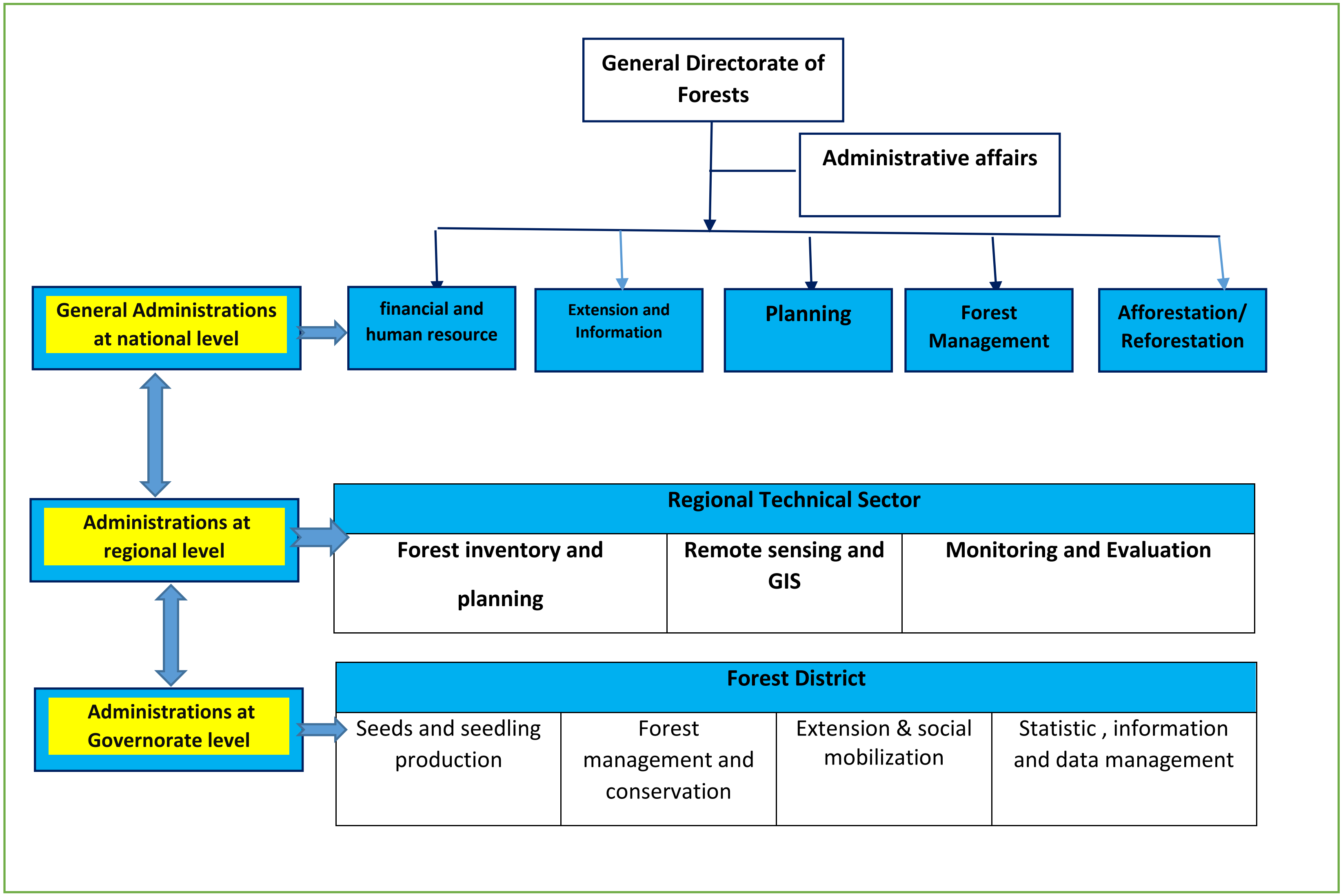


Figure 6. Organizational structure of GDF

Forest Research

National Research institutions

The KSA location in the semi dry and dry zone, with low forest cover coupled with the complexity of environmental and ecosystems conservation challenges creates a tremendous challenge in developing sustainable forest management practices.

In natural resource management (NRM), research deals with issues, activities and strategies relating to exploration, documentation, conservation, improvement, sustainable utilization, processing, marketing, industrialization, monitoring and analysis of resources of different kinds and distribution scope and size (Okafor 2003). There is a great desire for forest research in KSA to generate knowledge on how to improve forest management and productivity, preserve biodiversity, maintain ecologic integrity, and to continue the provision of environmental and social services. Investment in research and education are prerequisite to make the forest sector grow and contribute to national development.

As leading academic institutions, some universities in Saudi Arabia recognizes the importance of forest conservation and improvement as early as three decades ago through teaching and research work.

There are many scientific institutions involved in both forest and environmental related academic and research in Saudi Arabia namely:

1. King Saud University (Riyadh)
2. King Faisal University (Dammam)
3. 4- King Khaled University (Abha)
4. King Fahad University of Petroleum and Minerals (Dhahran)
5. Imam Mohammed bin Saud Islamic University (Riyadh)
6. Islamic University (Medina)
7. Umm al-Qura University (Mecca)
8. King Abdulaziz University (Jeddah)
9. Taiba University
10. Taif University
11. Qassim University

Other environmental research-related institutions are included in Table 18 below:

Table 18. Environmental research institutions in KSA

Institution	Research field
Ministry of Defense; Military Survey	Preparation of maps for all of Saudi Arabia and conducting Research in Territorial waters
Meteorological and Environment Protection	Research and studies on the Quality of Air, Soil, Natural Habitats, the Quality and Conservation of Water and preparation of reports on the weather and the climate
Ministry of Agriculture	Five agriculture research centers under the Ministry

	• National Agricultural Research Center, Riyadh • Rangeland and Animal Wealth Center in Al-Jouf • Agricultural Research Center in Jizan • Horticulture Research Center in Najran • Date and Date-palm Research Center in Al-Hasa
National Commission for Wildlife Conservation and Development	National Wildlife Research Center (NWRC)
King Khaled wildlife Research Center (KKWRC)	Captive breeding of gazelles and their reintroduction into protected areas
Jubail Marine Wildlife Sanctuary Center	Undertaking comprehensive survey of coastal and Arabian Gulf ecosystems.
Al-Sudairy Gazelle Center	Breeding and ecological studies on Gazelle Reem.
Forest Research Group (College of Food & Agricultural Sciences, King Saud University)	Forest research, extension, and teaching

Regional Research Institutions

The following regional research institutions are established in the region and are involved in conservation of biodiversity.

- ICARDA – International Center for Agriculture Research in Dry Areas Established in 1977 and based in Aleppo, Syria. Among its tasks is to improve the welfare of people in the dry areas of the world and to enhance food production. ICARDA which work with MoEWA, contributes to scaling out successful water use technologies in KSA to increase productivity and quality while conserving the natural resource base.

- Arab Center for the Studies of Arid Zones and Dry Lands ACSAD established in 1971 in affiliation with the Arab League. It is a regional center for research and studies on the development of the arid and semi-arid areas of the Arab World. Its activities include research, training programs, organizing scientific meetings, providing technical advice and assistance, and establishing technical cooperation with Arab and international organizations.

- International Plant Genetic Resources Institute (IPGRI) regional office located in Aleppo, Syria. IPGRI collaborates with national programs in conducting research, assist in the activities of seed collection and documentation, their conservation and training activities which cover a wide range of species that include vegetables, tree crops, native shrubs, and grasses.

- Environment and Development Center in the Arab region and Europe (CEDARE) Established in1992 in Cairo, Egypt. Works in coordination with governmental organizations, United Nations institutions, international bodies, private sector, public media, and the civil society in general. It combines environmental policies, and decision makers and his interests include management of coastal and aquatic resources, as well as land resources, and handles issues of commerce, investment, and environment.

Based on the FSR lessons learnt, there is an urgent need for forest research to guide future forestry developments by generating knowledge and introducing state of the art forest-related technologies and innovations in KSA. Following are some research areas identified as priority to speed up the process of forest development in KSA:

- Natural terrestrial forest conservation and management
- Conservation and management of mangrove forests
- Ecosystem services and sustainable use of biodiversity
- impact of climate change on all forest type
- Ecosystem service valuation
- Trees and shrubs in agroforestry and silvopastoral systems
- Tree breeding and intensive forestry
- Forest related policy and socio-economic research
- Non-timber forest resources.
- Role of forest in climate change
- Desertification control
- Nursery and seedling technologies
- Seed propagation and certification

Gaps and weakness

- Absence of a specialized forestry research institution in the country considered to be the main gap that lag context specific forestry research.
- Scattered ad hoc research is done by universities on personal individual interest but not guided by a national forestry plan that addresses country priorities in forestry field.
- Despite existence of many research institutions, the capacity of the forestry research in KSA is not to the level where it needs to be to generate appropriate technologies that contribute to forest sector development.
- Generally, forest research in KSA has been unable to provide adequate information and responses to the challenges of sustainable forest development.
- Most research activities are conventional resource assessment types, with small efforts in application of modern laboratories and technologies such as tree breeding, cloning, genetic improvement.
- The poor link between research and extension combined with the lack of coordination among institutions that operate in research and extension are also part of the challenge.
- The research agenda is of lesser relevance to the challenges facing conservation and sustainable management of the KSA forest resources.
- Forest sector development is not benefiting from research due to weak inter-sectoral coordination and poor research extension linkage.

- Lack of research information on the history of the natural forest stands, generation, population dynamic, ecological processes, growth rate, etc.

Recommendations

- Adopt a coordinated National Forestry Research strategy covering the areas of Forest biodiversity, conservation and management, ecological modelling, Climate and Carbon, Invasive Plants, Pests and Pathogens, physiological ecology, population dynamics, soil Carbon and nitrogen dynamics, watershed ecology, Silviculture, wood technology, woody and non woody products etc.
- Establish a specialized forest research center to foster the innovation and technological development needed in the fields of forestry in KSA.
- Orient forest research towards problem solving at the national, regional and local levels.
- Enhance collaboration with international and regional organization, and Research Centers and make use of research and training programs they offer. Develop national field training programs in collaboration with universities, scientific research centers, institutions and other bodies involved in environmental activities in line with the National Forestry Research strategy.
- Develop and establish scientific data base with scientific facts and information on the status of forests resources in KSA.
- Create synergies and linkages between legislation, regulations, and policies within and between research institutions.
- Develop networks, linkages, association, and bi-lateral relationships for institutions and staff development.
- Establish cooperation and exchange with research institutions in several different issues related to sustainable forest management and the forestry sector in KSA.
- Develop undergraduate and graduate programs in relevant universities and institutes to address forests related issues.
- Utilize protected areas as scientific research sites to study KSA fauna, flora and forests. The protected areas serve as living laboratories where researchers and students can conduct research.
- Develop the concepts of forestry, natural resources and biodiversity existing in curricula of general education and universities as well as training.

Part four

Recommended Strategic Interventions

Based on the sector review findings, an urgent National Forestry Development Program is proposed. This Program outlines the main required measures and actions to be taken to address the problems, challenges and barriers identified by the sector review. It also intends to guide the future development of KSA's forestry sector. The program aims at the adoption of a comprehensive approach for promoting sustainable and productive forestry. The program consists of six pillars as follows.

1. Sustainable management of KSA forest resources
2. Improving forest vitality and productivity
3. Improving forest operational and governance environment
4. Creating effective forest partnerships
5. Support rural community livelihood and welfare.
6. Enhancing enterprise and creating partnerships.

These pillars are to be integrated into five thematic areas namely:

1. Improve the kingdom's overall forest cover and productivity.
2. Managing forest ecosystems for sustainable provision of goods and services
3. Enhancing governance policy, legislative and institutional frameworks, and technical and institutional capacities,
4. Enhancing forest-based enterprises, especially among the youth, and creating partnerships
5. Gender, coordination between different sectors and Research

The key interventions and activities for realizing these thematic areas are presented in table 19 below.

Table 19. Recommended key strategic interventions and activities

Intervention area	Current status	Proposed actions to be taken
Pillar 1: Increase KSA forest cover vitality and productivity	Forest covers constitutes 1.3% of the total country with a total area 2, 727, 241 ha. Forest productivity not comprehensively quantified.	1. Survey, map, and demarcate all KSA forests. 2. Improve forest protection by reducing forest damage by man, fire, and diseases. Enforce forest law with the support of the local community and leaders. 3. Promote community-based forestry and private sector engagement. Enhance their capacity in forest management, protection, conservation, and sustainable utilization. 4. Promote alternative energy to reduce the dependency on forest resource as fuel wood in rural areas. 5. Expand tree planting inside and outside forest areas. 6. Continue the ongoing rehabilitation of degraded forest areas through tree planting initiatives and secure the supply of forest plantation materials to meet national needs. 7. Initiate and implement a national Afforestation and Reforestation program for rehabilitation of degraded forests, protection of watershed, climate change mitigation and adaptation, and combat desertification. 8. Adopt holistic forest landscape restoration and adaptive forest management approaches. 9. Establish a National Forest Monitoring System (NFMS).
Pillar 2: Conserve and protect kingdom vital natural resources and mitigation of climate change through forest-based solutions	Limited sustainable management of forest ecosystem goods and services. Limited use of forest solutions for sustainable land management and desertification control. Limited recognition of role of forestry in climate change mitigation and	10. Undertake regular and systematic forest resource assessment and inventory e.g. every five years. 11. Develop operational guidelines for forest management based on best practices and lesson learned on sustainable forest management. 12. Prepare and implement forest management plans for all forest especially in the Southwest regions following suitable forest management modalities in partnerships with local communities and private sector. The strategy for forest management should focus on NFWPs, forest ecosystem services and biodiversity conservation. 13. Bring degraded forest areas under extensive forest management based on international best practices and local knowledge. 14. Design and implement a public awareness and education Programme on sustainable forest management. 15. Contribute to the update and implementation of KSA National Biodiversity Strategy and

	adaptation.	Action Plan when related to trees and forest ecosystems. 16. Conduct valuations for all types of forests in KSA. 17. Include the role of forests in climate change mitigation and adaptation and consider preparing and implementing REDD+ projects within KSA forests. 18. Conduct watershed assessment and develop and implement an integrated watershed management plans in forests and forest lands. 19. Develop and implement plan to integrated forest in sustainable land management and land desertification control.
Pillar 3: Improve livelihood and welfare in forest adjacent communities.	Limited recognition of role of forest in supporting community livelihoods. Limited activities on afforestation/reforestation for livelihood.	20. Promote livelihoods activities for forest dependent communities through the development of ecotourism; honey production; agroforestry, aromatic and medicinal plant production, gums and resin, etc. 21. Conduct related market surveys and value chain studies for non woody forest products (NWFPs) in KSA for further development of markets for these products. 22. Promote forest-based job creation and incomes generation in forestry sector. 23. Develop and expand economically viable non timber market opportunities. 24. Develop Programme for payment of ecosystem services within forested areas. 25. Promote planting of high economically value trees on private and communal lands by providing seeds, seedlings, technologies. 26. Establish forest carbon trade or payment mechanisms by linking forests, biodiversity and watershed conservation and management. 27. Ensure the active involvement of women and youth in the forestry sector and their participation and representation of sector decision-making processes.
Pillar 4: Improve Forest sector governance, coordination, and institution efficiency	No National Forest Policy. Range and forest Act exist but no specific Forest Law. National Forest strategy need update. Limited capacity of forest department at national and regional level with few qualified human resources	28. Formulate and adopt a National Forest Programme including the development of a national forest policy through a participatory framework with well-defined indicators, roles, and responsibilities to promote, monitor and assess forest governance at national, regional, and local levels. 29. Once the National Forest Policy is available, formulate and implement a specific Forest Act. 30. Re-structure the General Directorate of Forests in line with new HR systems and delegation of authority at different level. 31. Establish human resource management and development systems in forests and forestry.

	Weak inter-sectoral coordination. High political concern on environmental protection and conservation.	32. Recruit qualified professionals, ensure gender equality, and put in place a system for promotion of forest personnel. 33. Improve training quality, based on training need assessment with established training partnerships with related national and international institutions. 34. Establish a Collaborative Implementation Framework through establishment of a Technical Advisory Committee (TAC) and other participatory mechanisms to guide the implementation of development initiatives. 35. Enhance the role of forest institutions in the national bodies and related regional and international development frameworks such as UNCCD, CBD, UNFCCC, UNFF, RAMSAR, CITES, etc. 36.
Pillar 5: Enhance private enterprises with the forest sector and enhance partnerships	Forestry sector contribution to GDP not yet quantified. Lack of experience in forestry as a profitable business enterprise Limited private sector involvement in forestry. Lack of private sector involvement in forestry planning and implementation activities. No community or private forest exist.	37. Identify areas for potential partnership with local community, private sector, and civil society organizations for forest management. 38. Prepare guidelines and set out modalities for public-community-private partnerships in different areas of the forestry sector and increase the use of participatory planning. 39. Enhance the role of the local community in forest management for better benefit sharing and participation. 40. Recognize the private sector and local community in the forest policy and law as key partners for social, environmental, commercial, and economic development in the forestry sector. 41. Establish formal institutional partnerships and structures to enable active local and private sector engagement. 42. Build capacity of government, private sector, community and civil society on business and enterprise management and use of technologies for production, processing, and marketing of non-wood forest products.

Pillar 6: Strengthen and improve forest research.	No specialized forest research institute. Forestry research randomly carried out by universities, and agriculture training centres. Forest department not involved in identification of forestry research priorities.	43. Establish a specialized forest research center and create a forestry research committee to determine the national forestry research priorities. 44. Establish partnerships between forest and academic institutions and research centers to improve collaboration and coordination in the identification of research problems and communication and dissemination of forest research results. 45. Establish central forestry research data and information for KSA, including a database of all research carried out by government, universities, and NGOs and make it available and accessible for all stakeholders.

Part Five

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Annex

Table 20. Key stakeholders, their role in provision, regulating, cultural forest ecosystem goods & services and the degree of their influence

Stakeholder	Related functional role	Provisioning Goods and Services	Regulating Services	Cultural Services	Resource health and sustainability	Degree of influence (H=high, M=medium, L=Low)
Ministry of Environment, Water and Agriculture (at national, regional and local level)	Mandated for management of forest resources in KSA	Responsible for provision of Woody and non woody forest products (timber, fuel wood, Food, Fresh water, Genetic resources Ornamental resources	Contribution to (Air quality regulation, Climate regulation, Disease regulation, Erosion control, Natural hazard control, Pest regulation, Pollination, Water [flood] regulation Water purification and waste treatment	Provision of Aesthetic values, Cultural heritage values, educational values Knowledge systems Recreation and tourism, Sense of place Social relations Spiritual and religious values	Responsible for (Rehabilitation & Restoration, Afforestation & reforestation, Protection and conservation, Sustainable Management)	H
Minister of Energy, Industry and Mineral Resources	Mandated for provision of alternative energy		Benefit from regulating services as one of the main contributor to emission and environmental problems	Benefit from cultural services provided by forest resources	+ve provision of alternative energy reduced dependency on forest for energy -ve contribution to environmental	M

					problems	
Ministry of Interior	Mandated to implement the forest laws and regulations		Benefit from regulating services provided by forest resources	Benefit from cultural services provided by forest resources	Contribute to forest protection (environmental police)	M
Ministry of Economics and Planning	Support the sustainable development		Benefit from regulating services provided by forest resources	Benefit from cultural services provided by forest resources	Contribute to sustainable natural resources management planning	L
Ministry of Defense	Support to biodiversity conservation		Benefit from regulating services provided by forest resources	Benefit from cultural services provided by forest resources	As member of the national biological diversity Conservation Committee	L
Ministry of Education	Support to the research and capacity building of the forestry sector (qualified human resource, research &training)	Contribute to provision of woody and NWFPs	Contribute to regulating services	Contribute to cultural services	Contribute to conservation and sustainable NR management	H
Ministry of Finance	Financial support to the development	Benefit from provision of good and services	Benefit from regulating services provided by forest resources	Benefit from cultural services provided by forest resources	Contribute to sustainability through provision of financial support	L
Ministry of Justice	Support and implementation of Legalization, legislation implementation		Benefit from regulating services provided by forest resources	Benefit from cultural services provided by forest resources	Contribute to forest protection	L

Ministry of Media	Active role by, spreading environmental values and contributes to raise the awareness and roles that the forests in KSA is playing.	Provide tools for awareness and publicity	Benefit from regulating services provided by forest resources	Benefit from cultural services provided by forest resources	Contribute to NR conservation and sustainability through Awareness and Publicity of environmental values and importance of KSA forest resource	M
Universities and Research Centers	Support to the research and capacity building of the forestry sector (qualified human resource, research &training)	Contribute to provision of woody and NWFPs	Contribute to regulating services	Contribute to cultural services	Contribute to conservation and sustainable NR management	H
Private Sector	Private individual and groups businesses, interested in woody and NWFPs, carbon credits, biodiversity/ habitat offsetting	Contribute to provision of woody and NWFPs	Contribute to regulating services	Contribute and benefit from cultural services provided by forest resources	Contribute to protection and sustainable NR management	H
Local Community	Local people near-by forest resources who use and	Contribute to provision of woody and NWFPs	Contribute to regulating services	Contribute to and benefit from cultural services	Contribute to protection, conservation and sustainable NR	H

	depends on the resource for livelihood purposes				management	
Civil Organization	Organizations interested in conservation, the natural resources and environment,	Contribute to provision of woody and NWFPs	Contribute to regulating services	Contribute to cultural services	Contribute to conservation and sustainable NR management	H
Un Agencies (FAO, UNDP & IFAD	Support NR and environmental sustainability conservation	Contribute to provision of woody and NWFPs	Contribute to regulating services	Contribute to cultural services	Contribute to conservation and sustainable NR management	H