Review Of Regional and Global Policies In Support Of SRM, Especially LDN And Opportunities for Leveraging Further Funds for SRM Initiatives in the Arab Region

FINAL REPORT

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This review has been performed by the Arab Organization of Agriculture Development (AOAD) for the International Union for the Conservation of Nature (IUCN) in fulfilment of the terms of the contract (AVRO-00058), as part of the "Healthy Ecosystems for Rangeland Development" (HERD) Project.

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Regional and Global Policies in Support of Sustainable Rangeland Management and Land Degradation Neutrality, their Value-Addition to National Policies, and Opportunities for Leveraging Further Funds for Regional SRM Initiatives In the Arab Region

CONTENT:

List of Acronyms

3S	Initiative on Sustainability, Stability and Security
ACSAD	Arab Centre for Studies of Arid Zones and Dry Areas
AF	Adaptation Fund
AFR100	African Union Initiative to restore 100 million hectares of degraded lands
AGIEC	Arab Group on International Environmental Conventions to Combat Desertification and Biodiversity
ALAP	African Landscapes Action Plan
AMWC	Arab Ministerial Water Council
ANSRM	Arab Network for SRM
ANZECC	Australian and New Zealand Environment and Conservation Council
AOAD	Arab Organization for Agricultural Development
APIF	*Awqaf Properties Investment Fund*
ARLI	African Resilient Landscapes Initiative
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AU	Animal Unit
BLM	Bureau of Land Management
CAMRE	Arab Council of Ministers Responsible for Environmental Affairs
CBCO	Community-Based Conservation Organisations
CBD	United Nations Convention for Biodiversity
CBRM	Community-based rangeland management
CC	climate change
CGIAR	Consultative Group for International Agricultural Research
CGMS-Ma	Crop Growth Monitoring System of Morocco
COP	Conference of the Parties
CRC	Conflict Resolution Centres
DAFWA	Department of Agriculture and Food, Western Australia
DAD-IS	Domestic Animal Diversity Information System
DMN	National Directorate of Meteorology of the Ministry of Equipment, Transport, logistics and Water
DSS	Directorate of Strategies and Statistics of the Ministry of Agriculture
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
ELBC	Ethno-Lineage Based Cooperatives
FERI	Forest Ecosystem Restoration Initiative
FLR	Forest Landscape Restoration
FLR	Forest Landscape Restoration
FMD	foot and mouth disease
FU	Forage Unit
GCC	Gulf Cooperation Council
GCF	Green Climate Fund
GDI	The Global dryland initiative

GDP	Gross Domestic Product
GEF	Global Environment Facility
GGW	The Great Green Wall
GHG	Green House Gaze
GIS	geographic information systems
GPFLR	Global Partnership on Forest and Landscape Restoration
IAV Hassan II	Agronomic and Veterinary Institute Hassan II
ICARDA	International Center for Agricultural Research in the Dry Areas
ICBA	International Center for Biosaline Agriculture
IFAD	International Fund for Agricultural Development
ILRI	the International Livestock Research Institute
INRA	National Institute for Agronomic Research
ITPGR	International Treaty for Plant Genetic Resources for Food and Agriculture
IUCN	International Union for Conservation of Nature
JCED	Joint Committee on Environment and Development in the Arab Region
LAS	League of Arab States
LDCF	Least Developed Countries Fund
LDN	Land Degradation Neutrality
MENA	Middle East and North Africa
NAP	National Action Plans
NbS	Nature-based Solutions
NBSAP	National Biodiversity Strategies and Action Plans
NDC	Nationally Determined Contributions
NDVI	Normalized Difference Vegetation Index
NENA	Near East and North Africa
NGOs	non-governmental organisations
OIE	World Organisation for Animal Health
PA	Paris Agreement
PCA	Paris Climate Agreement
PDPEO	Livestock and Rangelands Development Project in Eastern Morocco
PDRTD	Tafilalet and Dades Rural Development Project (Morocco)
PDRMZA	Rural Development Project in the Mountain Zones of Al-Haouz Province
PDREMA	Rural Development Project in the Eastern Middle Atlas Mountains
PES	payment for ecosystems services
PLB	Pastoral Lands Board
PRAIS	Performance Review and Assessment of Implementation System
SAR	Saudi Riyal
SCCF	Special Climate Change Fund
SDG	Sustainable Development Goal
SLM	sustainable land management
SRM	sustainable rangeland management
STDM	Social Tenure Domain Model

SWALIM	Somalian Water and Land Information Management system
TEV	Total Economic Values
TTI	Trillion Trees Initiative
UN	United Nations
UNCCD	United Nations Convention for Combating Desertification
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
USFS	United States Forest Service
VNR	Voluntary National Reviews
WOFOST	World Food Studies simulation model

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INTRODUCTION

Rangeland is defined by the Food and Agriculture Organization of the United Nations (FAO) as "land on which the indigenous vegetation is predominantly grasses, grass-like plants, forbs or shrubs that are grazed or have the potential to be grazed, and which is used as a natural ecosystem for the production of grazing livestock and wildlife" (FAO, 2011). By their nature, rangelands are fragile ecosystems and when mismanaged readily result in degradation, drop in productivity, loss of biodiversity and water retention capacity, carbon emissions and reduced productivity.

Policy can be defined as the "Prudence or wisdom in the management of affairs" as well as "A definite course or method of action selected from among alternatives and in light of given conditions to guide and determine present and future decisions (Merriam-Dictionary, 2020). Policies and their incentive frameworks are the mechanisms by which governments seek to align development with societal objectives. Agricultural policies, for instance, typically aim at growth with equity (FAO, 2011).

This review of the regional and global policies in support of sustainable rangelands management (SRM), their value-addition to national policies, and opportunities for leveraging further funds for regional SRM initiatives is performed within the framework of the HERD Project "Healthy Ecosystems for Rangeland Development: Sustainable Rangeland Management Strategies and Practices" (UNEP, 2017).

Its objective consists of assessing the policies aimed at assuring SRM in the Arab Region and in the world, while at the same time contributing in the efforts for achieving land degradation neutrality and mitigating / adapting to climate change impact on the rangelands and pastoral communities. National and global policies and opportunities in support of leveraging more resources for SRM funding are also of interest in this review.

The overall approach of this review consists of identifying, documenting, analysing and assessing the policies related to SRM at national, regional and global levels, their application and their socioeconomic and environmental impacts in the Arab region. The task has been performed based on the available information in reports and publications of various research and studies, in addition to a survey at the LAS countries and to stakeholders' consultation.

In terms of the themes of the policy review taken into consideration, they relate to (i) the rangelands as ecosystem and as resource base, (ii) the pastoralists and resource users, and (iii) the resource outputs. We grouped them in five main components, namely: governance, knowledge, sustainable management and development, livestock development, and Sustaining livelihoods and human development.

While reviewing SRM policies at all levels, we are keeping in mind the importance of:

- Science-based evidence in targeting policy and investment,
- Policy implementation and monitoring and evaluation of policy effectiveness,
- Compliance with UN and international conventions and synergy with processes including the three Rio conventions and the Sustainable Development Goals (SDG), especially SDG1 (no poverty), SDG2 (zero hunger), SDG5 (Gender and equality), SDG6 (clean water and sanitation), SDG10 (reduced inequalities), SDG12 (Responsible production and consumption), SDG13 (climate action) and SDG15 (life on land).

I. RANGELAND RESOURCES IN THE ARAB REGION, FUNCTION, EXTENT, STATE, CHANGE, THREATS, AND TRENDS

1.1. Rangeland Resources in the Arab Region

1.1.1. Arab region; area, location , climate , and population

The Arab region is located in North Africa and southwestern Asia, covering a total area of approximately 1,345 million hectares, representing 9% of the world's total surface. It includes 22 countries grouped under the umbrella of the League of Arab States (LAS), belonging to four geographical sub-regions as follows (Figure 1):

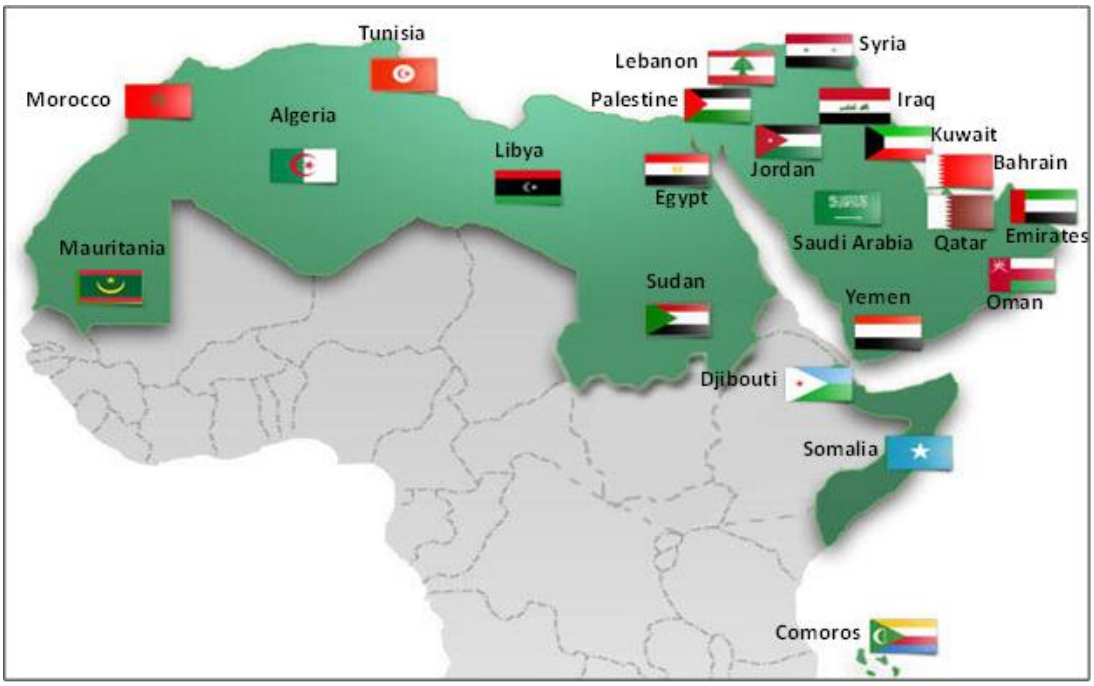
i. The western sub-region with a total area of 610 million hectares, including Algeria, Libya, Morocco, Mauretania and Tunisia;

ii. The middle sub-region (the Nile Basin and the Horn of Africa), covering about 355 million hectares, and including Egypt, Comoros, Somalia, Djibouti and Sudan;

iii. The Arabian Peninsula with total area of 310 million hectares, including Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, Emirates, and Yemen;

iv. The eastern sub-region with total area of 70 million hectares, including Iraq, Jordan, Lebanon, Palestine, and Syria in (AOAD, 2018).

In most of the Arab region prevails hyper-arid, arid and semi-arid climate, characterized by low rainfall; about 66% of the total area receives less than 100 mm of annual precipitation. Deserts and lands threatened by desertification constitute about 80% of the total area of the Arab world. In general, the region is subject to increasingly frequent extreme events, including droughts, floods and sandstorms (AOAD, 2002).



Source (LAS, 2020)

Figure 1. Map of the Arab Nation

Furthermore, the Arab region suffers from limited freshwater resources, as it is among of the areas of water scarcity (less than 1000 m^3 / person / year). Water scarcity is a major

environmental issue in most Arab countries due to the low and fluctuating rainfall, extreme ambient temperatures and high evapotranspiration, all causing high pressure on the natural ecosystems.

The total population of the Arab region reached about 423 million in 2018, with an annual growth rate, during the period 2015 - 2018, of about 1.9%, which is higher than the global rate during the same period of 1.1%. Rural population in the Arab region is estimated to be 183 million, with higher annual growth rate of 4.7% compared with only 0.3% globally (AOAD, 2018). Thus, population increase is an important challenge facing development efforts in the Arab region, which increases the pressure on the natural resources in general and on rangelands in particular, and results in resources degradation, poverty and low ecosystem and social resilience.

1.1.2. Major environments in the Arab region

Ecologists classified environments in the Arab region into four major types:

a. **The Mediterranean Environment,** which includes Lebanon, most of Palestine, the northern and western parts of Jordan, the western and north western parts of Syria, the coastal parts of Egypt, and some northern parts of the Arab Western sub-region. Various areas belonging to this environment are characterized by mild rainy winters and hot dry summers with annual average precipitation ranging between 300-1000 mm/year. Annual precipitation decreases significantly, as we move from west to east or from north to south. Regions with annual rainfall exceeding 400 mm/year are dominated by evergreen forests. Furthermore, Mediterranean environment embraces large mountainous areas characterized by evergreen species and leathery leaves. Although the Mediterranean environment is rich in plant species, it is considered to be of limited pastoral importance, because of the mountainous and rugged areas dominated by forests, leaving areas of limited size suitable for grazing (Shorbagy, 1993).

b. **The Steppe Environment,** including some parts of Jordan (especially the north-eastern parts), most of Syria, northern Iraq, and some parts of North Africa. This environment includes multiple ecosystems of plains, plateaus, and high mountain ranges. It is characterized by limited rainfall vents occurring mostly in winter and spring, and a long dry season of 5 to 7 months per year extending through summer and autumn, as well as hot summer temperatures and cold winter. This sub region is dominated by short grasses, and is considered among the richest sub regions in plant resources offering great pastoral importance to the Arab region.

   Most lands of the Steppe environment receive an annual rainfall of less than 200 mm/year, and in some countries are considered rangelands by law. This environment is dominated by agro-pastoral communities and is known in Syria and neighbouring countries as main areas for Awassi sheep and Shami goats (Shorbagy, 1993).

c. **Desert environment, i**ncluding large parts of Algeria, Morocco, Mauritania, Libya, Egypt, southern Jordan, southern Iraq, northern and central Arabian Peninsula, and some parts of northern Sudan. It is generally a low-rainfall area, with the exception of the northern parts, where rainfall ranges between 150-200 mm/year. Rainfall in this area decreases gradually as we head to the south, and becomes increasingly irregular in time and space and many years may pass without rainfall. This sub region is home to a large number of nomads and transhumant pastoralists moving between grazing areas, with their tents

and animals. This environment is characterized by a sparse vegetation and limited number of drought tolerant species (AOAD, 2006).

d. **The Tropical Environment**, prevailing in most of Sudan, Somalia, Djibouti, western and southern parts of the Arabian Peninsula (Hijaz, Assir, parts of Yemen, Oman and some parts of the United Arab Emirates) and parts of Palestine. The tropical environment is characterized by high temperatures in the summer and in winter, rare frost incidents, and heavy summer rains. This environment comprises a variety in its geographical features (flat plains, high mountains with deep valleys and swamp areas) resulting in its richness in natural and cultivated plant resources. Beside the tree steppes this environment embrace vast areas of tall grass, which transforms in some high altitude areas into forest trees and bushes mixed with tall grasses, while in the rainiest areas tropical rainforests dominate.

   The tropical environment areas are considered the richest and most important pastoral areas in the Arab region, especially in the countries of Sudan, Somalia, and southern Arabian Peninsula, due to the abundance of vegetation and high plant and pastoral productivity. This region is a concentration area for Sudanese and Somali sheep and camels, and one of the richest cattle areas, which makes it the most important animal production area in the Arab world (AOAD, 2006).

1.1.3. Rangelands extent and change during the period 2010 – 2017

Rangelands in the Arab world cover an area of 409.07 million hectares forming about 30% of the Arab world's landmass (AOAD, 2019b). Table 1 and figure 2 shows the rangeland's surface per country and the change in rangeland areas in the Arab Region during the period 2010-2017. Saudi Arabia includes the largest area of rangeland in the Arab countries with 146 million hectares, or 35.7% of the total Arab rangelands, while the total area of rangelands in Iraq, Sudan, Somalia, Algeria, and Morocco constitutes 49.3% of the total Arab rangelands (Figure 3).

Overall, rangeland surface remained unchanged during the 2010-2017 period in 16 countries, namely: Bahrain, Comoros, Djibouti, Jordan, Egypt, Emirates, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Qatar, Saudi Arabia, Somalia, and Yemen. It decreased in 4 countries, including, Algeria (1.3%), Sudan (41.5%), Syria (0.3%), and Tunisia (2.6%). Iraq and Palestine reported increase in the rangelands surface of 3.7% and 24.2% respectively.

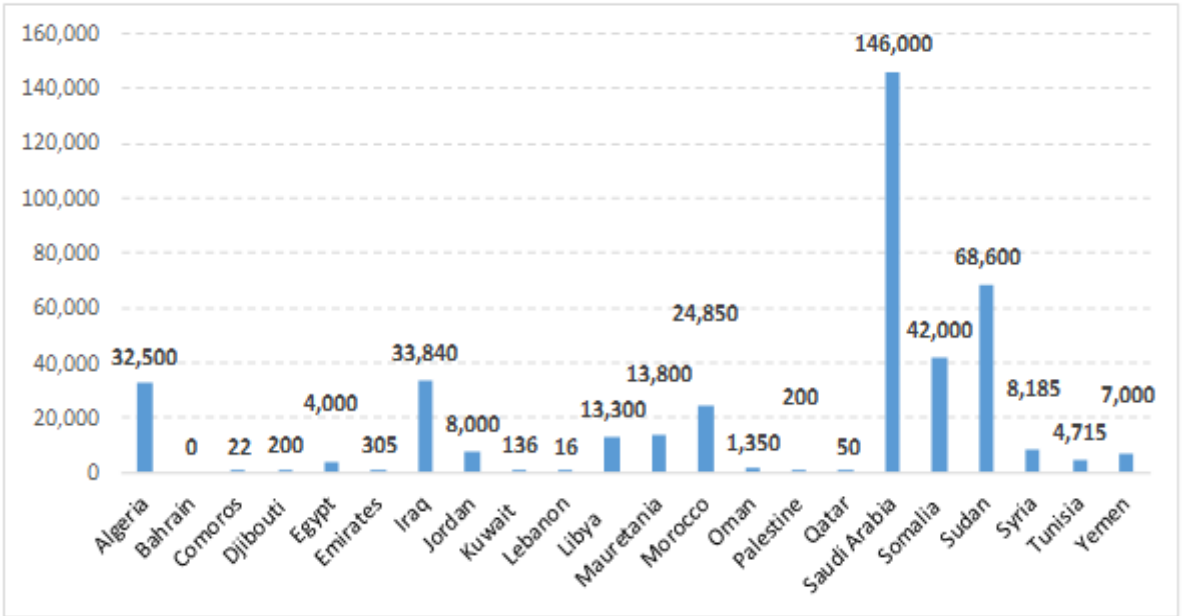
The total area recorded a decrease of 10.5 % (-47,928 million hectares) during the 2010-2017 period from 456,997 million hectares in 2010 to 409.069 million hectares in 2017, (Figures 3 and 4). This decrease has many explanations, which we summarize as follows:

- The separation of South-Sudan from the Republic of Sudan in 2011 caused a decrease in the rangeland area from 117.2 million hectares in 2010 to 68.6 million hectares after the separation. The decrease of 48.6 million hectares represents 41.5% of the total rangeland area in Sudan.
- The other changes are relatively minor (0.3-3.5%), and are mainly due to change in land use, among the croplands, forestlands and other land uses. This type of change has been rather substantial in Palestine also, where the change rate attained 24%.

Table 1. Rangelands area in the Arab countries during the 2010-2017 period (1000 hectares)

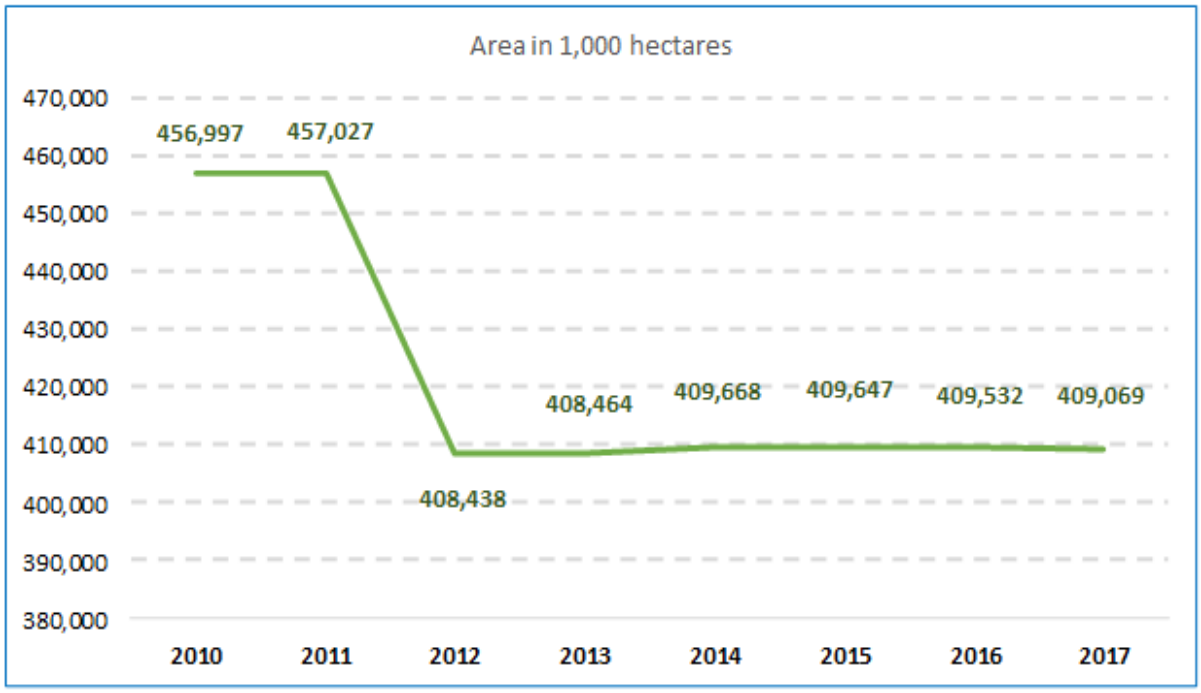
Country / Year	Rangeland Area in 1000 hectares							
	2010	2011	2012	2013	2014	2015	2016	2017
Algeria	32,938	32,942	32,943	32,969	32,966	32,969	32,911	32,500
Bahrain	0	0	0	0	0	0	0	0
Comoros	22	22	22	22	22	22	22	22
Djibouti	200	200	200	200	200	200	200	200
Egypt	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Emirates	305	305	305	305	305	305	305	305
Iraq	32,634	32,634	32,634	32,634	33,845	33,840	33,840	33,840
Jordan	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
Kuwait	136	136	136	136	136	136	136	136
Lebanon	16	16	16	16	16	16	16	16
Libya	13,300	13,300	13,300	13,300	13,300	13,300	13,300	13,300
Mauretania	13,800	13,800	13,800	13,800	13,800	13,800	13,800	13,800
Morocco	24,850	24,850	24,850	24,850	24,850	24,850	24,850	24,850
Oman	1,354	1,354	1,354	1,354	1,350	1,350	1,350	1,350
Palestine	161	200	200	200	200	200	200	200
Qatar	50	50	50	50	50	50	50	50
Saudi Arabia	146,000	146,000	146,000	146,000	146,000	146,000	146,000	146,000
Somalia	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000
Sudan	117,180	117,180	68,600	68,600	68,600	68,600	68,600	68,600
Syria	8,212	8,199	8,189	8,189	8,189	8,189	8,185	8,185
Tunisia	4,839	4,839	4,839	4,839	4,839	4,820	4,767.00	4,715
Yemen	7,000	7,000	7,000	7,000	7,000	7,000.00	7,000.00	7,000
Total	**456,997**	**457,027**	**408,438**	**408,464**	**409,668**	**409,647**	**409,532**	**409,069**

Source: (AOAD, 2019, MAFWO, 2020, Adar and Darfaoui, 2014)



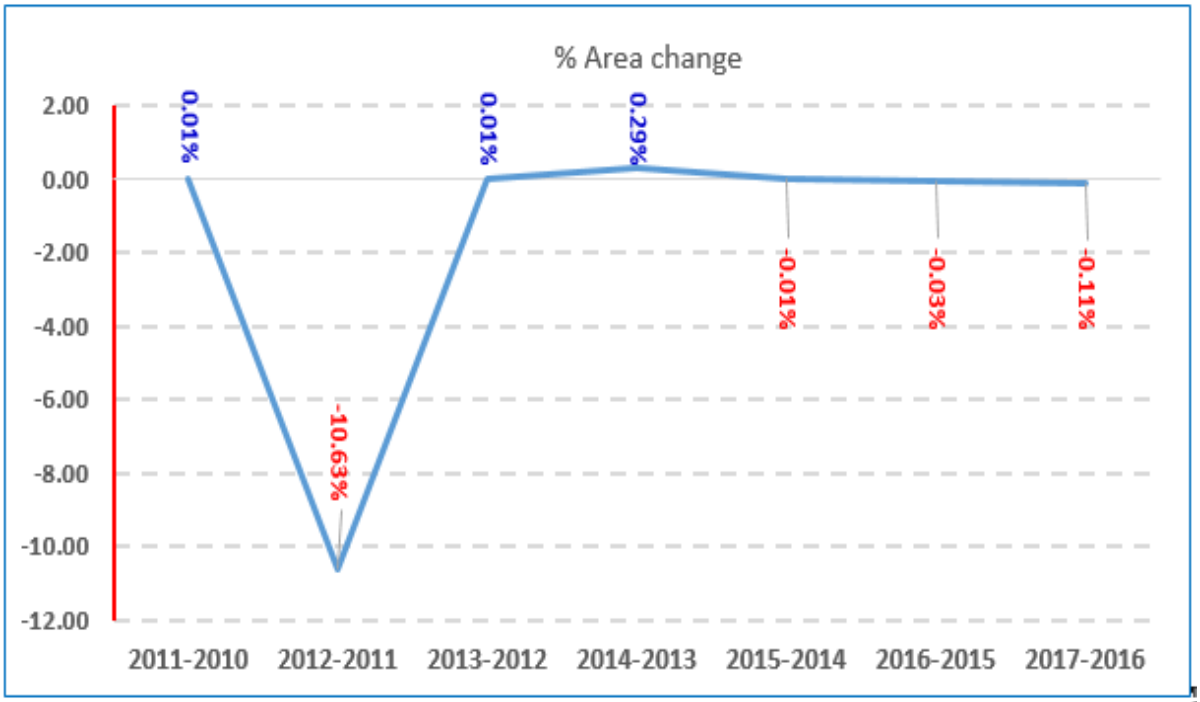
Source: (charted data from *AOAD, 2019, Adar and Darfaoui, 2014)*

Figure 2. Rangeland area in the Arab countries in 2017 (1,000 hectares)



Source: (charted data from *AOAD, 2019, Adar and Darfaoui, 2014)*

Figure 3. Total rangeland area in the Arab Region between 2010 and 2017



Source: (charted data from *AOAD, 2019, Adar and Darfaoui, 2014)*

Figure 4. Percent yearly change in rangeland area in the Arab Region (2010 – 2017)

1.1.4. Trend in grasslands cover and productivity

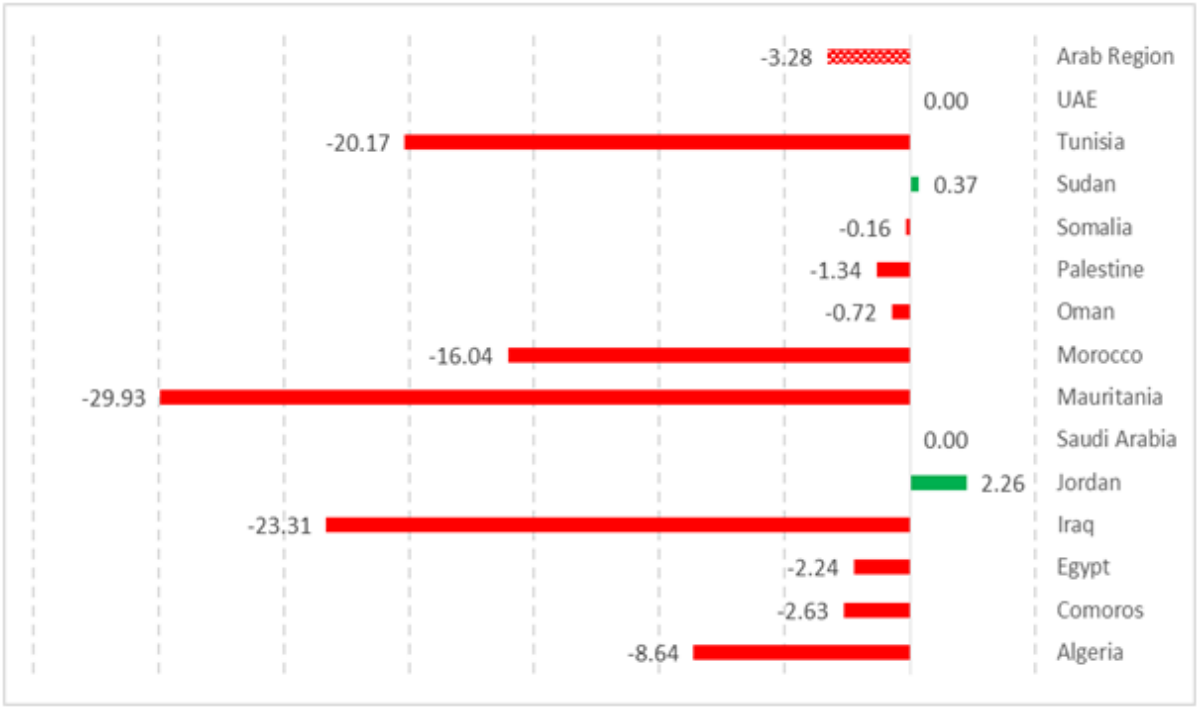
This assessment of the trend in grasslands' cover and productivity in the Arab region is based on the data reported in 2018 by 16 countries to the UNCCD's Performance Review and Assessment of Implementation System (PRAIS). The UNCCD called on all States parties to report on their efforts to achieve LDN targets, which correspond to the SDG 15.3 and to set voluntary targets to achieve this goal. By the end of April 2018, 152countries submitted their LDN reports, among which 16 Arab states: Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Tunisia, Emirates and Yemen.

In 2015, grasslands covered 28.9% of the total land area in the reporting countries. Regarding the other land cover categories in these countries, areas covered by trees areas occupied 1.5%, while croplands, wetlands, industrial areas and other lands covered 8.5, 0.2, 0.2 and 61.0% respectively. During the period 2000-2015, grasslands experienced a decline at a rate of 3.3%, which is comparable to that recorded in Africa (2.8%), Asia (3.0%) and the world (1.5%). The largest decreases occurred in Mauritania (30%), Iraq (23%), Tunisia (20%), Morocco (16%) and Algeria (9%). Areas covered by trees recorded an annual increase of 0.67%, which is considered positive when compared with 0,1% decrease recorded globally during the same period (Table 2 and Figure 5) (Darfaoui, 2019 and UNCCD, 2019).

Table 2. Grasslands area in Arab states and change during the 2000-2015 period

Country	Grasslands area (Km^2)		Change area	Change %
	2000	2015	2000-2015	2000-2015
Algeria	109,273	99,836	-9,437	**-8.6**
Comoros	228	222	-6	**-2.7**
Egypt	15,090	14,752	-338	**-2.3**
Iraq	19,085	14,636	-4,449	**-23.3**
Jordan	1,679	1,717	38	**2.3**
Saudi Arabia	1,700,000	1,700,000	0	**0.0**
Mauritania	160,602	112,530	-48,072	**-29.9**
Morocco	242,563	203,660	-38,903	**-16.0**
Oman	18,817	18,681	-136	**-0.7**
Palestine	1,194	1,178	-16	**-1.3**
Somalia	478,018	477,265	-753	**-0.2**
Sudan	409,862	411,385	1,523	**0.4**
Tunisia	17,631	14,075	-3,556	**-20.2**
UAE	430	430	0	**0.0**
Total	3,244,155	3,174,557	-69,598	**-3.3**
Change percent in Africa				**-2,8**
Change percent in Asia				**-3,0**
Change percent Globally				**-1,5**

Source: (Darfaoui, 2019 and UNCCD 2019)



Source : (Darfaoui, 2019)

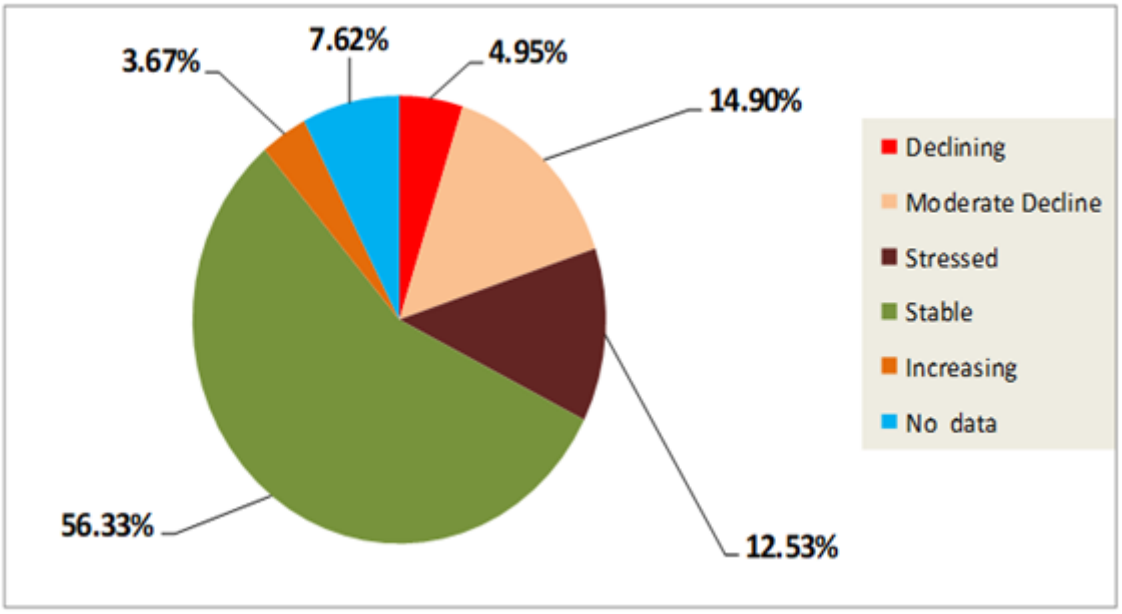
Figure 5. Percent change in Grassland in 13 Arab States during the 2000-2015 period

In terms of the trend in land productivity during 2000-2015, grasslands' productivity was mostly stable (62%) or declining (25%). Only a proportion of 4% of grasslands increased their productivity. In areas covered by trees, the trend in productivity is either strongly/moderately declining or under stress in about 66% of the lands. About 26% of these lands showed a stability in their productivity and only 8% had their productivity increase (Table 3 and Figure 6).

Table 3. Grassland productivity dynamics in 14 Arab states percent of total grassland area

Class country	Declining	Moderate Decline	Stressed	Stable	Increasing	No data	Period	D+M+Str
Algeria	2.1	0.9	1.5	77.9	11.4	6.3	2.1	**4.5**
Comoros	10.7	0.9	5.3	15.2	12.8	55.1	10.7	**16.9**
Egypt	0.1	0.2	0.1	0.8	0.0	98.8	0.1	**0.4**
Iraq	10.0	9.0	34.8	39.3	1.3	5.5	10.0	**53.8**
Jordan	4.3	8.2	6.5	63.3	0.7	16.9	4.3	**19.0**
Kuwait	3.9	9.8	2.0	17.6	0.0	66.7	3.9	**15.7**
Mauritania	2.2	3.8	2.8	89.1	0.0	2.0	2.2	**8.9**
Saudi Arabia	14.4	34.3	16.8	28.5	6.0	0.0	14.4	**65.5**
Morocco	4.9	44.6	1.6	37.8	8.3	2.8	4.9	**51.1**
Oman	7.9	6.3	7.4	30.7	0.0	47.7	7.9	**21.6**
Palestine	1.6	0.8	1.1	89.9	5.8	0.7	1.6	**3.5**
Somalia	0.4	3.2	18.2	69.3	0.7	8.2	0.4	**21.8**
Sudan	3.1	8.5	10.9	66.0	3.7	7.8	3.1	**22.5**
Tunisia	8.1	8.7	1.0	76.6	0.4	5.3	8.1	**17.8**
Total area	5.0	14.9	12.5	56.3	3.7	7.6	5.0	**32.4**

Source: Aggregation from Arab countries LDN (PRAIS) reports (UNCCD, 2018)



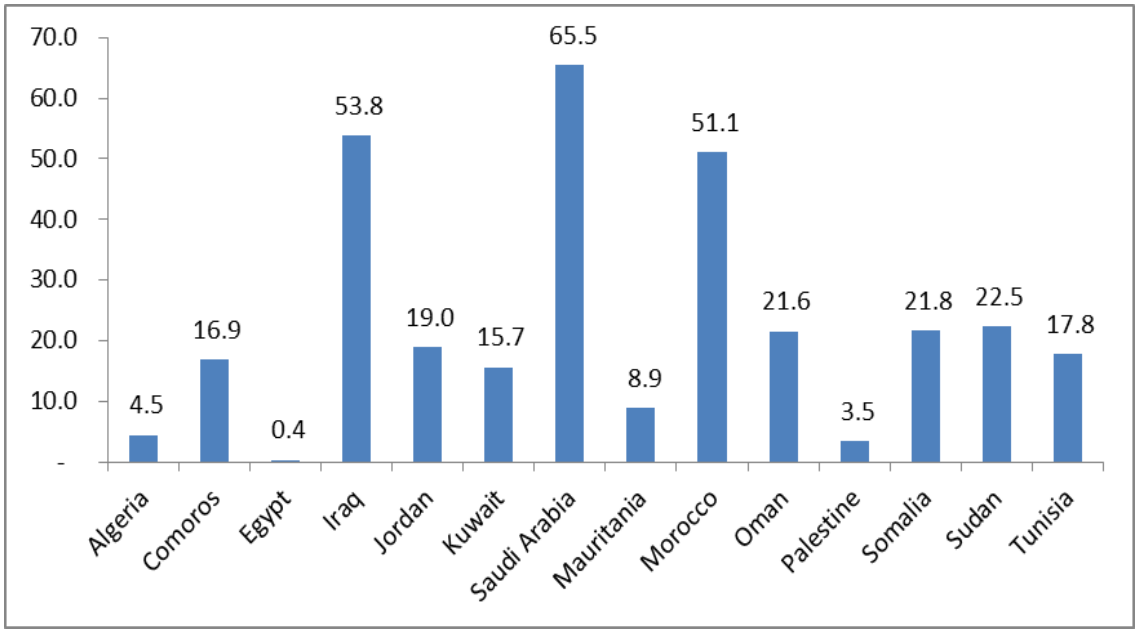
Source: Aggregation from Arab countries LDN (PRAIS) reports (UNCCD, 2018)

Figure 6. Trend in productivity of Grassland categories in 14 Arab states (% of countries)

1.1.5. SDG 15.3.1. Percentage of degraded land to total land area

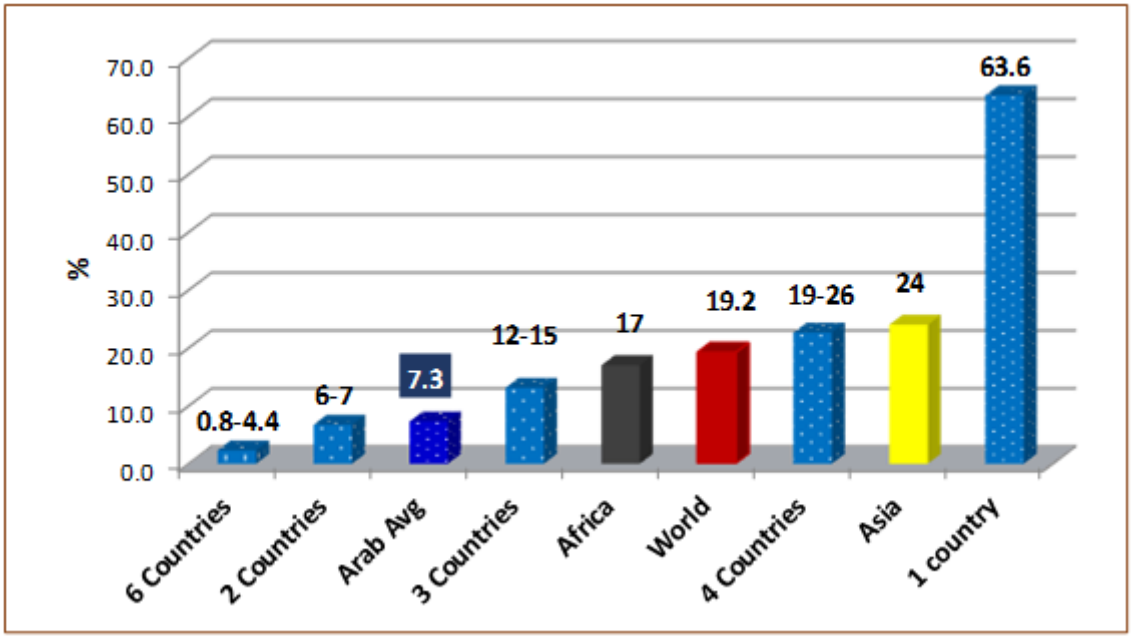
The proportion estimates of total degraded lands as proportion from the total land area, reported by Arab countries in 2015 was 7.7%. The highest proportion was recorded in Kuwait at 63.6 %, followed by Somalia 23%, Comoros 22 %, and Morocco 18.9 %. In addition, the lowest proportions of land degradation were recorded in Algeria (0.8%), Egypt (1.1 %), and Mauritania (2.9 %). (Figures 7 and 8).

The level of land degradation reported from 11 states of the Arab Region is in fact quite low when compared with the rate reported globally estimated at 19.2%, as well as with those reported in Africa (17%) and Asia (24%) regions. These data are too low and do not serve the interest of Arab states to obtain the international support needed in their fight against desertification and struggle to achieve LDN. The examination of the source and methods of these data generation and analysis showed that these sources and methods are not adapted to the Arab environments and need to be revaluated (Darfaoui, 2019).



Source: Aggregation from Arab countries LDN (PRAIS) reports (UNCCD, 2018)

Figure 7. Proportion of grasslands with productivity declining or stressed in Arab countries



Source: (Darfaoui, 2019)

Figure 8. Classes of land degradation in Arab Countries (SDG 15.3)

1.1.6. Causes of rangelands degradation in the Arab Region's LDN reports

The reasons behind land degradation and the changes in land cover and use reported are numerous. They are either direct causes, related to improper management, including; over-exploitation of land resources such as deforestation and overgrazing; non-environmentally friendly urban and industrial activities, resulting in the destruction of vegetal cover, erosion, pollution, and disruption of the water cycle. Alternatively, indirect causes related to the increase in population, wars, conflicts, and occupation, in addition to poverty and poor governance, all of which negatively affect land resources (Darfaoui, 2019 and Darfaoui, 2019a).

1.1.7. Arab rangelands' economic, social and environmental functions

In general, there is a lack of appreciation of the socioeconomic and environmental roles of rangelands in the Arab region. Rangelands are often neglected in the debate on regional priorities. Development authorities generally perceive food security from the agricultural perspective, which often misses the role of forests and rangelands in contributing to food security, the safeguard of ecosystem vitality and productivity, and their protective role against land degradation and climate change. Few countries have tried to assess the Total Economic Values (TEV) of forest & woodlands ecosystems and their contribution to Gross Domestic Product (GDP). Tunisia has conducted studies on the valuation of the TEV of the forest, rangelands resources and the cost of degradation of forests, other-wooded lands,

and rangelands ecosystems during the period 2012-2014. Similar efforts were carried out in Jordan with support from GIZ and IUCN (FAO, 2015) and in Morocco (World Bank, 2017).

1.1.8. Contribution of rangelands in the GDPs in Arab Countries

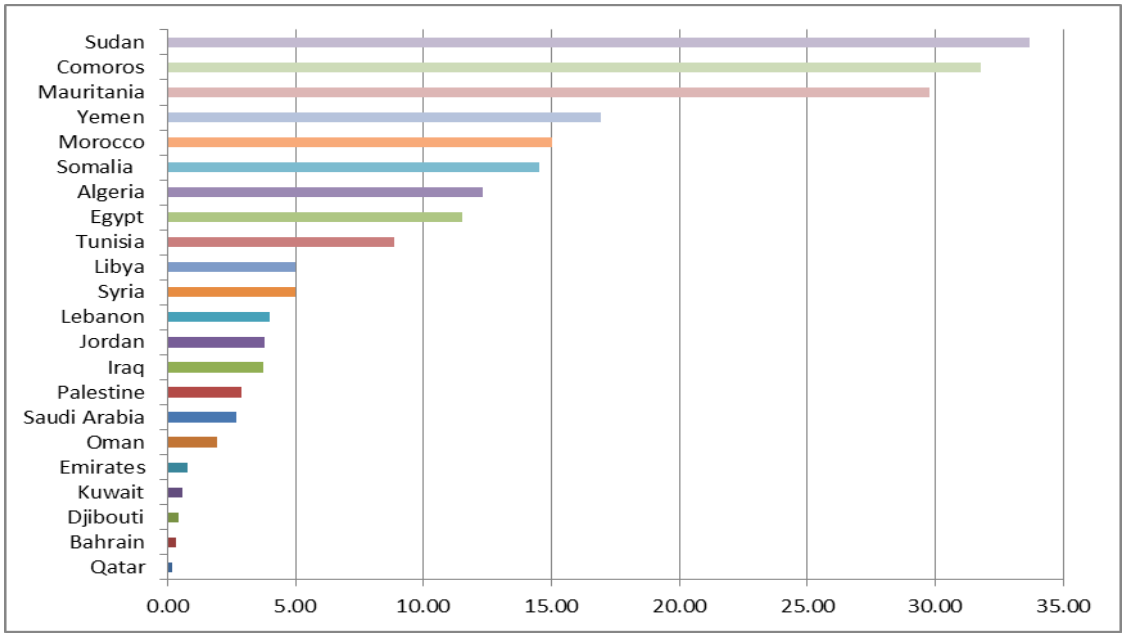
Generally, there is no accurate data available on rangeland's contribution to the GDP of the Arab region as a whole. Usually, the contribution of this sector is calculated as a part of the agricultural output. Table 4 shows the contribution of the agricultural sector to the GDP of the Arab countries.

The value of agricultural GDP differs from one country to the other. It is highest in Sudan with the contribution of the agricultural sector to GDP at 33.7%, followed by Comoros (31.8%), Mauritania (29.8%), Yemen (17.0%), Morocco (15.0%), Somalia (14.5%), Algeria (12.3%), while in Jordan, Tunisia, Egypt, Syria, Iraq, and Palestine, it ranges between 2.9 and 8.9%. The percentage decreases in the Gulf Cooperation Council (GCC) countries and Djibouti, as it ranges between 0.2% in Qatar and 2.7% in Saudi Arabia (Figure 9) (AOAD, 2018).

Table 4. Share of Agriculture in GDP in Arab countries 2014-2016

Country	Contribution of agricultural production in GDP %		
	2014	2015	2016
Algeria	10.30	11.81	12.30
Bahrain	0.28	0.31	0.33
Comoros	29.45	34.25	31.76
Djibouti	0.49	0.45	0.45
Egypt	11.09	11.32	11.54
Emirates	0.64	0.74	0.80
Iraq	4.69	3.82	3.76
Jordan	3.32	3.68	3.79
Kuwait	0.45	0.54	0.57
Lebanon	4.31	3.65	4.00
Libya	3.64	4.96	5.01
Mauritania	19.06	24.85	29.76
Morocco	11.65	14.78	15.00
Oman	1.29	1.58	1.93
Palestine	3.39	3.29	2.90
Qatar	0.12	0.16	0.18
Saudi Arabia	2.23	2.62	2.69
Somalia	14.52	14.52	14.52
Sudan	31.55	31.42	33.68
Syria	5.00	5.00	5.00
Tunisia	9.15	10.29	8.87
Yemen	10.58	12.19	16.95
Average	5.03	5.92	6.07

Source: (AOAD, 2018)



Source: (AOAD, 2018)

Figure 9. Share of Agricultural in GDP in Arab countries in 2016 (%)

FAO in a study conducted in 2011 in the Near East countries reported that the share of livestock in agricultural GDP was 26 % in morocco, 48 % in Algeria, 30% in Libya, and 33% in Syria (FAO, 2011).

1.1.9. Production functions of rangelands in the Arab region

Rangelands constitute an important renewable natural resource in the Arab Region. They are characterized by their large extent, diverse geological formations, diversity of terrain, and variable climates from one country to the other and within countries. This resulted in the presence a great variability in natural environments and diversity in the vegetation cover and composition, offering important and diverse environmental, economic, and social functions.

Generally, rangelands contribute around 15-35% to livestock's diet in most Arab environments. Trees and shrubs are also a good food source for ruminants, especially in dry seasons and before the rainy season, their contribution may reach up to 20% of livestock feed.

Furthermore, natural rangelands in the Arab world are an important source for medicinal and aromatic plants, provide protection and shelter for wildlife, and offer various products for herders and their animals such as firewood, building materials, food (honey and edible fruits), dyes, fibre, and ropes. In addition, rangeland represent important watersheds for water harvesting and landscapes for preserving the environment and biodiversity, and providing tourism and recreational activities (Al-Hajj, 2014).

In Sudan, the rangeland sector plays an important role in the national economy and food security. In 2014 they supported the livelihoods of about 14-20% of the rural population, and contributed 60% of the total agricultural output, and 20% of the GDP. During 2013, Sudanese rangelands provided 1,466 million tons of red meat, 4,359 million tons of milk, and 53.5 thousand pieces of leather, and a revenue value of the livestock exports estimated

at 620 million USD. The annual average contribution of livestock exports is about 24.6% of the total country's total exports.

In certain Sudanese states, such as in South Kordofan, livestock depends on rangelands as the main source contributing to 80% of their diet. In Sennar state, the local community mostly depends on rangelands products as food source provided by edible fruits of trees and shrubs, such as *Dactyloctenium aegyptium*, *Echinochloa colona, Sonchus oleraceus*, and others, especially during droughts and disasters. Furthermore, rangelands provide shelter for different types of wildlife in the state. (Alamin, 2014).

In Saudi Arabia rangelands are the source of fodder for a large number of livestock and wildlife, contributing about 20% to livestock feeding requirements and are the source of aromatic and medicinal plants, minerals, ecotourism and recreation, fuelwood and other products. Rangelands in Saudi Arabia constitute large watershed providing all the surface and ground water resources of the country (Adar and Darfaoui, 2015).

In Oman, The number of native and endemic plant species reaches about 1200 species; most of them are annual plants. Trees constitute only about 0.5% of the country's flora. Rangelands have many functions and provide divers services in Oman, the most important are (Ghawas Ahmad. 2014):

i. Forage for livestock, especially in Dhofar Mountains, (500,000 hectares), the main livestock grazing-source most of the year.

ii. Food products for people, such as edible fruits of *Ziziphus spina-christi* and *Ficus spp*. and others.

iii. Honey bees foraging resources,

iv. Shade and shelter for humans and wildlife.

v. Wood for construction purposes (barns, rural housing, tools, etc.).

vi. Aromatic and medicinal plants and products.

vii. Soil protection from water and wind erosion and groundwater aquifers' recharge.

viii. Traditional crop cultivation to produce cowpea, sorghum, cucumber, and other products

In Jordan, rangelands supplies about 25-30% of the annual nutritional needs of livestock. Furthermore, due to rangelands huge extent, they constitute the main watersheds capturing rainfall and groundwater recharge. In addition, they form important natural habitat for wild fauna and flora conservation and reproduction. Rangelands and their driven products are the main sources of income for livestock owners and pastoral society's livelihoods. The number of those depending on pastoral activities directly or indirectly is estimated at (185,000) people residing in 170 main locations (Alrashdan, 2014).

In Palestine, rangelands also provide a variety of products and services, including feed, food, wildlife habitat, shade and shelter, aromatic and medicinal plants, watersheds, minerals, etc. (Bani Oudah, 2015).

In Tunisia, in general, rangelands contribute to the total national livestock diet between 10% and 28%. They also provide a variety of products and services (Qhis, 2015).

In Yemen, in spite of the advanced degradation of rangelands, they still are important resources for the rural and transhumant populations to raise and feed their livestock at relatively low cost, especially when compared to other fodder sources. Furthermore, rangelands in Yemen are very important when considering their role in protecting the environment and preserving soils from water and wind erosion, recharging groundwater aquifers, an as important nectar source for honey bees, medicinal and aromatic plants and firewood. Moreover, rangelands are a good source for tourism, recreation and hiking activities (Almaqtari, 2014).

1.2. Constraints, threats and Trends

Rangelands in the Arab region face many constraints and threats that contribute to the deterioration of their condition, productivity and livelihood of pastoral communities. These threats are of environmental and socioeconomic nature (AOAD, 2006). Political instability, disputes, conflicts and displacements occurring in the region also increase the pressure and stress on ecosystems, affect land use, and cause land degradation (FAO, 2015a and Darfaoui, 2019). Numerous studies and reports highlighted the constraints and threats facing Arab rangelands and pastoral communities, which can be classified as follow (Figure 10) (AOAD, 2007).

1.2.1. Environmental constraints and threats

The hyper-aridity of the climate, which prevails in more than 80% of the Arab Region, produces a harsh environment, characterised by extreme temperatures (hot in summer, cold in the winter), strong winds, dust and sand storms, severe water deficit, frequent and long droughts, climate change and many other constraints and threats.

1.2.2. Socioeconomic and governance constraints and threats

- ***Increase in population***

The increasing population in the Arab region exceeded 2.6% per year, which generates an increasing pressure and threat to natural rangelands. This threat is a driver to an increase in the demand for animal products, which, in turn, increases the pressure on these resources and causes loss of resilience and degradation.

- ***Decreasing herders numbers***

Due to the hard labour involved in herding, low return and the social dynamics in the Arab region, the profession of herder is no longer desirable, which resulted in an increase in immigration rates from rural areas to cities. This situation prompted livestock owners in many countries, especially in Arab Gulf states and eastern countries, to use expatriate workers to herd their flocks. For example, more than 95% of herdsmen in Jordan are from Migrant workers. The percentages may be similar in most Arab Gulf states. This fact constitutes an important threat to pastoralism, leading to:

- Loss of local traditional knowledge in SRM and ways to deal with drought and uncertainty accumulated by pastoralists over centuries.

- Lack of experience and knowledge of the new expatriate herders, which increases pressure on natural pastures and ultimately cause their deterioration.

- ***Agricultural expansion***

The expansion of agriculture generally at the expense of the best natural rangelands reduces the rangelands production and productivity and increases the pressure on them. Although cultivated areas may produce fodder crops and crop residues that contribute in feeding for livestock, they still may have negative impact on the pastoral systems.

- ***Overgrazing and increasing livestock numbers***

Statistics indicate a steady increase in the number of livestock in the Arab region, which causes a threat to rangeland through overstocking, early grazing, and increases rangeland misuse and deterioration (AOAD, 2018).

Changing of livestock breeding regimes and the gradual shift to intensive breeding based on non-traditional fodder materials may sometimes lead to a major threat to the natural pastures, as this encourages uncontrolled transition to semi-stable patterns. In addition, some Arab countries suffer from non-controlled movement of livestock across borders between neighbouring countries, which increases the pressure and threat to natural pastures in those countries.

- ***Logging and fires***

Herders and local communities cut trees and shrubs for use as fuelwood, and livestock feed. The threat to trees and shrubs increases with increasing land cover degradation and during dry and winter (snowy) seasons. Furthermore, seasonal as well as human induced fires are a real threat to rangeland and can become uncontrolled and very damaging when they spread due to the environmental conditions such as high temperatures and windy conditions, and high occurrence of fire-prone species, or degraded forests. For example, in the western parts of Sudan, fires threaten thousands of hectares due to the thick vegetal cover as result of limited grazing due to lack of water sources.

- ***Rangelands Governance: tenure, policies, regulations and institutions***

Rangelands tenure differs in Arab countries. Government ownership is prevailing over rangelands in most countries. Nevertheless, in some Arab countries, there is private or tribal ownership. Sometimes, rangeland ownership may cause conflicts between tribes within the country, which poses a threat to rangelands. However, the greatest threat comes from the non-regulated anarchic common use of the collective pastoral resources.

The absence, weakness or obsoleteness of rangeland policies, plans and strategies, and regulations in many Arab countries has an impact on the state and sustainability of the rangelands resources. The weakness of the institutions poses a major threat to the rangelands, through insufficient resources and budget, inadequate capacity, in both numbers and skills, weak or absence of extension and awareness raising programs, lack of accurate data and marginalization of the sector and pastoral the communities.

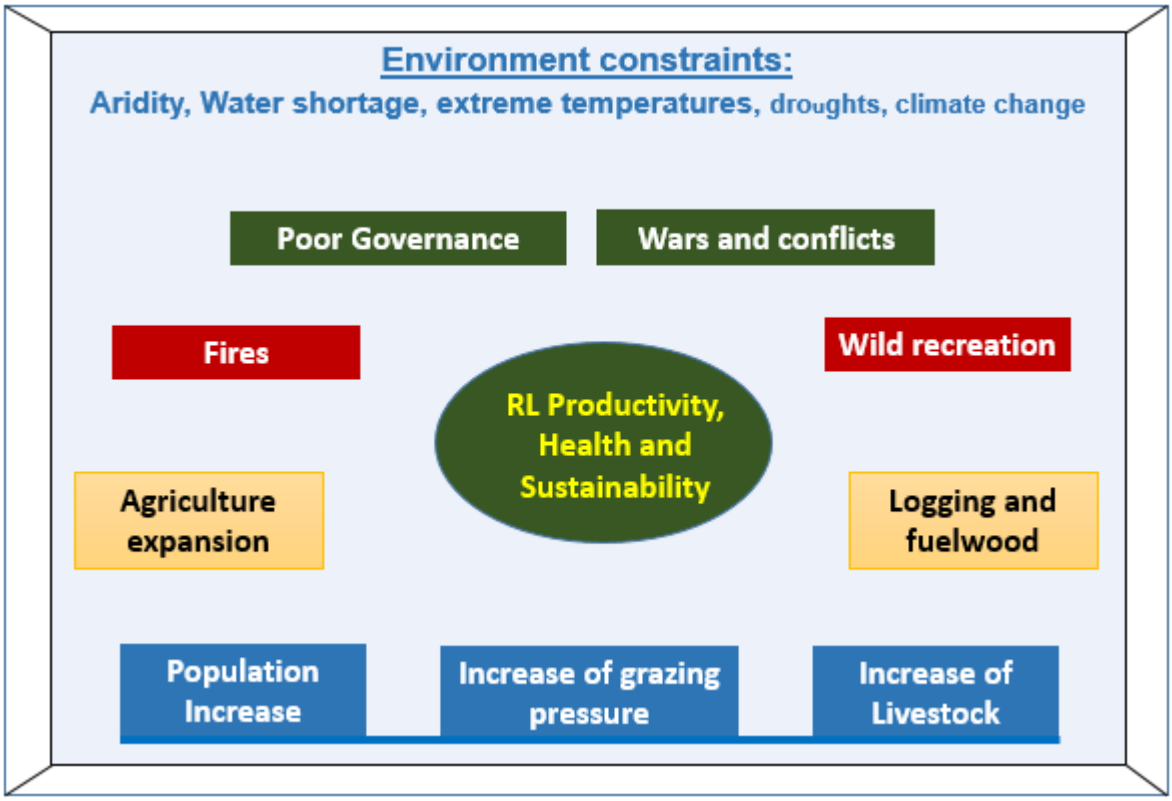


Figure 10. Constraints and threats to SRM in the Arab Region

II. RANGELANDS IN THE ARAB COUNTRIES' NDCS, LDN TARGET SETTING AND SDGs

2.1 Arab countries setting LDN targets

The UNCCD's first strategic plan, covering the 2008-2018 period, came to its term, without achieving its main objective of reversing the upward trend of land degradation and desertification. This situation led the United Nations General Assembly to include desertification / land degradation moratorium in the innovative sense of "neutralizing land degradation" among its 17 2030-Sustainable Development Goals (SDG). SDG 15.3 aims to "Combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world".

In 2015, the UNCCD endorsed the SDG 15.3 and the concept of neutralizing land degradation (UNCCD, 2017). It called on all States parties to report on their efforts to achieve LDN efforts and to set voluntary targets to achieve this goal. By the end of April 2020, 122 countries committed to setting LDN Targets, including 12 Arab countries, which are Algeria, Comoros, Egypt, Jordan, Lebanon, Mauritania, Morocco, Somalia, Sudan, Iraq, Kuwait and Tunisia (UNCCD, 2020). Rangelands, as resources, land use and as vast areas subject to degradation and desertification are directly concerned in this approach.

2.1.1 LDN Voluntary Goals

The Arab States, which have set voluntary targets to neutralize land degradation by the year 2030, are Algeria, Comoros, Egypt, Jordan, Lebanon, Mauritania, Morocco, Somalia, Sudan, Iraq, Kuwait and Syria. The Arab targets include land resources as a whole, but more especially rangelands, forests, croplands and wetlands. They concern conservation and restoration of degraded lands, and improving governance (institutions and regulation and community development and involvement). Table 5 summarizes the quantified targets related to rangelands reported by Arab countries.

Table 5. Summary of the quantified Arab voluntary LDN targets related to rangelands and forests

Country	Objectives	Target
Algeria	Water and soil conservation operations (Square km)	15,000
	Rangelands improvement (Square km)	20,000
	Increase tree cover (Square km)	4,750
Comoros	Increase tree cover (%)	50%
	Rehabilitation of degraded and abandoned lands (%)	20%
Egypt	Rangelands improvement (Square km)	8,000
	Increase tree cover (%)	25%
	Water and soil conservation operations (%)	25%
Jordan	Forest restoration (Square km)	50
	Rangelands improvement (Square km)	1,222.4
Kuwait	Reducing land degradation (%)	from 72 to 30%
Mauritania	Increase tree cover (%)	31%
	Stop forest conversion (%)	25%
	Stop forest degradation (%)	50%
Sudan	Rangelands improvement, increase productivity	by 2.5 ton/ha

Country	Objectives	Target
	Forest restoration (Square km)	5,100
	Rehabilitation of wetlands (Square km)	705
Tunisia	Increase vegetal cover (%)	from 8.2 to 9.2%
	Increase forest cover (%)	From 33 to 60%
	Rangelands improvement (%)	From 19 to 32%
Emirates	Conservation of drylands and wetlands (%)	12%
	Conservation of coastal and marine areas (%)	14%

Source: (Darfaoui, 2019a)

2.2 Rangelands in *Arab* Countries NDCs

With regard to climate change (CC), the Paris Agreement (PA) was a milestone achievement in the response of the international community to this challenge. The agreement was built on the first Nationally Determined Contributions (NDCs) submitted by Parties to the United Nations Framework Convention on Climate Change (UNFCCC) (UNFCCC, 2020). All the 22 Arab countries signed the agreement and 19 of them have ratified it as of April 2020. The countries, which are yet to ratify it, are Iraq, Libya and Yemen. Among the 22 Arab countries, 21 have communicated their first INDC, and only Libya has not done so yet.

Rangelands and forests are a source of Green House Gazes (GHGs) causing Climate change, but when well managed, they provide huge carbon sink potential, thus can make great contribution in climate change mitigation and in adaptation to its impact. Globally, Rangelands may store up to 30% of the world's soil carbon in addition to the considerable amount of aboveground carbon stored in the vegetal cover (Grace, et al., 2006). In view of the vast extent of rangelands and the degraded nature of large areas of these systems, the potential to sequester carbon through improved management is substantial. In terms of resilience, and despite an apparent fragility, Arab range and forest landscapes, have demonstrated, for several centuries, strong resilience to changes stemming from human activities. Nevertheless, climate change is expected to affect them heavily (FAO, 2018).

2.3 Role of rangelands *in CC* mitigation*/adaptation in the Arab countries*

Arab NDCs did not include quantified contributions of forests and rangelands in CC mitigation and the reduction of the GHG emissions. Instead they suggested plans and actions to intensify CO2 absorption capacities of rangelands and forests, through reforestation and restoration of pastoral lands. However, most of the planned actions were narrative, and only three NDCs included quantified planned actions to reduce emissions from forests and rangelands, including:

- Morocco: planting of about 50,000 hectares per year, with a focus on local species ,
- Palestine: Increase afforestation/reforestation by 200 ha per year.
- Sudan: Afforestation of 25% of the total area by 2030 (790,795 hectares per year).

Countries conditioned these actions by the provision of international support, including funds, capacity building and technology transfer.

The adaptation components of the Arab NDCs targeted rangelands, mainly their rehabilitation and sustainable management, in addition to boosting range livestock and livestock producers' resilience. The planned actions include; range rehabilitation/ improvement, creation of range reserves, rangeland resources sustainable management, infrastructure, improving animal feeding, health, and genetics, and strengthening research and extension, in addition to enabling environment to empower vulnerable communities and increase their resilience (Darfaoui, 2019a and FAO, 2019a). The following is an example of the quantitative targets provided in Arab countries NDCs:

Kuwait	**Reduce desertification rate from 75% to 51% to reduce dust storms**
	Increasing the percentage of protected areas from 8% to 18%
Mauritania	Restoration of 10,000 ha/year degraded lands
	300 surveys for aquifer exploration
	Realization of 2000 small solar drinking water supply networks in rural areas
Morocco	Reconstitution of forests on 200,000 ha
	Erosion control on 1.5 million ha over 20 years (75,000 ha / year)

NCDs provided information on the means of implementing their planned mitigation/adaptation actions, including; raising awareness, enhancing the local communities, capacity building, appropriate policies, institutions and regulations, enhancing research, monitoring and establishment of early warning systems, and leveraging sufficient funds.

2.4 Involvement *of range institutions in developing/implementing NDCs & LDN*

Rangelands are an essential component when addressing land degradation in the Arab region, as result of the importance of their extent, their socio-economic and environmental role and the pressures they undergo. Therefore, related institutions play a central role in the setting and implementation of LDN targets. They are also directly involved in the planning and implementation of actions to achieve the NDCs' targets in at least 10 Arab countries, with significant rangelands and forest resources.

2.5 Rangelands *and the SDGs*

The degradation of rangelands and forests in NENA countries and the drop in their productivity are bringing about low living standards, high poverty, malnutrition, conflict, and reduced resilience. The widening gap between production and consumption, exacerbated by population growth and shrinking resources, is leading to faster change in land use, degradation and deforestation (UNCCD, 2017b). In these conditions, rangelands development and sustainable management, and the empowerment of the pastoral communities and improvement of their livelihoods stand in the heart of the efforts to achieve the SDGs, especially SDG1 and SDG2 where pastoral communities are victim to poverty and hunger and their productive activities will contribute to zero those two factors. Pastoralists are also suffering from gender inequality and socioeconomic inequalities, and therefore are targeted in SDG5 and SDG10. It goes also without saying that SDG 15 (life on land) and SDG 13 (climate action) are directly affected by the rangelands' and forests' state and restoration. Their restoration and

sustainable management serve LDN targets, CC mitigation/adaptation efforts, biodiversity conservation and boosts resilience (Darfaoui, 2019a).

A number of 16 Arab states, among 144 globally, submitted their Voluntary National Reviews (VNR) of the efforts towards achieving the SDG during the 2016-2019 period. Rangelands and forestry issues were discussed mainly while reporting about SDG 15 and SDG 15 in the VNRs of Algeria, Mauritania, Tunisia, Jordan, Saudi Arabia and Sudan. Sudan also emphasized the role of rangelands, forests and livestock in SDGs 1, 9 and 12. Arab Golf countries, with the exception of Saudi Arabia, considered rangelands and forests in their VNRs from an environmental standpoint and stressed the role and efforts to restore mangroves. The SDGs related to the socioeconomic needs and livelihoods of pastoralists and forest communities were not isolated in the VNRs, but were targeted among the overall national populations (Darfaoui, 2019a).

III. REGIONAL AND GLOBAL POLICIES AND POLICY FRAMEWORKS SUPPORTING SRM AND LDN

3.1. RANGELANDS GOVERNANCE

Governance has decisive impact on rangelands' management, condition, products and services, and on the pastoral communities' livelihoods (Darfaoui, 2019 Herrera, Davies and Baena, 2014).

FAO defines governance as "the way in which society is managed and how the competing priorities and interests of different groups are reconciled. It includes the formal institutions of government as well as informal arrangements. Governance is concerned with the processes by which citizens participate in decision-making, how government is accountable to its citizens and how society obliges its members to observe its rules and laws." (FAO, 2007).

IUCN in its social policy program defined governance as "The norms, institutions and processes that determine how power and responsibilities are exercised, how decisions are taken and how citizens participate in the management of natural resources (Campese et al., 2016).

Pastoral governance systems, in the Arab region and in the world, have evolved throughout history and accumulated knowledge, practice and resilience. Traditional schemes, such as the Hima system known in most Arab countries in the east and Agdal in the Maghreb, are famous for their adaptation to the local socioeconomic and environmental conditions, and for their resilience. They allowed the pastoral societies to benefit from rangelands' goods and services and sustain the resource base. They also integrated strategies and practices that allowed coping with uncertainties, including droughts, and natural disasters. The admitted success to the traditional pastoral systems has been attributed to efficient ethnic inclusive institutions, well-adapted customary laws and efficient enforcement mechanisms, in addition to general awareness. Part of the traditional systems success can also attributed to the fact that resources were less degraded and therefore more abundant and that human population and livestock numbers were limited compared to the current situation. Natural events, such as droughts, fires and diseases were factors continuously adjusting the ecosystems' dynamic balance.

Deep changes in the governance of rangelands and the pastoral societies have been taking place during the last century, leading to the disruption of the traditional pastoral systems and establishment of new land tenure rules, new regulations and new institutions, which in most cases proved unsuitable and triggered land degradation, poverty, loss of biodiversity and decline in resilience.

Reviving the pastoral systems, restoring the adequate levels of goods and services provided by rangelands, and achieving SRM and LDN targets requires investing in land tenure reform, community-based range management, range restoration/improvement, monitoring, building strong rangelands database and information systems and investing in

mainstreaming rangelands issues with the national development agenda and global environmental policy processes.

Furthermore, achieving SRM and LDN requires adopting and implementing national and regional rangelands' strategies in consistency and harmony with the goals and programs of the other sectors' national strategies and with the regional and international conventions and agreements, especially the Rio convention, namely the UNCCD, the CBD and the UNFCCC, and with the UN SDGs.

There are also some well-agreed policies to adopt if the SRM and LDN targets are to be pursued effectively and efficiently by countries, and these are (Figure 11):

1. The sustainability concept (including the economic, social and environmental aspects).
2. The responsibility of the government in the Inventory, monitoring, conservation, management and restoration of rangelands, through direct action, incentives, research, extension, awareness, and capacity building.
3. Enabling pastoralists' control over their pastoral resources,
4. Empowering the pastoral communities and cooperatives, and building partnership relations with them and with the other stakeholders.
5. Producing and sharing knowledge and valuing local knowledge.
6. Adequate pastoral financing services,
7. Adequate incentives/subsidies favouring the SRM and LDN and not the opposite.

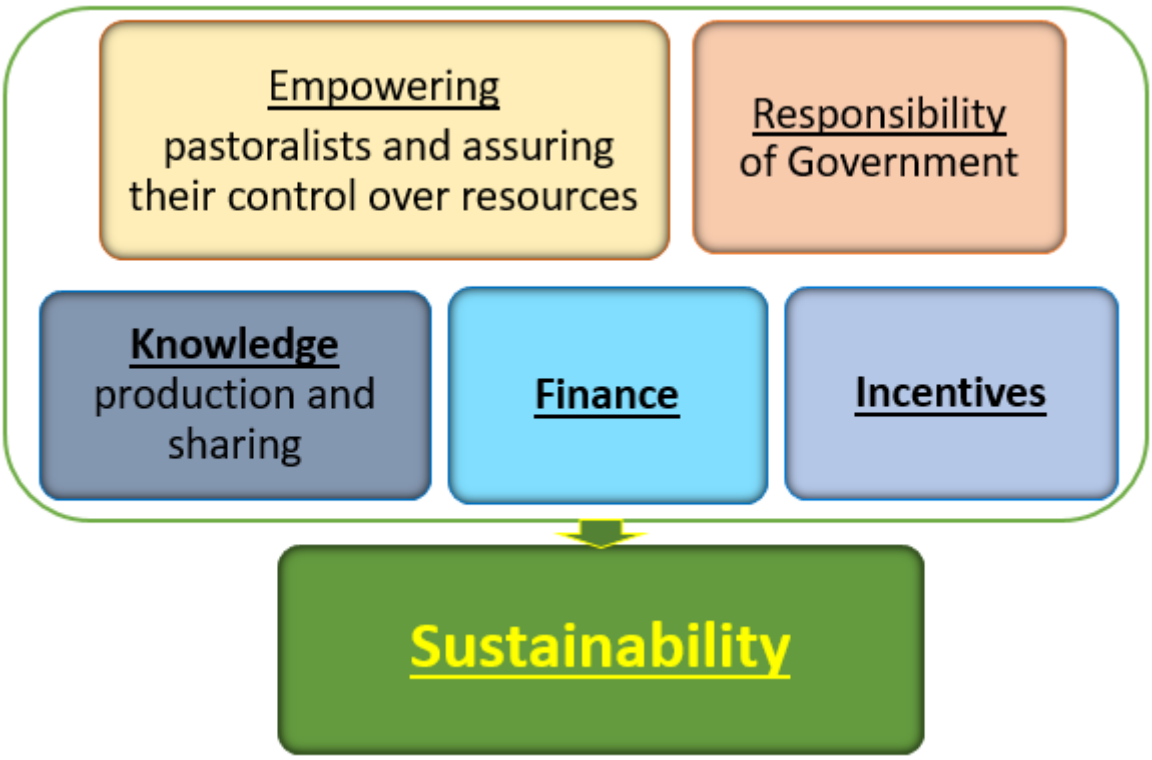


Figure 11. Some agreed principals and policies for achieving SRM and LDN targets

For the purpose of this review, we base our approach to governance of rangelands in the Arab Region and in the world on a series of factors, which affect significantly the ecological condition and sustainable management of rangelands and pastoralists. These are; land tenure, the institutional setup and capacity, regulations, incentives and their effects on resources management, stakeholder's participation and involvement of the private sector, customary and traditional values and practices, and funding. The objective is to perform a diagnosis of the current governance in the Arab Region and recommend ways of improvement to achieve SRM and LDN, in light of the world's experience and success stories.

3.1.1. *Rangeland* tenure

3.1.1.1. Rangeland tenure in Arab countries

Arab countries, in their legislation, define rangelands in broad terms, based on vegetal cover, usage as grazing lands and/or on the amount of rainfall they receive. Rangelands cover areas averaging 27.6% of the total landmass in the Arab world, and reaching up to 79% in Saudi Arabia, yet there is a general perception in the whole Arab Region that due to their low economic return, rangelands are a residual category of land, yet to been converted to other uses with higher productivity. This attitude translates into a dilemma in terms of rangelands governance in these countries, as rangeland users and pastoralists operate in the uncertainty and risk of losing their rights in favour of other uses considered more profitable.

Traditionally, rangelands in the Region were managed under tribal systems, where land belonged to tribes and ethnic groups, and where tribal institutions (leaders and councils) controlled territories, animal movement, range use and resolved users' conflicts. This status favoured sustainable management, conservation and sustained productivity under the prevailing environmental and socioeconomic conditions. With the development of the modern administrative systems, and disruption of the traditional ones, the tie between the land and its owners/users/managers disconnected and rangeland resources have been subject to collective open-access grazing, where everyone has the right as user, but has no obligations towards their maintenance, development or sustainability. This situation opened the door to overexploitation (overgrazing, excessive fuelwood removal), encroachment of other land uses on the best most productive pastures, especially agriculture, leading to grazing lands impoverishment, in addition to the expansion of wild urbanization and the quarrying and mining activities.

The change in land tenure, resulting in the pastoralists losing ownership of their land resources, led to lack of motivation for pastoralists and Bedouins to conserve and restore the rangelands and manage them in a sustainable manner (UNEP, 2017). This trend persists, even though some countries are working towards shifting to more community-based management systems (FAO, 2017).

In the traditional systems, and because of the land tenure allowing control of pastoralists over the rangeland and grazing agreements among communities, nomadic Bedouins grazed their livestock by moving between plains, mountains, valleys and other different geographic forms, benefiting from ecosystem diversity, apart from political borders, venturing even into the neighbouring countries. This was the case for pastoralists from Jordan, Syria, Iraq, Saudi Arabia and Yemen, and in the Maghreb countries (UNEP, 2017 and MOAJ, 2014). This

mobility, on large areas and on a variety of ecosystems and resource diversity, allowed providing adequate quantity and quality forage for livestock, and at the same time, allowing periods of rest for pastures for natural regeneration. The discontinuity of the transboundary livestock mobility and the change to a more sedentary grazing regime has put extra stress on the land, livestock and on the Bedouins as well (Davies et al., 2018).

Most governments in the Arab countries view state owned and communal pastoral lands as state property, while the pastoral communities consider them their territory. Poorly defined tenure rights often lead to conflicts and equity issues. They also constitute an impediment to sustainable management and development efforts. The success of SRM depends greatly on the extent to which pastoral communities are granted full control over access and use of the resources and on the assurance of benefiting from pastoral improvements.

Currently, authors describe six rangeland tenures in the Arab states:

1- State owned lands with recognized rights for tribes and ethnic groups, as is the case in Algeria (Yazid, 2013) and Jordan (MOAJ, 2014),
2- State owned lands with NO recognized rights for tribes and ethnic groups, as is the case in Saudi Arabia (Adar and Darfaoui, 2015),
3- Collective lands owned by local communities/ethnic groups, but under the tutelage of the government (Ministry of interior), such as in Morocco (Naggar, 2018) and Tunisia (Qhiss, 2015).
4- Private rangelands, in general of limited extent, owned by individuals, companies or religious institutions, such as "*waqf"* lands originally donated on permanent basis by Muslims for public usage. Where *Waqf* rangelands exists, they are managed either by designated custodians or by the government. The Saudi Awqaf Properties Investment Fund (2020) defines the Arabic word Waqf (or Wakf, with plural Awqaf or Awkaf) as "assets that are donated, bequeathed, or purchased for being held in perpetual trust for general or specific charitable causes that are socially beneficial". In many ways, the concept of waqf is similar to the Western concept of endowment. The strong emphasis placed on the perpetuity of awqaf has led, over the years, to a considerable accumulation of societal wealth, such that awqaf has become an important economic sector dedicated to the improvement of the socio-economic welfare in many Countries (APIF, 2020).
5- Rangelands under the forest regime in Algeria (Yazid, 2013), Morocco (Naggar, 2018) and Tunisia (Qhiss, 2015).
6- Lands registered in the name of some government institutions, namely Armed Forces, big mining companies, such as oil companies, as is the case in Jordan (MOAJ, 2014) and Saudi Arabia (Adar and Darfaoui, 2015).

In the absence of delineation of collective lands, common ownership is unable to withstand individual styles of behaviour marked by the private appropriation of land, clearing and conversion to agricultural land.

Table 6 shows the land tenure categories, their extent, proportion and the managing institutions in Tunisia.

Table 6. Land tenure categories, their legal frame and management institutions in Tunisia

Land tenure	Area and ratio			Managing institutions
	Legal frame	Area (ha)	%	
Collective	Subject to forest law	600,000	11	Management councils under the supervision of forestry GD.
	Not Subject to forest law	2,086,000	36	Management Councils and development groups
Public		114,000	2	Public sector
Private		1,200,000	21	Private sector
Forests, including pasture reserves and alfa steppes	Subject to forest law	1,752,000	30	Forestry services
Total		**5,752,000**	**100**	

Source: (Qhiss, 2015)

In Jordan, the state legally owns all uncultivated or building-free land, including pastoral areas. Land ownership in the Badia of Jordan includes, (i) privately owned land, (ii) state owned land /Treasury of the Hashemite Kingdom of Jordan, and (iii) lands registered in the name of some government institutions, and Jordan Armed Forces. Secured tenure rights in Jordon are related to registered use rights granted by the state (Miri) and private property rights (Molk). Holders of these freehold property rights have full control over their land resources. Although, rangelands are government property, Bedouins consider them tribal domain with full rights of use by the tribes' communities. This creates land use conflicts and results in mismanagement of the natural resources causing overgrazing and degradation (MOAJ, 2014 and UNEP, 2017)

In Morocco, collective rangelands remain subject to old legislation enacted in evolved socio-politico-economic environments, and suffering from many gaps and inadequacies, jeopardizing the resource sustainability. This situation causes several constraints:

- the absence of secured boundaries recognized by all parties, creating conflicts between the neighbouring communities, thus constituting an obstacle to planning and SRM;
- the existence of ambiguities as to the concept user rights and the collective land management legal bodies, creating increasing pressure on pastoral resources;
- the pre-eminence of supervision, often favouring political management to the sustainable management of the pastoral resources ;

In Yemen, rangeland ownership differs from one region to another as result of the interaction among geographical, social and administrative factors. In mountain areas, pastoral lands adjacent to agricultural terraces are private property of the individuals or groups owning the agricultural land, and as we move away from agricultural lands, rangelands belong to individuals, villages or tribes, and only limited areas are waqf or state owned (AbdeNasser, 2014).

Sudan has taken several initiatives to develop the pastoral sector and overcome the land tenure difficulties, including embarking in ranching operations, sedentarisation of nomadic pastoralists. The Ghazala ranch, for instance, established in western Sudan as early as 1958,

is one of the first initiatives, designed to develop the pastoral sector. The project was established on an 80 square miles area, and was provided with the necessary skilled staff, infrastructure and resources. However, although Ghazala ranch achieved some positive results in cattle raising and range improvements, the project failed to sustain itself and ended with the foreign funding, as result of failure to include local communities and resources' scarcity (Fadlallah et al., 2018*).*

The land rights of settled farmers are recognized in most countries since they are resident on their farms; the rights of pastoral groups, however, who are usually mobile, are less well defined since they only use a piece of grassland at a particular season. If others clear such grassland for crops, however unsustainable, it may be considered as "development" and pastoralists are at a risk of losing their rights. In addition, traditional pastoral tenure is not usually strong enough to prevent confiscation by the state, probably without compensation, for mineral prospecting, infrastructure, building or nature reserves. While cropland can conveniently be allocated to individual smallholders, the large areas of low-yielding grassland involved in mobile herding and the desirability of managing such pasture at the landscape scale make the allocation of grassland to individual families problematic (although such allocation has been done in China and in other countries). Allocation to groups seems preferable, but at what scale and to whom grazing should be allocated is problematic (FAO, 2019).

Private ownership of rangelands exists in limited number of countries. Access to these private rangelands by other users is governed by contractual arrangements between the landowners and the users. Even though land ownership is well defined in this case, private rangelands also show clear signs of degradation due to overuse (FAO, 2017a).

Security of tenure and security of access to resources is required to enable sustainable resource management, sound business planning, conservation of biological diversity and achieving LDN target. The right to security of tenure should be balanced by a responsibility for ecologically sustainable management of the resource and by safeguards for its ultimate protection and secure access (ANZECC and ARMCANZ, 1999).

Overcoming the disadvantages of open-access systems require the adoption of collective actions for SRM in most if not in all Arab Countries. Examples of such actions may include; (i) rangeland cooperatives, given control over the resources, operating in specific geographical locations or domains claimed tribal "grazing domain/rights", (ii) traditional Hima management systems in which land and key resources are designated for conservation and sustainable management by local communities, in line with tribal traditions. Also (iii) concession/leasing operating systems in which land is granted to tribes/fractions for a period of time (25-99 years) that would allow for better management of pastoral resources within the frame of contracts defining the beneficiaries rights and obligation, and environmental safeguards (FAO, 2017a).

3.1.1.2. Rangeland tenure globally

The typical objective of land policy is to ensure its equitable and secure access (Molden, 2007). Land policies set the framework for land allocation and land use planning, and set rules for management, investment in land, including commercial tenure and sovereign investment (FAO, 2004). Secure tenure of rangeland or grazing rights is essential for

livestock producers and pastoralists to have secure livelihoods and to be able to invest in rangeland and manage them sustainably.

Even as herd mobility is recognized as a necessary strategy and despite the environmental and economic rationale of pastoral mobility, the constraints on movement are manifold (Behnke et al., 1993; Niamir-Fuller, 1999). Not only is there an absence of supporting legal frameworks for mobility, such as mechanisms for regulating transhumance, but also prevailing attitudes are stacked against mobility. Some policy makers maintain that pastoralists need to settle in order to benefit from services and that it is too difficult to deliver services to mobile pastoralists. In this way, administrative exigency can lead to the adoption of policies that curtail mobility and instead support pastoralists' sedentarisation (UNDP 2003).

In Africa, much like in the Arab Region, herd mobility is a key strategy of livestock producers to benefit from environmental heterogeneity and assure sustainable management of rangeland resources. The preservation of herd mobility requires the legal recognition of existing customary tenure arrangements, especially those that provide for the intermittent or seasonal use of a wide variety of ecological resources (Behnke, 1992).

Secure tenure of land or grazing rights is essential if stock-raisers and pastoralists are to have secure livelihoods and can invest in and manage grassland in a sustainable fashion. Where grassland production systems are purely commercial, as in Central North America, South Africa, Patagonia, and the Campos, the land is held in either freehold or long-term leasehold. Therefore, commercial stock raisers can invest in infrastructure, notably water and fencing to delimit and secure the properties. Since commercial enterprises hold valid land titles, their land can be used as collateral for loans (FAO, 2019).

Ranchers in the USA maintain production within differing configurations of rangeland control and ownership (Fairfax et al, 2005). They rely on access to large areas of land, often with tenuous property rights through leases and permits (Huntsinger et al., 2010). However, even when rangelands are private property held individually, and the right to benefit seems straightforward, the emphasis for a pastoralist goes to maintaining the ability to benefit despite regulatory, market, environmental, social and political relations that might seek to constrain such ability. When the rancher owns the land, income sufficient to support the property is critical to maintain access to the resource and to reduce rangeland conversion to other uses (Huntsinger et al., 2014).

In Australia, rangelands are State owned, and the Land tenure in the rangelands is predominantly pastoral leasehold, with leases issued under the Land Administration Act 1997. The State, through the Pastoral Lands Board (PLB), leases large tracts of land known as 'stations' (equivalent to 'ranches') to individuals or pastoral companies, for a duration varying from 18 to 99 years (Williams, 2014). Persons or companies leasing the station have complete rights to the grazing of the pastoral lease. A permit from the PLB is required for any non-pastoral use carried out on a pastoral lease. The Department of Agriculture and Food, Western Australia (DAFWA), provides rangeland monitoring and pastoral lease inspection services, to insure SRM and prevent active land degradation. Agreements among leaseholders are of practice in Australia to allow for seasonal livestock mobility, thus contribute to assure achieving SRM and LDN targets (DPIRD. 2020).

Kenya adopted the Social Tenure Domain Model (STDM) as part of the "Rangelands Initiative Africa", a framework, which recognises that secure tenure builds confidence among the resource users, and therefore promotes confidence in investment at different levels; small-scale, large-scale, urban and rural investors who all benefit from security of tenure (Liniger and Studer, 2019).

Management systems based on allocating communal rights of access, management and control is a viable alternative, more suitable for rangelands. However, those systems need to ensure the security of tenure and access to resources by their legitimate users (Herrera, Davies and Baena, 2014).

3.1.1.3. Achievements and recommendations related to land tenure

Arab rangelands, characterized by harsh environments, extensive livestock breeding and mobile pastoralism have been, and for many remain, the main activity capable of assuring the production of rangelands' goods and services, sustaining livelihoods and avoiding land degradation and desertification. Support and security of such management systems and way of life, through appropriate land policies, is a pledge of sustainable development, stability and peace in the Arab Region's communities.

In many Arab countries, rangelands are state owned and tribes and ethnic groups are deprived of any right on their lands or pastoral resources. This renders pastoral resources "Mochaa" open to all, in a real "tragedy of the common". Such situation is generating a continuous resource degradation process and is hindering any efforts to restore and sustainably manage pastoral resources.

In addition, the perception in the whole Arab Region that rangelands are residual category of land, yet to been converted to other uses with higher productivity, needs to be revaluated if SRM goals are to achieve.

When examining the existing rangelands governance systems, it is clear that the ones based on collective management by rangelands' users, such as rangelands cooperatives, the Agdal and the Hima systems, are promising options to achieve the SRM goals. This is more so when they are well capacitated, properly designed through participative transparent systems, and promoted by robust policies, regulations and structured purpose-oriented incentives (FAO, 2017).

In Jordan, the piloted initiative for reviving the traditional Hima system has made significant success in rangelands management through securing rights and access to rangeland resources, improving governance of land and natural resources, enhancing income generation and promoting active engagement of women (FAO, 2017).

In Morocco, collective lands owned by local communities/ethnic groups, under the tutelage of the government, offer better tenure than situations in countries where the land is totally state owned, with no rights recognised or secured for tribes/ethnic groups. Community-based management developed in Morocco through numerous integrated rural development projects, on collective lands achieved positive results; however, more institutionalized legal

secure rights for pastoralists and their cooperatives remain a necessity for the approach to be successful.

Regarding the Hima and Agdal systems, known in the entire Arab Region, although their virtues are widely recognized as a traditional appropriate system for SRM, and some countries are working towards reinstating them, some countries see in Hima a threat to their social network and a means of reviving tribal animosities.

Despite the established benefits of cross-border mobility, pastoralists face many restrictions in crossing international borders. Physical barriers prevent transboundary mobility of livestock for several reasons, including citizenship, preventing the spread of livestock disease, managing insecurity, challenges in accessing public services and others. Several mechanisms can be considered to improve transboundary movements such as bilateral and multilateral treaties and agreements on transhumance, regional mechanisms, national legislation and subnational arrangements, and non-binding agreements in the absence of legal arrangements (Davies et al., 2018).

3.1.2. Institutional setup and capacity

Traditionally, rangelands in the NENA Region were managed under tribal systems where tribal leaders controlled territories, animal movement, range use and resolved conflicts between user groups. With the introduction of the modern government administrative systems, governments abolished the traditional systems and put the rangelands under collective open-access grazing (FAO, 2017a). They substituted tribal institutions by government administrations and traditional laws (Orf) by modern regulations.

3.1.2.1. Regional Administrative institutions

Rangelands fall under the responsibility of many state institutions in the Arab Countries, most of them under the Ministries of Agriculture and few under the Forestry and Environment departments. In several countries, more than one institution operate in rangelands management and development of livestock, including Algeria, Tunisia and Morocco, this is more so when forest rangelands are managed under the forest system, while non-forest pasture lands fall under different management regimes. Other ministries are also involved in the administration of rangelands and pastoral communities', such as the ministries of interior, the ministries of equipment, the ministry of planning, and the ministries in charge of the social services.

At the regional level, AOAD and ACSAD, the two sister organisations under the umbrella of the League of Arab States, play a role in coordinating and guiding rangelands management and research in the Arab States. The Arab Rangeland Network, created in 2014 by AOAD is also starting to play a coordination and cooperation role. FAO, CGIAR, IUCN, IFAD, UNDP, UNEP all provide assistance development and research at national and regional levels, in addition to their global assistance.

However, because rangelands are sometimes not the top priority for any single ministry or organization, they sometimes fall between the gaps between institutions, receiving below average investment and poorly designed policies (UNEP, 2017).

In addition to central departments in charge of rangelands management, and livestock development other national and/or local governmental institutions are involved in specific activities, such as research, extension, teaching and capacity building, monitoring, early warning and supplying inputs.

Among the innovations in the Arab institutional setup, Sudan has created Conflict Resolution Centres (CRC) along the transhumance tracks. CRCs work to resolve conflicts related to pastoral and forest resources, farming, water, or land holding. The CRCs operate through various approaches including; mediation, arbitration, negotiation, peace and confidence building and archiving (Khatir, 2014).

Committees or councils, composed of the various government institutions involved in communal rangelands and pastoral affairs management have been created in certain countries, including, Algeria, Morocco, Palestine and Tunisia. Representatives of the pastoralists, Agriculture Chambers, professional unions, NGOs and other stakeholders are generally the members of such committees/Councils. Their role is that of coordinating and building partnerships.

However, many weaknesses are reported in the administrative set up in charge of rangelands and pastoralism in the Arab Countries, both at the central and local levels (Figure 12). These include:

- Severe shortages in technical staff specialized in rangelands management disciplines. Central as well as local institutions in some countries do not count more than few specialised engineers among their staff. This is the case of countries like Egypt, Oman or Saudi Arabia, where rangelands may cover millions of hectares.
- Low staff skills and a huge need for capacity building;
- inadequate human resources management and weak governance;
- Lack of coordination among the relevant institutions and bodies;
- insufficient funding;
- insufficient equipment;
- low awareness of government officials in the various departments concerned, about the importance of rangelands and the needs of their users;
- lack of a national rangeland development strategies and action plans in certain countries to guide the administrative institutions work;
- Insufficient interest in technical and social research and studies in the fields of rangelands.

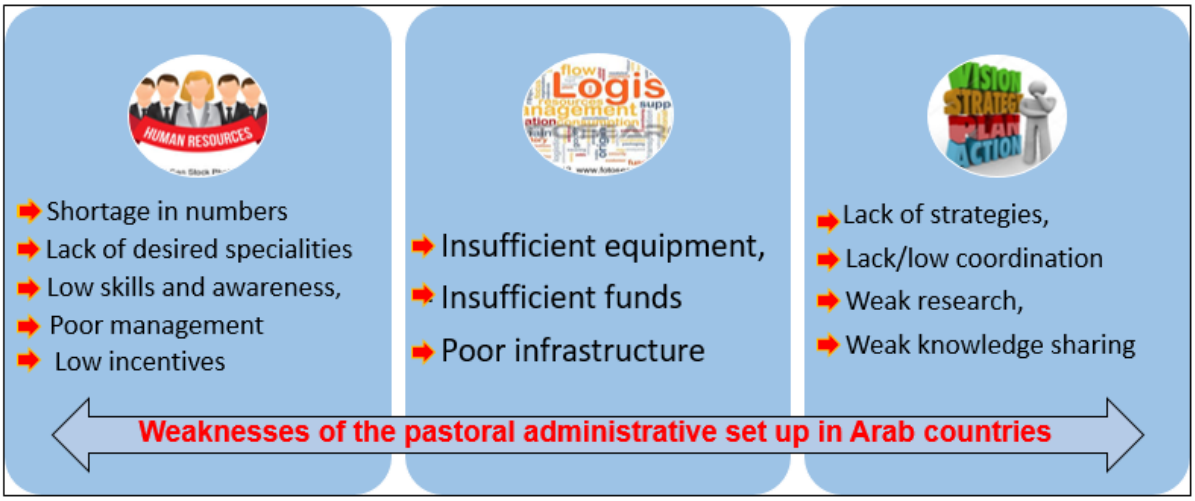


Figure 12. Weaknesses of the range administrative institutions in the Arab countries

These shortages need to be addressed, while consolidation the strengths, which are represented by the existence of the institutions and existence of a nucleus of skilled actors within these institutions capable of leading the change and strengthening the capacity and infrastructure. The interest by the regional organization, including, AOAD, ACSAD, IUCN, FAO, UNEP, ICARDA, and others are also a strength to be put into advantage of the region and its countries.

3.1.2.2. Rangelands administrative institutions Globally

Just like in Arab countries, rangelands fall under the responsibility of many state institutions worldwide. Most of these institutions are under the ministries of Agriculture, few of them under the Forestry, and under environment departments. In several countries more than one institution operate in rangelands management and livestock development sector.

In African Botswana, Land Boards, which fall under the Ministry of Land and Housing, are one of the four government bodies, together with district administration, local councils and tribal administration. Land Boards are composed of twelve community members selected or elected. The Land Boards have sole authority over land; they work closely with other local authorities and relevant departments. Land Boards wholly administrate, govern and allocate Tribal land (Adams and White, 2003).

In the United States of America, the United States Forest Service (USFS) and the Bureau of Land Management (BLM) manage rangelands. Most of the low land arid ranges are under the jurisdiction of the BLM, with the dual objective of conservation and sustainable use of timber, forage and mineral resources. Sedentary ranchers and sheep producers were given precedence in the allocation of allotments on these lands. Both USFS and BLM lands are managed in the public interest, including for recreation, and wildlife habitats. Other institutions are also involved in US rangelands management supervision, such as the US Fish and Wildlife Service, state land departments and game and fish departments (Huntsinger et al., 2014).

In Australia, rangelands fall under the responsibility of two ministerial councils: the Australian and New Zealand Environment and Conservation Council (ANZECC), and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ).

The Councils jointly established collaborative mechanisms and working groups to develop and implement the national framework for managing Australia's rangelands and the National Principles and Guidelines for Rangeland Management. The Commonwealth Government has recently established the Natural Heritage Trust to provide funds and encouragement for a more rapid and effective shift to ecological sustainability in Australia. The Natural Heritage Trust lays the foundation for a co-operative effort between Commonwealth, State and Territory Governments, local government, regional and community groups, and individual landholders and managers for ecologically sustainable management. The Trust, and the range of initiatives it will support, are based on the recognition that an integrated approach is needed across the spectrum of environment and production objectives to achieve long term and durable outcomes from investments made by communities, governments and land managers (ANZECC and ARMCANZ. 1999) .

The literature reviewed above showed the existence at the global level of a variety of experiences of administrative and sometimes elected institutional structures and bodies, which tend to govern rangelands and the pastoral livestock system. These experiences have various strengths related to the practice and to the accumulated experiences and skills. However, many also suffer from constraints such as lack of coordination among institutions, insufficient funding, and low awareness on the economic, social and environmental importance of rangelands.

3.1.2.3. Recommendations for rangelands administrative institutions

The multiplicity of the governmental institution in the Arab countries requires coordination mechanisms to accomplish synergy in the action and achieve the common SRM and LDN targets. Collaborative councils and committees now exist in few countries, but such committees/councils lack in the majority of Arab states. Regional and international organisation, such as FAO, IUCN and AOAD have recommended creating such coordination mechanisms and reinforcing existing ones (AOAD, 2015).

Furthermore, Arab countries are to take action to reinforce their administrative institutions in charge of rangelands and pastoralism, by addressing the very many reported weaknesses, through well-planned, decentralised, deconcentrated and transparent governance. In addition, setting medium and long-term strategies and action plans, and strengthening the institutions via reinforced capacity to overcome the shortage in skilled staff, both at the central as well as at the local levels. To achieve this goal it is a necessity to focus on education, recruitment criteria and procedures, training and good human resources management. In addition, Arab countries need to allocate sufficient funding to the pastoral sector, and to raise awareness of government officials and the various stakeholders about the importance of rangelands and the precariousness of the pastoral societies. Engaging in active partnership with local communities, pastoralists' professional and socioeconomic organization and with all the stakeholders and addressing gender issues, will further strengthen the rangelands institutional governance in the Arab countries and in the region as a whole.

3.1.3. Pastoralist's institutions and Community-based management

3.1.3.1. Community based management in the Arab Region

Depriving pastoralists' traditional institutions of the control over their rangeland resources, and failure of the new substituting administrative institutions and regulations to replace the traditional rules and institutions and the weakness of the administrative law enforcement mechanisms, resulted in resources abuse and anarchic shifts in land use, causing land degradation, livelihoods' deterioration and exacerbation of conflicts over resources. In addition to these constraints, pastoral communities have been facing other challenges represented by growth in populations, shrinking in productive lands and their productivity, loss of biodiversity, widening of the food security gaps, shortage in social services coverage (health, education, energy and water supplies) and climate change impact.

Since their independence, in the beginning of the second half of the last century, Arab governments provided limited attention to the rural areas and communities, in general, and to rangelands and pastoral communities in particular. Their interventions to develop rangelands and pastoral communities were shy, on limited scale, and focused on technical approaches, privileging ecological and technological solutions, in a total oversight of the socioeconomic and community-based solutions. These approaches made limited impact, and rangelands resources and livelihoods continued their decline.

To overcome this shortage, many Arab countries tried to enhance the decision-making setting of pastoral institutions to balance between the rights and roles of traditional pastoral communities and those of the state and its institutions, but not without difficulties. In most cases, policy and institutional reforms further weakened pastoral institutions. Tidiane and his colleagues reported that countries adopted three main approaches (2002):

i. The first approach consisted of creating cooperatives providing membership to pastoralists, in the absence of legal empowerment frameworks. In this case, traditional institutions continued informally to manage range resources, despite the fact that they had no legal rights over these resources. Such actions led to conflicts and hindered development efforts.

ii. The second approach consisted on strengthening customary tribal claims, on limited territories. Pastoral-communities used traditional mechanisms and rules to manage the resources. This framework did not address intercommunity access options and hindered herd mobility.

iii. The third option is privatization with titling, tried mainly in Morocco and Tunisia. Privatization resulted in individualization of tribal collective land, which destroys traditional access-options that serve as a safety net for pastoralists' mobility.

Starting from the 1990s, the implementation, in several Arab countries (Syria, Morocco, Tunisia, Jordan, Syria) of a new generation of integrated rural development projects, in collaboration with international organizations and funds, namely IFAD, ADB, IUCN, UNDP adopted new approach, consisting in reviving/updating the traditional institutions in the modern form of Ethno-Lineage Based Cooperatives (ELBC). The new approach allowed the achievement of a certain degree of success in re-establishing the control of the pastoral communities on their rangeland's resources. It allowed the participation of pastoralists in the management processes, and in the establishment of fruitful partnerships among government administrators, pastoral communities, and the remaining stakeholders. These

innovations in community-based rangeland management, embodied by the ELBC, have become a keystone in the Moroccan, Syrian and Jordanian approaches for achieving SRM. Hundreds of ethno-lineage cooperatives are currently active throughout countries in the Arab Region (Boutaleb and Fermian, 2014; FAO, 2016; Fayad, 2016; Qhiss, 2016; Snaibi, 2018; UNEP, 2017).

Ethnic affiliation and belonging to the local community are the basis for the adherence to the new cooperatives/associations. The approach does not seek to settle herders, but rather promotes their mobility through innovative flexible management systems. Tribal institutions receive recognition into pastoral management cooperatives and participate directly in the decision making process.

The new cooperatives allowed boosting the communities' management capacities and provided pastoralists with a certain power, making of them reliable partners of the government bodies in making management decisions and implementing development strategies and programs.

Community-based rangeland management (CBRM), as described above, and with provision of control on the resources, were the means of reviving the Hima and Agdal traditional rangeland management systems in the Mashreq and the Maghreb countries respectively. The revival of these traditional schemes, which have proved their efficiency and resilience gave encouraging results and proved promising management options for application where appropriate (Dominguez, 2014; Al-Kayed. 2016).

The reviving of the Hima system at the Bani Hashem villages in Jordan provides an example how empowering local communities enables them to protect and sustainably manage their rangeland resources, which reflects positively on their socioeconomic status. Establishing the Hima Bani- Hashem Cooperative, providing it with control over the Hima, and revival of the tribal law in the form of a "code of conduct" recognized by the local authorities, empowered the community and created the conditions for SRM (FAO, 2016; Haddad, 2014 and Al-Kayed. 2016).

In addition to being partners in decision making for the governmental planning, development and management bodies, ELBC play divers roles and perform multiple tasks, including:

(i) ensuring assistance in management decision enforcements, such as opening, closure and respect of grazing reserves, and improved pastures,
(ii) supplying community members with livestock feed, veterinary vaccines and medicines,
(iii) managing pastoral infrastructure, such as water points,
(iv) managing their staff and their finance,
(v) organizing trainings, meetings, and helping in extension and awareness activities,
(vi) Sub-contracting tasks for the government in favour of its members,
(vii) In few cases sub-contracting range improvement tasks.

Nevertheless, the success and sustainability of the CBRM in the form of Ethno-lineage Cooperatives remains tributary of empowering these cooperatives to own the control over natural resources, which requires secure legal and community framework to establish those

rights. Many countries are making efforts to adapt/strengthen traditional land tenure rights to fit this approach of community based range management, including for the Hima system in Jordan and Lebanon, and Agdals in Morocco (UNEP, 2017; Boutaleb and Fermian and Dominguez, 2014).

Recent assessments have shown some challenges facing ELBC, which can affect their structure and functions and even their durability (Snaibi, 2018), these challenges include;

- loss of adherents' homogeneity, and divergent interests and priorities of cooperative members;
- differences and disputes among ethnic fractions, within the cooperatives;
- inappropriate cooperatives' sizes affecting social cohesion and performance;
- financial and capacity constraints;
- weak control over the rangelands resources, which need to be strengthened by laws and policy decisions.

3.1.3.2. Community based management globally

At the global scale, various schemes have been adopted and choices made in different countries, depending on their socioeconomic, environmental and cultural backgrounds. In most cases, these schemes and choices consisted on adopting new pastoral land tenure options, regulations and institutional setups on the remaining of the abandoned traditional ones. After decades of mostly unsuccessful attempts resulting in decline in productivity, rangelands degradation and deterioration in pastoral livelihoods, countries either privatized rangelands or adopted some sort of community-based rangelands management. Even in countries where ranching is dominant, CBRM was adopted as solution for overcoming common challenges faced by ranchers and for allowing livestock mobility to benefit from ecosystem diversity.

For instance, there are two major Community-Based Conservation Organisations (CBCO) operating in Africa (Northern Rangelands Trust, Kenya and Namibian Association of Community Based Natural Resource Management Support Organisations). These institutional arrangements aim at enhancing human social well-being and sustaining biodiversity. CBCO institutions are often composed of non-governmental organisations (NGOs), private individuals, and layers of government that represent, facilitate, or at least support local communities in conservation governance and resource management. This offers incentives to manage sustainably the natural resources, including rangelands, resulting in benefits in form of high incomes and profitability, wildlife conservation and preservation of biodiversity, ecosystem maintenance, soil and water conservation and more profitable ecotourism. Few constraints, however, were reported, such as lack of adherence to, and enforcement of, grazing rules, which limits the success of sustainable land management efforts, and generates conflicts between livestock and wildlife (Liniger and Studer, 2019).

In Mongolia, local pasture user organizations and herders' groups play a critical role in implementing community-based rangelands management projects. The aim of such projects, some of which supplemented by international funds, has been to facilitate the formation of hundreds of these associations, to develop capacity to establish participatory plans and to sign contracts on rangeland utilization with local government agencies. The

contract system being the keystone in linking the legal, policy and institutional framework for the management of rangelands at the local level. These associations allow herders to participate in decision-making, promote SRM and address diverse aspects of livestock management through building relationships among herders and with other stakeholders (Brouri, 2014).

In Spain, the land use rights moved from local farming communities to the environmental administration. This later was more interested in restoration and fire control than in preserving traditional land uses, notably pastoralism. The perception of livestock as negative agent in conservation led the environment administration to ban their activity in the most valued protected areas, as consequence to this policy, and due to loss of governance control and lack of capacity of local populations to manage their own lands, large areas in Spain were abandoned and depopulated. The environmental consequences of this decline in rural activity led to ecosystem degradation and loss of biodiversity (Prévosto et al., 2006).

Among the community based land management initiatives, it is worth mentioning the ICCAs (Indigenous and Community Conserved Areas). ICCAs are defined as "natural and/or modified ecosystems containing significant bio - diversity values and ecological services, voluntarily conserved by (sedentary and mobile) indigenous and local communities, through customary laws or other effective means" (Corrigan and Granziera, 2013).

ICCAs have three characteristics:

- Strong relationship between the local community and the specific site (territory, ecosystem).
- The indigenous people or local community is the major player in decision-making and implementation regarding the management of the site,
- The communities' management decisions and efforts lead to the conservation of biodiversity and ecological functions/ benefits and associated cultural values.

ICCAs by this meaning are community based management organization, which can play important role in SRM, and they can contribute significantly in improving rangelands governance towards increasing rangelands' productivity and improving their rendered services and livelihoods, and of course conserve biodiversity and ecological functions/ benefits and associated cultural values. ICCAs protect an enormous range of natural environments, species and agricultural and pastoral landscapes, managed through a wide diversity of institutions and rules by traditional and modern communities alike. Current estimates indicate that some 11% of the world's forests are under community ownership or administration (Khotary, 2006 and Corrigan and Granziera, 2013).

3.1.3.3. Community based management approach recommendations

Based on this review, it is possible to conclude that CBRM approach proved to be a promising management framework to strengthen SRM, achieve LDN targets and boost the resilience of pastoralists' livelihoods. ELBC accomplished great deal of success, and deserve scaling up in the Arab Region, with their adaptation to various countries' socioeconomic, political and cultural environments. Continuous empowering and tuning of these CBRM

institutions is however, required to assure their success. Continuous monitoring-evaluation-improvement of ELBC is also a necessity at this stage.

The success and sustainability of the CBRM in the form of ELBC, however requires empowering these institutions to own the control over natural resources, which requires secure legal and community framework to establish those rights.

Additional efforts are also necessary to overcome the challenges faced by the ongoing experience of ELBC, including loss of homogeneity of cooperative adherents; disputes among ethnic-fractions within the cooperatives; adoption of the appropriate cooperative size to conserve social cohesion and assure performance.

Furthermore, the success of the CBRM requires strengthening of the cooperatives planning, implementation and monitoring capacity, and human and financial resources. The success of the CBRM is also tributary of pastoralists' institutions empowerment and involvement as a full partner in the SRM planning and decision making, and in the national political representability and the developmental prioritization processes.

3.1.4. Rangeland regulations and their enforcement

3.1.4.1. Rangeland regulations in Arab countries

Rangeland regulations ensure the proper distribution and enforcement of rights and responsibilities related to SRM. They may aid in securing pastoralists rights on their resources and guarantee their participation and their institutions in rangelands resources management, planning and decision-making. They may also prohibit certain conduct, provide for sanctions, and offer a reliable basis for action in the face of political, socioeconomic and environmental changes.

In the Arab countries, we are currently witnessing the coexistence of a multitude of rules and procedures, pertaining to different legitimacies: positive law, customary law, religious law playing more or less a role in the arbitration of conflicts. In addition, current efforts by civil society, community organizations, projects and development associations are trying to support the development of local rules for access to resources and management of sylvopastorale areas (Naggar, 2018).

Arab countries vary in their adoption to rangelands legislations that provide the basis for use, regulation, protection, management, and sustainability of these resources. A limited number of countries adopted separate national rangelands regulations, the majority rely on regulations included in other sectors' laws, such as forestry, agriculture, environment and others. The countries that have adopted specific rangelands' regulation are Iraq, Mauritania, Morocco, Palestine, Saudi Arabia and Sudan. For this matter, Table 7 reflects the situation of the adoption of range management regulations by most Arab states.

Table 7. Rangelands regulations in the Arab Countries

Country	Current status
Algeria	**Decree No. 75-43 of June 17, 1975** including rangelands law
Bahrain	**No legislation** on rangelands is available in the country
Comoros	**Decree No. 66-617 of May 11, 1966,** includes some articles regulating grazing rights
Djibouti	**Decree No. 2013-110 / PR / DFAIT,** establishing the National Mechanism for Early Warning and Response to Pastoral and Urban Conflicts (CEWERU)
Egypt	**Law No. 5 of 1996** sets some rights for the use of desert land, other ways, there are no legislation in the country regulating rangeland management,
Iraq	**Royal Decree No. 8/2003** and its bylaws issued by Ministerial Resolution No. 12/2005A on pastoral lands and livestock management.
Jordan	**Agriculture Law No. (13), of 2015** and its amendments in 2016**;** Article 36; Instructions No. Z/45 of 2016 set rules for improving, developing, preserving and utilizing rangeland.
Kuwait	**No legislation** on rangelands is available in the country
Lebanon	Law No.444 of 2002 on environmental protection, which includes rules for integrated sustainable management of terrestrial natural resources and their valuation as economic resources, and reducing soil degradation and erosion and combating desertification.
Libya	**Law No. 5 of 1982** regarding the protection of grasslands and forests
Mauritania	**Law N ° 2000-044** on the pastoral charter in Mauritania
Morocco	**Law 113.13 of May 2016** on the transhumance and restoration and management of rangelands and forest pastures, In addition to 4 executive bylaws issued between 2017 and 2018.
Oman	**Royal Decree No. 8/2003** and its executive regulations issued by Ministerial decree No. 12/2005 is the Law for pastoral lands and animal wealth management
Palestine	**Decision of the Council of Ministers No. (381) of 2005** regulating the protection and development of rangelands
Qatar	**No legislation** on rangelands is available in the country
Saudi Arabia	**Range and Forest Law No 22/M of 1978 and its update in 2005**
Somalia	**Law No. 15 of 1969** on Fauna (Hunting) and Forest Conservation, includes some. Chapter II, Article 60 concern grazing and grazing reserves.
Sudan	**2015- Act (Law) of 4 March 2015,** on rangelands' management and development of fodder resources
Syria	**Law 26 of 2006**, on Beyda lands considered state property, including some regulation concerning rangelands and the pastoral cooperatives' management, in addition to forest law of 1953 and updates 1962 and 1969
Tunisia	**Law No. 63-17 on agricultural development of 27 May 1963** includes regulation applying to rangelands, other ways, but there is no legislation specific to rangeland management in the country.
UAE	**No legislation** on rangelands is available in the country
Yemen	**Environmental law 29-1995 i**ncludes some rules aiming at the conservation and the sustainable management of natural resources. However, there is no legislation in the country regulating rangeland management.

Source: (FAO, 2020a)

In Jordan, the earlier agriculture laws No 20 of 1973 and No 44 of 2002 defined rangelands as "the lands registered as such or any other state-owned lands, where annual rainfall is below 200 mm and that do not have sustainable irrigation, or lands confined for public use".

This definition, based mainly on rainfall potential is overlooking all the other ecological, social, economic and usage criteria (MOAJ, 2001). Both Agriculture Laws of 1973 and 2002 attributed ownership of rangelands to State's Treasury, which was the real manager of these estates, along with the Department of Land and Survey. The Ministry of Agriculture was mandated for the management of rangelands, but had no authority upon them, which resulted in the spread of quarries and deterioration of rangelands. Furthermore, these laws did not provide for the sustainable management of tribal lands by the Ministry of Agriculture (UNEP, 2017).

The newest law No 13 of 2015 has given more attention to rangelands, by prohibiting their transfer or the change in their use, and allowing their leasing to livestock producers and pastoralists cooperatives. This law also enforced rangelands resources and infrastructure's conservation, and sustainable management by allowing for reprimands for damaging Badia's vegetal cover, soil or infrastructure and for violating the rested grazing reserves and improved pastures. The Law No 13/2015 also permits the Minister of Agriculture to empower a number of employees of the Ministry as judicial police to assure law enforcement (Shawbaki, 2015).

In Mauritania, The Law No 044/2000 on the pastoral charter in Mauritania reserves collective rangelands exclusively for pastoralism activities and rendered them inalienable and imprescriptible. This law preserves the pastoral mobility under all circumstances, except for safety reasons. It also prohibits any development projects that could impair the vital interests of pastoralists, or seriously limits their access to pastoral resources (MDRE, 2000).

Furthermore, the Law No 044/2000 imposes the elaboration of regional development plans and provides for the reinforcement and management of pastoral infrastructure. It defines Pastoral organizations as groups of pastoralists who mainly derive their income from transhumant livestock and have the objective of promoting pastoralism. The Article 31 stipulates that the opinion of pastoral and agricultural organizations is required for the development of national, departmental, municipal land use planning relating to the organization of rangelands (MDRE, 2000).

In Morocco, pastoral legislation distinguishes between forest pastures and rangelands outside forests. Forest laws govern pasturelands comprised in the forest domain, in particular the 1917's law and the 1921, 1946, 1976 and 2002 bylaws. Collective rangelands outside forests are subject to the 1917's decree, which confers their ownership to the local ethnic communities under the tutelage of the Ministry of Interior. Collective rangelands' management went through several phases under the Agricultural Investment Code of 1969, the Law 33/94 on rainfed lands (1994), and finally the 2016's 113-13 law on the transhumance and development of rangelands and forest pastures (MAPM, 2016).

The Law 33/94 and its four bylaws outlined the methodology for preparing and implementing development projects in rainfed areas, including rangelands, with an emphasis on the need to involve beneficiaries and professional associations/cooperatives in all stages of management/development work. The Law 113-13 created the National and local Committees for Rangelands Management; as consultative bodies on all matters related

to SRM, including planning, legislation, organization of herd mobility and rangeland use, strengthening pastoral cooperatives, early warning, etc.… In addition, the Law 113-13 regulates the creation of pastoral perimeters and pastoral actions, including development; the practice of transhumance, grazing reserves; grazing permits and their attribution conditions; pastoral infrastructure management, particularly by professional organizations; disaster management and subsidies (MAPM, 2016).

Saudi Arabia, promulgated its first "Rangeland and Forest Law" by the Royal Decree (22/AD) in 1978 and updated it in 2005, along with its executive regulations. The violations control procedures were issued in 2008. This law put ownership of tribal range and forestlands within the state's properties, and prohibited the transfer of their ownership to other entities or individuals. It set conditions for establishing reserves and improved pastures and their exploitation. It also gave competencies and responsibilities to the Ministry of Agriculture to supervise the conservation and development of rangelands and forests, in collaboration with the other concerned authorities. It sets penalties for damaging vegetation, soil and infrastructure and for grazing in closed rested pastures. This law also established local enforcement committees (MOAS, 2005).

In 2019, the Kingdom of Saudi Arabia drafted new comprehensive environmental regulations, which cover rangelands and forests under the articles assigned to the vegetal cover. These regulations are currently in the adoption process pipeline. The novelty in these regulations is in the possibility to lease suitable rangelands for grazing and ecotourism purposes to investors and associations/cooperatives. The leases are for periods up to 25 years, with contracts, clarifying the rights and responsibilities of both the state and the contractor, especially with regard to resources' conservation and sustainable management. This measure may help the rangelands in Saudi Arabia to escape the real tragedy of the common; since the tribal entities and existing cooperative have zero control on rangeland resources and severe resource abuse and land degradation are occurring, while restoration/improvement and the appropriate scale are halted (MEWA, 2019).

In Sudan, the **"**2015- Act on rangelands' management and the development of fodder resources" classifies rangelands in four categories: collective rangelands, collective reserves (Hima), private reserves and improved pastures. The law designates the authorities in charge of managing rangelands and defines their tasks and duties in the fields of SRM, development and determination and collect of fees for the use of collective improved pastures. The 2015 law set penalties for damaging vegetation, soil and infrastructure and for grazing in closed rested pastures. It also charges the authorities and pastoralists representatives to set transhumance tracks to assure fluid animal mobility. This law considers transhumance tracks a collective property prohibited for other purposes. Finally, it designates the authorities responsible for supervising rangelands and enforcing the law (Sudanese Government, 2015).

The Syrian government enacted several laws prohibiting cultivation in the Badia (steppe), where the average precipitation does not exceed 200-250 mm per year. They also placed the focus on pasture rest-rotation and pastoral reserves and set the stage for creating cooperatives that contribute in the rangelands' management. These laws also compensated

the deficit from non-cultivation to pastoral cooperatives, in the form of cereal grains. (Souissi, 2014).

In 2006, the Syrian government passed the law No 26, on Badia lands, considering these lands private state property, delineated by an irrevocable decree. This law prohibits cultivation in the Badia rangelands, limits investment in these lands to grazing and forestry activities and encourages the creation of pastoral cooperatives. It also punishes violators of the closed grazing reserves and improved pastures, and empowers a number of employees of the Ministry of Agriculture as judicial police for law enforcement (Syrian Government, 2006).

In general, rangelands regulations in the Arab countries tend to address topics related to: (i) definition of rangelands, ownership, and institutions and bodies responsible for their management. (ii) Areas and procedures for establishing pastoral reserves and to some extent their management. (iii) In some cases compensation for pasture resting or non-cultivation; (iv) encouragement for investment in some of them; and (v) penalties against violations such as encroaching on rangelands and damaging vegetal cover and soil, grazing in closed rested pastures reserves.

However, rangelands' laws and legislations in many countries are no longer suitable, as some of their concepts and approaches request updating, as they no longer guarantee the adequate environment for the SRM and LDN targets set by the countries. Furthermore, they need to adopt/strengthen the holistic approach in SRM, and reinforce the empowering of pastoral communities and cooperatives, and provide them with control over the resources to secure their rights, their livelihoods and the sustainable management of their livestock and rangeland resources. They also need to strengthen coordination and partnership with the pastoralists' institutions and the remaining stakeholders and create/reinforce coordination mechanisms

At the regional level, AOAD organized its first expert meeting on "The harmonization and development of forest and rangelands policies and regulations in the Arab Nation, in light of the regional and global changes and convention" in 2002. Since then the subject came repeatedly on the Organizations' meetings related to SRM. The latest actions in this regard by AOAD consists of drafting, and the adoption by the AOAD's Executive Council, of the Arab Strategy for the Sustainable Management of Pastoral Resources 2020-2040 (AOAD, 2019), in addition to the provision of Arab Countries with a guide for developing and enforcing pastoral legislations (*AOAD, 2016)*.

3.1.4.2. Rangeland regulations globally

FAO (2010) recommends that countries continually and regularly perform legal reviews to provide themselves with the appropriate and up-to-date legislation to achieve their SRM and LDN targets. The recommended legal review should identify questions to address in the policy development process and guide subsequent legislative reforms. Any changes in existing policy is subject to evaluation to ensure that legislation is in line with policy objectives and contributes to their achievement. Legal reviews examine how laws relate to the subject, rangelands, pastoralism and LDN in our case, and identifies constraints and

opportunities for any new relevant policy. They also help identify and address areas where existing legislative provisions are conflicting, contradictory or insufficient. FAO experience underlines the importance of a broad legal review. The review should cover not only rangelands and forest-specific laws and regulations, but also related legal instruments, such as those on land tenure, land use planning, land management, environmental protection, protected areas and wildlife management, and wider institutional arrangements such as those dictating the allocation of powers and how decentralization is implemented (FAO, 2010).

In the past, policies and legislative frameworks have sought to manage the use of natural resources through command and control. Recently, however, there has been a trend towards decentralizing state power and its devolving responsibilities to local bodies. Tools of decentralization control of natural resources include national policies that facilitate community-based management. Specific policies on community-based management of rangelands are, rather, rare and opportunities are usually created through sectorial legislation relating to issues such as local government, land, forests and wildlife, water (Roe et al., 2009).

Rangelands are of cultural and social importance to Australians. They also encompass a range of diverse cultures and social structures and significant diversity of values and aspirations at individual and community level. The Australian Government in its Pastoral Act attempts to recognise and support this diversity in the development and management of the rangelands. In addition, it seeks, through legislation, to provide secure tenure arrangements in all its states and territories, clear definition of rights and duty of care, and an appropriate framework for the diverse and multiple uses within land capability and according to land suitability. It also seeks to enable users and managers to make appropriate investment and management decisions for ecologically sustainable rangeland management, including business viability (ANZECC and the ARMCANZ, 1999).

Several countries in West and Central Africa have adopted pastoral legislation (Burkina Faso, Guinea-Conakry, Mali, Mauritania and Niger) and others have embarked on this path (Chad, Senegal and Benin). These new legislations introduce interesting innovations, in particular: securing pastoral mobility; preservation of pastoral resources; clarifying the status of public pastoral land and securing pastoral infrastructure and equipment. However, these new laws are not fully applied. In addition, they contain shortcomings and ambiguities, which are reflected in: the transfer of responsibilities in the management of natural resources to the pastoral communities with no real decision-making power, and an imbalance between the rights recognized for pastoralists and those granted to farmers. In addition to a lack of rooting of texts laws and regulations governing the management of natural resources within local practices and customs, and a risk of closure of communal spaces under the effect of a process of poorly negotiated decentralization. These shortcomings are behind the weakening of pastoral land rights (Oussouby and Benkahla, 2014).

The African Union adopted a policy framework in relation to rangelands and pastoralism, with objectives shaped around two main areas (African Union, 2010):

- First, the framework acknowledges the complex and the multidimensional nature of pastoralism, but also, the limitations of governance frameworks and policies including inappropriate policies in some cases, and weak policy coordination. To overcome these constraints Objective 1 of the framework includes seven strategies, and covers issues of pastoral political representation, the legitimacy of traditional pastoral institutions, government commitment to pro-pastoral policies in general, integration of these policies into national frameworks, the roles and rights of women, and related issues.

- Second, a more specific area dealing with the core economic activity in pastoral areas – livestock production – and approaches to protect and develop livestock assets, and further integrate the trade of livestock and livestock products into domestic, regional and international markets. This livestock-focused objective in the framework emphasizes the importance of mobility to make efficient use of rangeland resources, and the ecological and economic logic of enabling in country and regional mobility. The objective also includes seven strategies, and covers the need for risk-based approaches to drought management in pastoral areas, and means to encourage rapid post-drought recovery.

In West African States, where pastoralist communities have always practiced nomadism as a strategic adaption to variable conditions and have developed ways of living and methods of farming that safeguard the land and its resources, ECOWAS (Economic Community of West African States), strives to provide the legal and operational framework for rangeland restoration and management. In Sahel countries, livestock farming accounts for around 40% of agricultural GDP and pastoral systems generate 50% of all meat and 70% of all milk produced

3.1.4.3. Regional and global regulations on water and water catchments

Water resources are vital, as life support for the pastoral communities, for the rangelands, as ecosystem and productive asset, and for the livestock. Natural rangelands require rainwater to grow and produce forage and other vegetal products and for livestock watering. Rangelands also represent essential watersheds receiving surface precipitations and allowing water infiltration to feed aquifers. Healthy rangelands with good vegetal cover and healthy soils are essential to maximize the benefit from water precipitations, both surface as well as underground water, and limit erosion, soil loss and dam siltation.

The Near East and North Africa (NENA) Region has the lowest per-capita fresh water resource availability among all regions of the world (424 m3 vs world average = 5,932.2m3), with serious problems of unsustainable water use. In the coming decades, the NENA region is expected to suffer severe intensification of water scarcity as well as more frequent, intense and long droughts (FAO, 2017c). Such shortage in water resources complicates the already disfavoured pastoral sector and related communities, which travel long distances to obtain their water needs and those of their animals.

To protect watersheds and assure the rights and obligations of all, including the pastoral communities and the pastoral sector, towards a sustainable benefit and management of

water resources, countries adopt laws and regulation related to water mobilization, use, management and conservation.

Most Arab countries adopted one or more laws related to water and land/soil conservation and sustainable use. Table 8 shows examples of such regulations. However, rural communities in general and rural communities in particular are suffering from insufficient supply of quality water for them and their livestock (Darfaoui, 2019). Water law need to set the stage for re-establishing the balance in water supply between urban and rural communities and take the needs and particularities of the pastoral communities and the pastoral sector into consideration.

Table 8. Sample of water and Land/soil conservation laws in Arab Countries

Country	Water law
Algeria	– Law No. 05-12 on water and its bylaws – Law No.01-20 relating to land use planning and sustainable development of December, 2001
Bahrain	– Legislative Decree No. 12 of 1980 regulating the use of groundwater, of 01 May 1980 – Decree Law No.7 of 1982 establishing the Council for Water Resources, of 01 March 1982 – Legislative Decree No.2 of 1971 concerning Water Monitoring and Control Regulations, of 13 January 1971
Comoros	– Water Code Law 94-037 Date of text: 21 December 1994 – Decree No. 66-617 regulating user rights, of May 11, 1966
Djibouti	– Loi No. 93/AN/95/3e L du 04 avril 1996 portant Code de l'eau, of 04 April 1996 – Decree No. 2013-110 / PR / DFAIT, establishing the National Mechanism for Early Warning and Response to Pastoral and Urban Conflicts (CEWERU)
Egypt	– Law No. 12 of 1984 promulgating the Law of Irrigation and Drainage of 22 March 1984 – Decree-Law No.14 of 2012 concerning the Integrated Development of the Sinai Peninsula of 13 September 2012
Lebanon	– Water Law No. 77 of 2018, of 13 April 2018 – Law No.444 of 2002 on environmental protection
Morocco	– Law No. 36-15 of August 10, 2016 relating to water – Dahir No. 1-69-170 on Soil conservation and restoration
Qatar	– Law No.20 of 2015 amending some provisions of Law No.26 of 2008 on the rationalization of electricity and water consumption, of 13 October 2015
Somalia	– Law No. 28 of 20 February 1971 Governing the Water Development Agency, of 20 February 1971 – National Water Act (No. 49 of 2011), of 28 March 2011
Tunisia	– Law No. 95-70 on the conservation of water and soil Date of text: 17 July 1995 – Law No. 63-17 on State encouragement for the development of agriculture of 27 May 1963
UAE	– Land Registration Law No. 7 of 2006 in Dubai, of 13 March 2006
Yemen	– Water Law No. 33 of 2002.

Source: (FAO, 2020a)

3.1.4.4. Recommendations on regulations

Legislation and policy are closely linked. Legislation is the vehicle for implementing the adopted policies and strategies. Rangelands' legislation should, therefore, be based on and guided by rangeland policy, not the opposite.

Many Arab countries do not have specific rangelands regulations to support the implementation of their policies and strategies/plans to achieve the SRM and LDN goals. For some these regulations are included in the environmental, forestry, agriculture or other sectors laws and regulations.

It is recommended for Arab states to draft/update laws and regulations specific to pastoral sector to be in harmony with the new concepts and approaches of holistic/integrated SRM, and effective CBRM. Furthermore, pastoral regulations must strengthen the participatory/partnership approach with the pastoralists' institutions and the remaining stakeholders and create/reinforce coordination mechanisms.

Although Arab rangelands regulations meet , in some of their clauses, with international conventions, especially the UNCCD and CBD, they need alignment with their updated terms and recommendations, such as LDN, and the NDCs, knowing that climate change is today one of the major challenges to SRM and pastoralists' livelihoods.

Law enforcement remains one of the major constraint in natural resources in general and in SRM in particular in the Arab countries. The existing laws and bylaws are far from being applied, failing to protect resources and infrastructure from abuse and law flouting, and missing opportunities for resource and livelihood sustainable development. Important efforts are required to overcome the challenge of law enforcing, by adopting efficient enforcement mechanisms, strong rangers/guards bodies, in addition to efficient judicial system aware and capable of law application to protect and promote SRM and LND targets achievements.

Furthermore, laws and bylaws must adopt a mix of measures, including incentives, disincentives, and persuasion to be efficient. They need to be well adapted to the socioeconomic, environmental and cultural conditions and values, and need to be applicable. Awareness of all ressources' users, decision makers, law enforcement workers and the whole public must be raised.

The Arab guide for developing and enforcing pastoral legislations developed by AOAD and the Arab Rangelands Network, suggest that pastoral regulations should embrace the following subjects (AOAD, 2016):

- National policies, regulations, strategies and action plans for pastoral resources.
- Mechanisms for pastoral laws enforcement, including rangelands guards regulations.
- Mechanisms for coordination among all stakeholders.
- Mechanisms for strengthening the Arab coordination in the field of rangelands policies, legislation and planning.
- Be in harmony with the international laws and regulations and with the UN environmental conventions and SDGs.

In terms of regulations related to water resources management, and in relation to rangelands and the pastoral communities, countries' water laws must strengthen the integrated, decentralized and participative management of water resources, aiming at guaranteeing the right of citizens/pastoralists to access to sufficient quality water in a sustainable and safe way. Laws must also set the conditions for increasing national water potential and considering the climate change impact and adaptation measures.

Legislation related to rainwater harvesting and to soil conservation and restoration, must aim at combating land degradation to reduce its negative impact on water resources. Water law must provide for incentives, subsidies and funding for soil conservation and sustainable watershed management to improve range ecosystems and therefore generate more mater of better quality.

3.1.5. Rangelands strategies in the Arab Region and their global integration

Few Arab countries have specific strategies/action plans for SRM, and these include Jordan and Saudi Arabia. The other countries include SRM plans and programmes/projects in their agricultural strategies, National Action Plans for combating desertification (NAP), Voluntary Targets to achieve LDN, and NDCs for mitigating/adapting to climate change. Some programmes and projects developed at the national level, usually with the support of funding institutions, constitute also partial action plans in some countries, such as in Jordan, Morocco, and Syria.

Algeria developed its plan for the development of the steppe regions, with the participation of the targeted communities in all stages of projects preparation, to assure they are simple, effective, easy-to-achieve, cost-effective, economically and socially profitable, and ecologically sustainable. The plan aims to restore degraded ecosystems, conserve natural resources, and improve conditions for livestock husbandry, in addition to restoring respect for traditional agriculture, improving livelihoods, and ensuring the stability of the population. Moreover, the plan aims at protecting and restoring degraded rangelands, improving pastoral livestock watering, promoting rural women's activities, and the promotion of renewable energies (Brouri, 2014).

Jordan adopted its rangelands' strategy in 2002 and updated it in 2014. The 2014 strategy's vision is to conserve and sustainably manage rangelands. It incorporates the Hima concept as a basic approach in the governance of Jordan's rangelands, and aims at achieving five objectives: (i) rangelands sustainable development and management, (ii) Improvement of social and economic conditions for livestock breeders and pastoral communities, taking into consideration gender issues. (iii) Capacity enhancement (training and awareness), (iv) monitoring and evaluation of rangeland status, and (v) engagement of Local communities in sustainable rangeland development and management. The strategy includes the implementation of four programmes and eight projects (MOAJ, 2014).

Morocco adopted a rangelands' development strategy in 1992, which served for about two decades as a benchmark for actions carried out in the management and development of pastoral resources (MARA, 1992). Currently, actions are implemented within the framework of several strategies and plans, including the Green Morocco agriculture strategy (Pillar II), the National Project for the Development of Rangelands and the Regulation of Transhumant

Flows, and the implementation of Regional (several provinces per region) Master Plans for pastoral planning. The new Moroccan "Generation Green" 2020-2030 strategy (MADRPMLCD, 2020) further emphasises the view to rangelands as a land category awaiting conversion to other agricultural or other more cost-effective uses.

The Moroccan strategy for SRM and development within forests rely on five strategic pillars, including: (i) the restoration of sylvopastorale ecosystems, (ii) improvement of the organization of sylvopastorale resources users, (iii) support for the socio-economic development of forest communities, (iv) improvement of governance, (v) holistic and dynamic research-development, (vi) strengthening the technical and organizational institutional capacities (Naggar, 2018).

Tunisia adopted three successive national rangelands' development plans: 1990-2001, 2001-2011 and 2015-2025, as part of the agricultural strategy. These plans include policies and programs to develop and achieve SRM, through implementing development projects, in cooperation with international institutions and funds (Qhiss, 2016).

Saudi Arabia adopted its first rangelands strategy 2020-2030 in 2019, with a vision aiming to achieve "Prosperous rangelands with diverse and sustainable ecosystems", and a mission to "Provide enabling capabilities and regulatory frameworks for SRM to conserve environmental resources and improve natural vegetation". The strategy has two main objectives: (i) reduce rangeland degradation and (ii) assure management and sustainable development of pastoral resources. The strategy rests on four pillars, namely governance, building database, management and sustainable development of rangelands, and Development of livestock; and includes 13 initiatives (MEWA, 2019b).

In Syria, the country's five-year plans for economic and social development included a project to develop the Badia. This project aimed to organize the Badia into pastoral associations with the objective of restoring rangelands and improving their productivity. The main areas of intervention of this project are as follows: (i) creating pastoral cooperative; (ii) establishing pastoral reserves and rested areas; (iii) establishing centres for sheep husbandry and rangelands improvement. In addition to (iv) strengthening institutions and building capacity (Souissi, 2014).

Regionally, AOAD drafted the Arab Strategy for the Sustainable Management of Pastoral Resources 2020-2040, and its Executive Council adopted it in 2020, making of it the LAS's framework for SRM. This strategy's vision is to achieve "Ecologically balanced pastures contributing significantly to food security and improving the livelihood of pastoral communities". The Arab rangelands strategy adopts three strategic objectives and four operational objectives, as follows (AOAD, 2019):

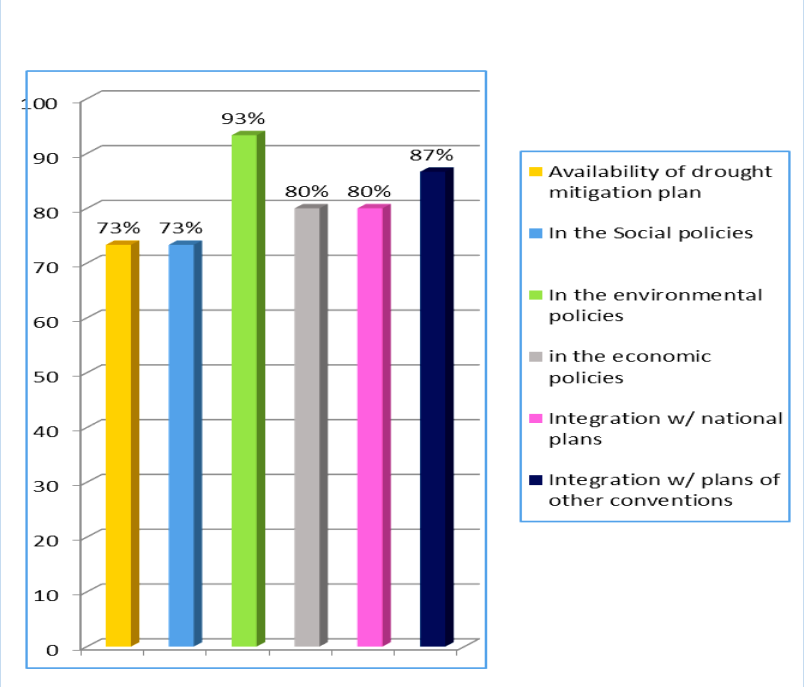
The strategic objectives include, (i) halting rangelands degradation, (ii) development and sustainable management of pastoral resources, (iii) and developing pastoral societies and improving their livelihoods. The operational objectives include, (i) regular inventory, monitoring and evaluation and establishing pastoral database and early warning; (ii) developing pastoral institutions, policies and legislations; (iii) building capacity; (iv) developing pastoral and environmental research and extension. The Arab Strategy for the

Sustainable Management of Pastoral Resources 2020-2040 includes 14 programs, seven of which are to achieve the strategic objectives and the remaining seven to achieve the operational objectives.

In summary, only few Arab states adopted specific rangelands strategies. The other countries include rangelands planning in different sectorial plans and strategies, including the agriculture, livestock, forestry and the environment sectors. This fact keeps rangelands' programmes and activities fragmented, and receiving less attention than merited. The prevailing situation hinders the deployment of significant efforts and misses the opportunity to address the rangelands and pastoralists issues in an integrated manner. The weakness of the pastoralists' communities and marginalization of their sector deprive them from lobbying power to raise their interests higher in the national socioeconomic agenda.

In addition, the dispersal of the rangelands and pastoralism planning over several related sectors and failure in their continuous update, results in the loss of sensitivity of the plans and programmes to the pastoralists needs, and to the continuous progress achieved worldwide in range management and development knowledge. Furthermore, the non-range-specific plans fail to embrace the new concepts and visions adopted by the international community, such as LDN, the SDGs and climate change mitigation/adaptation. The international instruments, when embraced may stimulate national-level processes, and improve the rangelands' governance and promote pastoralist's status and livelihoods.

SRM in many Arab countries is a keystone in their efforts to combat land degradation and desertification, and contribute to achieve food and environmental security. Figure 13 shows that a significant proportion of Arab countries integrated the programs and projects of their NAP to combat desertification and mitigate the effects of drought within other national development plans and plans of international environmental agreements (87%), especially climate change and biological diversity agreements (80%), and other plans Related to combating desertification and stopping land degradation (73%). Although these percentages show a positive trend, the countries and the regional and international organizations and Conventions need to make additional efforts to integrate LDN targets, biodiversity conservation, ecosystem management approaches, climate change mitigation/adaptation, and community residence in SRM strategies and plans.



Source: (Darfaoui, 2019)

Figure 13. Integration of SRM and combating desertification by Arab countries in their national policies and other socioeconomic and environmental plans

3.1.6. Community participation, empowerment, equity and gender

3.1.6.1. Community participation globally and in the Arab Region

Participation is a fundamental principal of governance. It is currently widely considered as an essential element in natural resources management, including in SRM. Participation is defined as "the fact of taking part or becoming involved" (The Cambridge dictionary, 2020). In the context of natural resources management, participation has been defined as a process that facilitates dialogue among actors, encourages communities and their institutions to manage and control resources, mobilises and validates popular knowledge and skills, and seeks to achieve sustainability, economic equity and social justice (CANARI, 2011).

Currently, countries, in the Arab Region and worldwide, are gradually accepting that the communities' role and participation are vital in all spheres of development. Therefore, sharing of powers and responsibilities to varying degrees to allow the co-management of natural resources in a participatory/partnership approach is inevitable. Local community involvement is increasingly viewed to lead to sustainable resource use, higher contribution to community livelihoods, shared management costs and responsibility, better information sharing and understanding, sustainability of the initiative, ownership by local stakeholders, and community empowerment (Musingo et al., 2015).

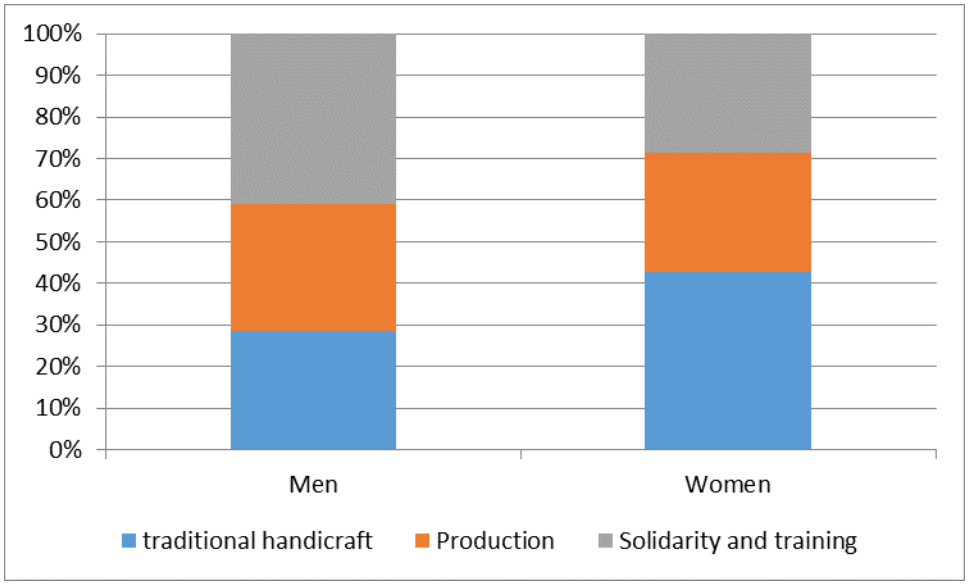
Community participation in natural resource management is a continuum, ranging from simple manipulative participation to self-mobilization, passing through passive participation, consultation, participation by material incentives, functional participation, and interactive participation (Musingo et al., 2015). The analysis of many reviewed projects reports and

publication shows that there is a great variation among Arab States in this continuum. While in some countries, including Golf states the process is still in its early stages and community participation in the natural resources management is in the best cases consultative, in some other countries the process has taken important steps forward, such as in Morocco, Jordan, Syria and Tunisia for instance. The Ethnic-Lineage-Based Cooperatives in these countries have allowed creating good synergies between the customary and administrative rules and institutions, allowing empowerment of pastoral communities and pushing their involvement and participation to higher levels. This greater participation of local communities in the management of their resources resulted in significant improvements in range condition, sustainability in resources and initiatives, improved livelihoods, raising of rangelands and pastoralism in the priority hierarchy and therefore policy changes in favour of the sector (Souissi, 2014 and Snaibi, 2018).

3.1.6.2. Women empowerment in the Arab Region

The SDG 5 adopted by the UN aims at achieving gender equality and empowering all women and girls. Responsible governance requires non-discrimination and gender equality, which includes the participation of women in all levels of decision-making. Women play an important role in the management of pastoral land. Their participation is essential to achieve the sustainable use of rangelands. Women pastoralists are among the most marginalised people in the world and are increasingly vulnerable to environmental and socio-economic shocks (FAO, 2016).

Rural women in the Arab world practice numerous and varied activities to increase their income and sustain their livelihood. These activities are of three categories: traditional handcrafting, productive, and training and solidarity activities. Traditional handcrafting concern aromatic and medicinal activities, fuelwood collection, energy alternatives and others. Productive activities, relate to agriculture, construction, and eco-tourism. Activities related to solidarity and training concern the establishment of rural development centres for training and rehabilitation, small income-generating projects (animal husbandry, beekeeping, fishing, etc.). Women have been reported to practice handcrafting in 43% of countries, compared to 29% by men (Figure 14). Women also practice productive activities in more countries then men, 30% versus 28%. As for activities related to solidarity and training, they are practiced more by men in 41% of countries compared to 29% by women (Darfaoui, 2019).



Source: (Darfaoui, 2019)

Figure 14. Proportion of men and women activities in rural communities in Arab countries

In Jordan, Both, the 2002 and the updated (2014) SRM strategies included the Promotion of gender equality and the empowerment of women. The updated one includes a programme on empowerment of pastoral communities including women for self-sustainable management of pastoral resources. The local initiative of the Bani-Hashem Hima considers women an important factor of change with significant knowledge and relevant skills and experience of great importance for climate change mitigation/adaptation efforts and for biodiversity conservation and combating desertification. On this basis, women were included in the Community-based organization's bodies. This step contributed in the success of the initiative, which improved the management of the Hima and improved its ecological condition and productivity. It also helped build local community's capacity, pastoralists' involvement, especially women, who improved their livelihoods and benefited from secured access to the Hima resources and political empowerment at the local arena (Haddad, 2014).

In Morocco, the role of women in the pastoral societies has been essential, in all the socioeconomic and environmental aspects of the pastoral life, including livestock herding, feeding, product transformation, fuelwood and substitute energy supply, in addition to household activity. Women empowerment has been a keystone in the Moroccan policies and legislation in the latest decades. However, although some progress has been made in many aspects, the rural women is still in a fragile situation and enduring discrimination, especially in the application of customary regulations related to securing their right to collective land resources.

It is important to notice that women development has been a constant component in all the rural and rangelands development projects, implemented in Morocco since the early 1980's, including the IFAD; PDPEO (2002), PDRTD (2006), PLPCDRP-HPO (2009-2015), PDRMZA (2014), PDREMA (2018) in eastern Morocco, and subsequent projects implemented throughout the country until today (IFAD, 2020). These projects focused on women's organization in cooperatives, education, technical and managerial capacity building, and income generating activities. The evaluation of these projects indicates that the action taken in favour of promoting rural women has been positive and undoubtedly contributed to the

reinforcement of the changes in the social fabric of the rural communities in the targeted areas. They enabled boosting the pre-existing extension strategy in favour of women, and improved women's economic and social conditions through the literacy actions and the income-generating activities (IFAD, 2020).

In Sudan, rural women's life is directly relying on natural resources, namely rangelands, forests and water. Women in this country contribute significantly in national income by directly practicing pastoralism, agriculture, trade, animal husbandry, valorisation of rangelands and livestock products, wood and energy supply, etc... However, Sudanese rural women constitute the group most affected by armed conflicts, and from droughts and land degradation, translating into poverty, malnutrition, health problems, in addition to exclusion from the resources rights and gender discrimination (Haroun, 2015).

Recognising the role of women, the Sudanese Government created a Women Development Unit within the Livestock Development Department, which is the department, dedicated to providing extension services for pastoralists and assuring their sustainable social and economic development.

Sudan has implemented several projects aiming at women empowerment. Among those worth mentioning; the women's associations IFAD project in the *Abu Daliq* area, and the project implemented by the Development Operations Corporation in cooperation with the Centre for Studies of Pastoralists and Farmers aimed at supporting and improving rural women's' production. The two pilot projects contributed in improving the nutrition status of the targeted communities, and in upgrading the technical skills and environmental awareness of these communities. The two initiatives demonstrated the importance of the collaboration and coordination among the various national institutions, communities and the private sector in addition to the regional and international institutions for enhancing development efforts in the region and efforts to achieve the SDGs (Tawer, 2014).

3.1.6.3. Women empowerment globally

Empowering women is essential in empowering pastoral societies, improving their livelihoods, and achieving SRM and LDN targets. Ensuring access to natural resources and economic opportunities is key to empowering pastoralist women. This was the key message of an all-women panel event titled "Women's empowerment for better resilience in pastoralist communities." Organized by FAO's Pastoralist Knowledge Hub, on the side of the 44th meeting of the Committee on World Food Security (FAO, 2017b).

In Sub Saharan Africa, the context of many pastoral societies is changing, and so does the role of women in these societies. In many instances, state new laws and codes are increasingly accommodating the role and resource rights of women with the aim of removing gender bias as an obstacle to change (Liniger and Studer, 2019).

Kenya's new Land Act (2016), provides the gender equity right and gives women access to matrimonial property and land. Under the same law, women can inherit land from their parents; while previously, only male children were entitled to inherit property. Furthermore, the Land Act prohibits gender discrimination in the management of communal lands in Kenya. Through marriage, men and women gain automatic membership to the community, and thus to community resources (Liniger and Studer, 2019).

The **Ethiopian** National Action Plan for Gender Equality 2006-2010 identified severe gender inequalities, especially in pastoral and agro pastoral societies. The plan called for specific measures to increase gender-balanced representation within the political and public sphere, with special attention to women in pastoral regions (MoWA 2006).

The **African Union's** policy document on pastoralism "Policy Framework for Pastoralism in Africa", in its strategy 1.5 specifies that the role and rights of women in pastoral communities is to be strengthened (African Union 2010).

In India, the National Rural Livelihoods Mission (NRLM) Project lunched by the Government of India in 2011 supports small rural women producers through agriculture and livestock productivity enhancement, value chain development, and non-farm activities. In the state of Bihar alone, currently nearly seven million women are part of self-help-groups that help the women to form producer groups at the village level, to act as local hubs for collective training, to aggregate their produce, and to control quality. Larger women-owned producer companies undertake collective procurement through these groups and provide direct market linkage for small women farmers who previously sold to local intermediaries. The NRLM so far has reached to more than 45 million women. Collectively they have saved $1.4 billion and leveraged $20 billion from commercial banks. NRLM is also supporting nearly 3.3 million women farmers to increase their productivity in agriculture and livestock (World Bank, 2017b).

In Europe too, as herds movements in rural areas have been revitalised and increased in profile and strength, remaining shepherds and pastoralists have also mobilised themselves in order to highlight their needs and concerns. The Spanish *vias pecurias* or livestock corridors that allow for the seasonal mobility of pastoralist herds is an example of this support. By mainstreaming gender across all their policies, the Spanish Agency for International Development Cooperation ensures that women have equal representation in terms of livelihood and resource rights (FAO, 2017b).

3.1.6.4. Recommendation on Community participation, empowerment and gender

In light of the above, empowering pastoral communities, in general and pastoral women in particular, is essential for the community-based rangelands' management to succeed and produce the desired positive impact on the decision-making and implementation processes, and hence on the SRM and livelihoods and their resilience. Men, women, youth and all gender categories must be empowered and treated equally and equally benefit from rangelands products and services. Such empowerment takes several forms, starting by securing their control over the pastoral resources and transhumance tracks, and securing the rangelands from anarchic encroachment by other land uses. Furthermore, empowerment is achieved through communities' institutions organization, awareness, education and capacity building, and through increased funding, involvement in policymaking, planning, implementation and the evaluation processes.

Women, globally as in the Arab Region, play a crucial role within pastoralist societies, not just as livestock producers, income generators, and caregivers, but also as key organizers and keepers of local knowledge. They are integral to maintaining pastoralist community life and identity. Yet, they remain vulnerable and must constantly negotiate their position within their households, communities and otherwise.

Pastoralist women serve as custodians of pastoral livelihoods, culture, and community, and play a key role in adapting to changing conditions. Therefore, empowering women by ensuring their access to natural resources, financing and economic opportunities is essential for productive sustainable and resilient pastoralism (FAO, 2017b).

3.1.7. Incentives and expatriate herders and their effects on resources management

Pastoral livestock feeds on rangelands forage, but as these lands are unable to cover their needs, animals feed on crop residues, fodder crop products, and agro-industrial by-products. This makes the pastoral sector sensitive to policies and decisions targeting the agricultural and agro industrial sectors, in particular, and other sectors as well. States' policies in the agriculture sector as a whole affect directly or indirectly rangelands health, management conditions, and pastoralists' livelihoods. Decisions concerning prohibition of cultivation in areas receiving low rainfall for instance favour the sustainable management and improvement of rangelands, as the case in Syria (law No 26) and Sudan (2015's rangelands law).

In Sudan, three policies adopted in the recent decades directly affected rangelands (Mohamed, 2014):

a. Prohibiting cultivation of low rainfall areas north of latitude 13, and reserving those areas for grazing. This policy helped to preserve the northern and central states' pastures.
b. Reclaiming "monkeys" lands used by cattle herders, resulted in the shrinking of available areas of the *Baggara* (cattle grazing), and increased pressure of the remaining pastures.
c. Regulating the use of agricultural machinery by the government, limited the destruction of traditional pastures.

Most of the Arab states adopt policies related to the mitigation of the effects of drought on the agricultural sector, including implementing programs and actions to safeguard and protect livestock. The three-fold objective of such programs consist of:

I. Safeguarding the genetic resources by containing the decapitalization of the livestock within tolerable range, in order to allow rapid herds reconstitution in favourable years;
II. Avoiding the collapse of animals and animal products' prices;
III. Compensate partially for herders losses.

Opinions on these operations remain controversial. Many consider them as insignificant in the face of the magnitude of the scourge. In Morocco for instance, annual volume injected feed as part of this operation hardly exceeds 1.5% of the livestock's feeding requirements. Others point to them as a major cause of inflated livestock numbers, and consequently rangeland degradation and pastoralists' poverty and loss of resilience. In fact, although subsidised feed amounts distributed might be minimal, they could have a notable impact on rangeland resources if administered in limited time and space (Boulanouar, 2005).

In Algeria, the low interest rates policy practiced until the mid-1980s encouraged an increase in livestock in the steppe zone, forcing the Agricultural Bank to cancel its loans for the purchase of livestock in 1986 (Abaab et al., 2000).

In Jordan, historically, the size of herd held by Bedouins was constrained by rangeland's herbage availability and the availability of herders (family labour), with flock numbers seldom-exceeding 150 to 200 heads. However, provision of subsidised feeds created a major incentive to increase herd size. Currently herds of 1,000 to 2,000 sheep are common. Pastures are unable to support such large herds; hence, they have become simple holding ground for livestock whilst feed and water are trucked in (IUCN, 2011).

Saudi Arabia's rangelands strategy (2019) considers continued feed subsidy a threat leading to inflated livestock numbers, which rises the pressure on natural pastures, causing their deterioration. This strategy attempts to link the feed subsidy in favour of commercial herds with grazing organization and application of the sustainable management practices adopted by the government.

Currently in 2020, the budget allocated for feed subsidy in Saudi Arabia amounted to 1,200 billion Saudi Riyals (SAR), at a rate of 8 riyals per sheep, 40 riyals per camels, and 60 riyals per cows (1 USD = 3.75 SAR). Livestock producers in Saudi Arabia are now requesting an increase in the subsidised feed and the payment of subsidies through bankcards (Tolani, 2020).

Among the incentive policies aimed at achieving SRM in the Arab countries, worth mentioning, is the Sultanate of Oman's camel population reduction program (Ghawass, 2014). This program, which costed more than 13 million Omani Riyals, consisted of purchasing large numbers of camels and selling them for slaughtering at lower prices to reduce their numbers, balance rangelands stocking rate and therefore provide better chances for rangelands regeneration and SRM.

In Arab Gulf states and eastern countries, governments encourage livestock producers to hire expatriate workers to herd their flocks, as result of Citizens' reluctance to herd animals flocks. The percentages of expatriate could attain 90-100% in these states. This fact constitutes an important threat to pastoralism, leading to increase in flock/livestock numbers, which otherwise would not happen without these herders, loss of local traditional knowledge, and management problems due to lack of experience and knowledge of the new expatriate herders. Saudi Arabia, in its latest rangelands strategy tried to link between permits to bring expatriates as herders and the countries requirement for SRM and LDN (MEWA, 2019b).

Globally, government policies often aim at keeping consumer prices of livestock products as low as possible. As result of such policies, and to compensate the producers, governments reduce taxes related to import or production and/or subsidize input prices, offer free services or grant subsidized credits. All these measures maintain artificial systems that can lead to inefficiencies, inequities, distortion of investment, and degradation of pastoral resources (FAO, 2017).

Recommendations to Arab countries in light of this assessment are to review their incentive and subsidy policies to the livestock sector, as well as the measures taken to mitigate the

effects of drought and approaches and methods of their implementation, in addition to expatriate herders hire. These measures, which are generally, intended to increase the productivity and face the immediate negative impact of droughts and disasters, and labour shortages, should not affect the ecosystem balance and sustainability, resilience, and cause land and resource degradation.

The amount, the nature, the target, the timing and the space for delivering incentives and subsidies to the pastoral and livestock sector are to be managed for promoting productivity, improving resources management and sustainability, and balancing stocking rates. At the same time, they must allow for balancing development opportunities among the agricultural and related sectors, empowering community-based-rangeland-management, and strengthening equity, transparency and adequate decentralisation and deconcentrating of power.

3.2. KNOWLEDGE

Knowledge is the basis and the key to SRM. Knowledge is necessary for the inventory, monitoring, and evaluation of the resources, and for the planning, implementation and assessment of the progress of strategies, programmes and projects. Furthermore, knowledge provides the foundation for establishing reference base, detecting trends, predicting outcomes and formulating recommendations regarding rangelands resources and pastoralists livelihoods.

Technical knowledge of efficient and adapted techniques, practices and technology are essential for achieving SRM and development and LDN. Information sharing, in the form of extension, awareness and network platforms are the vehicle for knowledge dissemination, and upscaling of success stories and for avoiding failing non-adapted solutions.

Traditional pastoralism's knowledge, customary practices, institutions and regulations are still of use in many countries in the world, and in most Arab countries, alongside with newly developed ones. Succeeding marriage between the traditional and modern knowledge and practices is the warranty for successful SRM, durable development and resilience to continuous economic, social and environmental changes.

3.2.1. Traditional knowledge

Pastoralists possess their own traditional knowledge, which proved for centuries its ability to assure sustainable management of rangelands and livestock under the prevailing environmental and socioeconomic conditions. Sustainability and the balancing among livelihoods and the environment exigencies are the core of this knowledge. The wisdom and traditional knowledge of pastoralists has been tuned through practice and through accumulation and adaptive processes for generations. Traditional knowledge guaranteed secured open rights and organized well-controlled open access to common resources. It set the stage for sustainable, flexible and resilient management, which was based on mobility and opportunistic management. Local knowledge did not overlook many of the approaches praised by today's scientific and managerial communities, such as participation, voice, gender, decentralization and transparency.

It is therefore, of paramount importance to revive and develop the use of traditional knowledge in the Arab countries, especially because pastoralism is still based on traditional practices, rules and institutions in most of these countries. Recovering pastoral knowledge, however, depends on collecting, studying and developing this knowledge using scientific methods in research stations and in laboratories, but also through practice within the framework of community-based-management approaches.

In Jordan for instance, the piloted initiative for reviving the traditional Hima system made remarkable success in rangelands management through securing rights and access to land tenure, improving governance of land and natural resources, enhancing income generation and promoting the active engagement of women (FAO, 2017a).

The community based management initiatives described earlier in this review in many other countries, such as Morocco (Agdals and ELBC), Syria, and others, all made positive impact through revival and development of local traditional knowledge and practices.

3.2.2. *Rangeland* resources tracking and knowledge sharing in the Arab Region and global integration

The average proportion of degraded lands reported by 16 Arab countries in 2015 (SDG 15.3.1) was estimated at 7.3%, ranging between 0.8% in Algeria and 63.6% in Kuwait. The level of land degradation reported in the Arab Region is very low when compared with the levels reported globally (19.2%), as well as with those reported in Africa (17%) and Asia (24%) (Figures 7 and 8). The countries utilized the default data made available by the UNCCD to assess land degradation, mainly because they were lacking local accurate data and the capacity to produce such information. The global default data proved less adapted to dry lands, which are covering more than 80% in the region, where higher satellite imagery resolutions and more ground truthing are required (Darfaoui, 2019).

For Arab Countries to perform accurate and reliable inventories and assessment of their rangeland resources and build living databases, they are in great need to develop capacities and technologies, namely in remote sensing, GIS and ground studies, to produce dependable local maps and databases for planning, monitoring/evaluation, and reporting. They also need to develop harmonized criteria and indicators for land use and SRM.

Dissemination of information and knowledge to all stakeholders, especially decision makers, rangeland users and investors must be among Arab counties' priorities, as should be the allocation of sufficient resources for knowledge development, adaptation and sharing.

A limited number of Arab countries have developed systems and networks for information production and exchange on best practices for land management and drought preparedness. Only seven countries - Comoros, Kuwait, Mauritania, Morocco, Saudi Arabia, Somalia and Tunisia – declared having such systems in 2018. The departments and units responsible for this aspect are located in the ministries of Agriculture, Environment and Disaster Management and sometimes run by committees formed for drought management (Darfaoui, 2019). These systems use remote sensing, geographic information systems (GIS), ground truthing, the Internet, and other technologies.

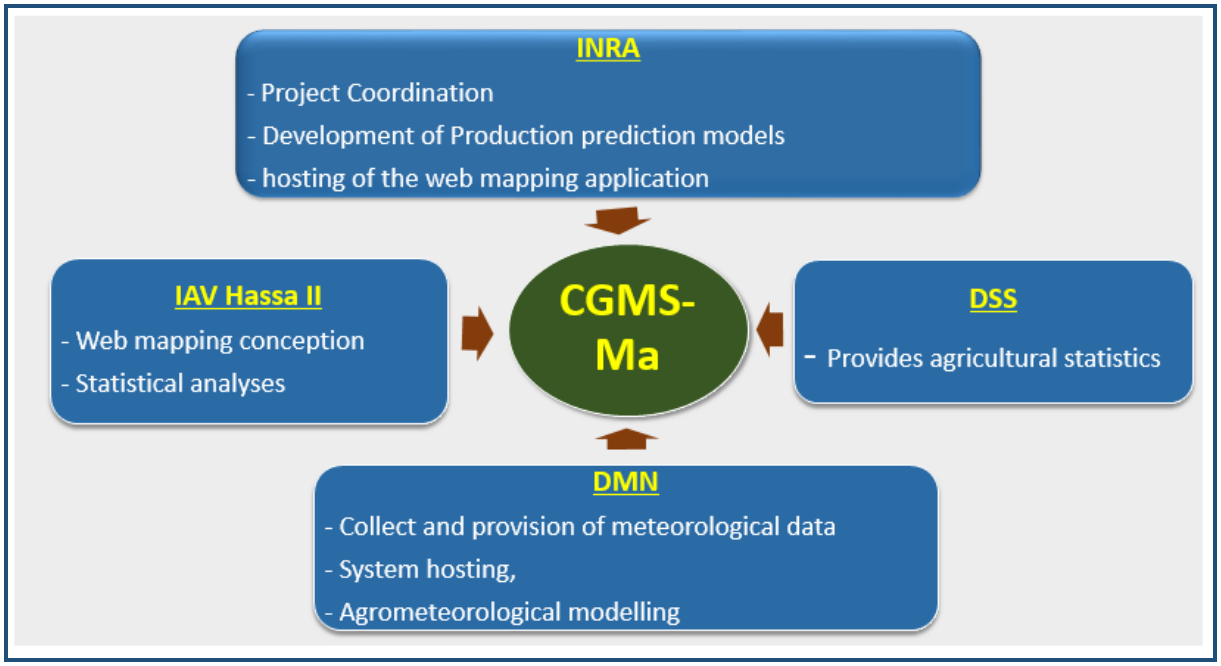
Some of these systems were established as parts of cooperation projects with international organizations, as for the Somalian Water and Land Information Management system (SWALIM), designed to strengthen community resilience through; providing drought and flood risk early warning information, the improvement of flood/drought risk management, and capacity development (FAO, 2020b).

In Morocco, the Crop Growth Monitoring System (CGMS-Ma) was established to track cereal crops and rangelands resources. It is the result of a collaboration among the National Institute for Agronomic Research (INRA), the Agronomic and Veterinary Institute Hassan II (IAV Hassan II) and the Strategies and Statistics Department (DSS) of the Ministry of Agriculture, and the National Meteorological Department (DMN) of the Ministry of Equipment, Transport, Logistics and Water (Figure 15). The CGMS-Ma started in 2011 by providing forecasts of cereal production. It was later extended to forecast rangelands' herbage production (Balaghi and Mayhou, 2018). The CGMS-Ma consists of:

i. A database including weather, NDVI, WOFOST (the World Food Studies simulation model) and crop statistics data;

ii. A reference grid (4.5*4.5 km^2) including crop mask, soil map and administrative vectors;

iii. An open sources web mapping tool (www.CGMS-Maroc.ma) allowing: data analysis, data mapping, similarity analysis, yield forecasting and an open source data and maps.



Source: Balaghi and Mayhou, 2018

Figure 15. The Crop Growth Monitoring System: collaborating institutions

The Moroccan public authorities use the CGMS-Ma as planning and drought early warning tool. Researchers and other stakeholders, including informed pastoralists, use it for various purposes.

At the regional level, AOAD initiative of the Arab Network for SRM (ANSRM), also referred to as the Arab Pastoral Network, created in 2014 represents a good platform for information and knowledge dissemination and sharing. All Arab countries are considered members in the ANSRM, according to the decision of AOAD Executive Council, composed of the Arab ministers for agriculture. Nonetheless, only 14 countries have activated their membership in the network, and designated focal points up to now. These member states are; Algeria, Egypt, Iraq, Jordan, Lebanon, Mauritania, Oman, Qatar, Palestine, Saudi Arabia, Sudan, Syria and Tunisia.

The ANSRM held three meeting up to now in 2015, 2016 and 2018. It has implemented some activities in collaboration with AOAD, including the drafting of the Arab SRM Strategy 2020-2040, the guide for Arab rangelands regulation, the rangelands Arab terminology dictionary and several training activities (AOAD, 2015, 2016, 2017, 2017a). The ANSRM activity and its impact on information sharing and dissemination are still very limited and need strengthening.

Globally, there are several initiatives for rangelands resources knowledge production and sharing. These include the **World Initiative for Sustainable Pastoralism** (**WISP**), which is a global network, hosted by IUCN, and designed as an advocacy platform to empower pastoralists and demonstrate that pastoralism is an effective and efficient way to manage world's drylands. Arab countries are members of **WISP** (IUCN, 2011).

Furthermore, Arab pastoralists are active in the **Pastoralists Hub** hosted by FAO, where the participation is made through networks organized by regions, providing easy dialogue through shared regional languages, as well as through thematic working groups that promote south-south learning. The Northern Africa and Near East regional network encompasses the Arab League countries plus Iran and Turkey. It is a platform for information and knowledge sharing via the internet, and it offers an additional opportunity for Arab SRM.

A coordination of the activities and creation of a synergy among all the national, regional and international networks, especially WISP, FAO-Pastoralists Hub and the Arab Pastoral Network, is recommended and will have a positive impact on the SRM in the region, especially that most Arab countries are members of all these platforms.

3.2.3. Management and restoration knowledge and practices

Arab countries use a variety of practices to increase rangelands' production of forage, livestock and other goods and to improve livelihoods. These practices aim at improving the vegetal cover and biodiversity, soil conservation and restoration, improving livestock performance, nutrition and health, strengthening ecosystem and communities resilience. They are also aiming at avoiding, reducing and reversing land degradation and desertification.

Table 9 summarizes the land management and restoration actions most practiced in the Arab countries, including range seeding and planting by trees, shrubs and forbs, soil and water conservation (rainwater harvesting, control of water and wind erosion, sand-dune fixation), creation of reserves and protected areas, and improvement of the livelihood of the pastoral communities. Other activities include livestock development, ecosystem restoration, and establishment of sustainable grazing systems (Darfaoui, 2019a).

Table 9. Land management and **r**estoration practices in the Arab countries

Restoration activities	Number of countries	Restoration activities	Number of countries
Planting trees and shrubs	11	Sustainable grazing systems	5
Soil and water conservation	10	Creation of cooperatives	4
Reserves and protected areas	10	Sand dunes fixation	4
Planting and reseeding pastures	8	Assuring good health and IPM in forests and rangelands	2
Strengthening Ecosystem restoration and resilience	8	Develop green tourism	1
Livestock development	6	Preserve wildlife and biodiversity	6

Source: (Darfaoui 2019a)

LDN reports and NDCs included various practices and technologies aimed at protecting the land from degradation, achieving sustainable management and mitigating/adapting to climate change, but with great variation among and within countries, and with great discrepancies in their application and the levels of efficiency achieved. There is, consequently, a need for technical support in capacity building and technology transfer and development, in addition to efficient information and knowledge sharing mechanisms and networks. This can be accomplished by cooperation among the Arab countries and with the rest of the world countries and organizations.

3.2.4. SRM Research, extension and awareness

SRM Research

Applied scientific and socioeconomic research are the guide to efficient work in the field of management and sustainable development of pastoral systems. They allow the development, transfer and adaptation of technologies destined to overcome the difficulties faced by producers and manufacturers working along the various production chains, such as animal and plant production, resource tracking, restoration and improvement of rangelands, biodiversity, genetic resources and seeds, manufacturing, marketing, and others.

The national agricultural research institutions and universities are in charge of conducting scientific and applied research in the field of RSM in the Arab world. Research centers specializing in arid areas and desert lands and pastoral research stations existing in many Arab countries, conduct great deal of pastoral research. This is the case in most Arab states, such as Algeria, Egypt, Oman, Morocco, Saudi Arabia, Sudan, and Syria. The research conducted in these institutions and centers covers most the technical, socioeconomic and

environmental aspects of rangelands and pastoral societies and livelihoods and development approaches, methods and techniques.

Reports have shown that pastoral research in the Arab countries is weak and characterized by low productivity and failure to propose adequate and reliable solutions to the many problems and challenges facing the pastoral ecosystems and communities. Among the main mentioned causes of this failure: insufficient allocated human resources and funds, non-adapted infrastructure, lack of collaboration and synergy among the research institutions and researchers, and with developers and pastoralists themselves. Additionally, among these causes the non-exploitation of the research findings and developed techniques by the development-extension systems (Adar and Darfaoui, 2015; Bourbouze et al, 2009; Al-Hajj, 2014; Kawass, 2014).

ACSAD, the Arab Centre for Studies of Arid Zones and Dry areas, has carried out several research and development programmes, projects and activities related to rangelands and combating desertification in cooperation with member states. Among these research activities, the survey and assessment of agricultural natural resources; developing methods and alternatives for the rehabilitation of degraded areas; development, transfer and adaptation of efficient and sustainable agricultural technologies in cooperation with research and extension centres in the Arab countries. Also socioeconomic studies concerning the pastoralists, and search for ways and means to increase their income and resilience. ACSAD research also concerns developing plants and animal species' productivity, efficiency, genetics and nutrition, in addition to capacity building (ACSAD, 2020; Assiri, 2015).

ICARDA, the International Center for Agricultural Research in the Dry Areas, is an international organization, under the umbrella of the Consultative Group for International Agricultural Research (CGIAR), undertaking research-for-development. It aims at providing innovative, science-based solutions for communities across dry areas. In partnership with research institutions, NGOs, governments, and the private sector, ICARDA works in the Arab countries, namely in (i) evaluating pastoral plant species in saline conditions; and (ii) identifying options for improving rangeland management. It is also active in (iii) rangeland regeneration and replanting of indigenous forage crops, shrubs and trees; (iv) rangeland rehabilitation through micro water harvesting; (v) pastoral policies and regulations; (vi) promoting the participatory approach; (vii) pastoral soil research and combating land degradation; (viii) and climate change adaptation.

ICARDA, the International Livestock Research Institute (ILRI) and IUCN have been working together to develop a rangeland restoration toolbox that aims to compile the current state-of-knowledge on SRM practices in dry areas. This information resource is expected to contribute significantly towards ensuring rangelands ecosystem sustainably and LDN. Through targeting a landscape scale that uses an integrated and multidisciplinary approach, this promising tool aims to address the biophysical and socioeconomic linkages and trade-offs existing between the different land uses. The approach highlights the important role of rangelands governance within communal areas. It also underscores the need to base

decision-making on both indigenous knowledge and modern science, in order to empower communities to make good choices based on the best information available (ICARDA, 2019).

SRM extension

Agricultural extension plays an important role in disseminating the scientific research products and technologies to pastoralists and other target groups. Modern extension adopts up-to-date and participatory methods and means for acquiring and transmitting appropriate knowledge and technologies at the proper time, rate and place, and assure efficiency, flexibility, readiness and proximity to the producers.

The ministries of agriculture and related institutions and bodies are in charge of extension of knowledge and technology in the fields of pastoralism and related disciplines and activities in Arab countries. Various approaches and methods are adopted to achieve diverse objectives, among which; (i) developing the pastoral sector through embracing appropriate management systems, improving rangelands productivity and condition, upgrading livestock production and health techniques. (ii) Strengthening the participatory approach, (iii) improving livelihoods and combating poverty, (iv) assuring the sustainable management of the natural resources and environmental protection, (v) encouraging and stimulating initiatives Qhiss, 2017; Assiri, 2016; Khair, 2017).

The approaches and methods adopted in the Arab pastoral extension programmes include:

- The participatory approach as an essential element for defining the areas and types of actions and of involving pastoral communities in defining development programs,
- Pastoralists' technical advice,
- demonstration plots,
- Capacity building of the target groups in fields related to rangelands and animal husbandry and improving the skills of extension professionals,
- Establishing agreements with research institutions and involve stakeholders to set research and extension objectives and priorities,
- Sensitizing the targeted groups, at all levels, including decision makers, to the importance of the SRM,
- Producing brochures, technical reports, and multimedia related to SRM,
- Organizing pastoralists and related target groups in cooperatives and professional bodies to strengthen the SRM in Arab countries.

Several constraints face pastoralism extension specialists in the Arab countries, including:

- Under staffing of extensional institutions and low extensional and technical skills,
- Low level of involvement and participation of the pastoralists and their organizations in the extension efforts,
- Insufficient allocation of funds and equipment to the pastoral extension efforts,
- Organizational constraints concerning limited adherence of pastoralists to cooperatives (4% in Tunisia for instance),

- Multiplicity of extension institutions and lack of coordination among them,
- Low involvement of research institutions and researchers in the extension and advising programs and operations (Qhiss, 2017; Assiri, 2017; Khair, 2017).

3.2.5. Recommendation for knowledge production and dissemination in the Arab Region

In light of the present review, Arab Countries are in need of adopting policies, and mobilizing more resources and funds, to revive traditional knowledge, strengthen scientific research, and create knowledge and develop/adapt technologies. Countries must allocate more budget and qualified human resources to research in range ecology and management principals, concepts, approaches, techniques and technologies. Such policies and actions are vital for achieving SRM and LDN targets, obtaining healthy and productive pastures, and for improving pastoralists' livelihoods and resilience.

In addition, Arab countries must develop adequate knowledge sharing and dissemination platforms, and with the assistance of the regional and international institutions make the best use of the available regional and international knowledge sharing networks. The objective is to bring together rangeland users including pastoralists, agro-pastoralists, farmers and other rangelands users, in addition to scientists, researchers, developers and extension workers, to learn, discuss, develop/implement policies, strategies and programs mutually beneficial and appropriate SRM and LDN schemes and technologies.

The Arab Network for Sustainable Range Management represents an opportunity for the region to strengthen its common efforts to achieve SRM and LDN goals and improve pastoral communities' livelihoods. Only 14 countries have activated their membership in this network up-to-now. The other countries should adhere and the network's capabilities and services require developing.

Arab countries' LDN reports, voluntary goals and NDCs include various costmary and modern practices and technologies aimed at protecting the land from degradation, achieving sustainable management and mitigating/adapting to climate change, but with great variation among and within countries, and great discrepancies in their application and their efficiency. We, therefore, recommend taking advantage of the discrepancies and strengthening the cooperation among Arab countries and with the international community, with the coordination and facilitation of AOAD, FAO, IUCN and the other regional and international organizations, and seizing the opportunities available under the Rio conventions.

Awareness plays the main role in giving rangelands and pastoralists the status they deserve and raise their priority in public development programs. Awareness also seeks to correct the behaviour of the public and rangeland users to treat rangelands with respect and protect the resources from abuse, pollution and degradation. Awareness in the field of rangelands must target all the groups of society, especially educators, decision makers, and various government agencies concerned with laws' promulgation, enforcement and application (justice departments), investment and environmental conservation. Awareness should also target the private sector actors, as they are potential investors in rangeland restoration, but

they do not always understand the returns of engaging in RL restoration. Awareness must start at the early educational stages, and must use all modern means, from visual and audio means, social media and others.

3.3. SUSTAINABLE MANAGEMENT OF RANGELAND RESOURCES

The United Nations defines sustainable land management (SLM), which applies perfectly to SRM as "the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions".

Based on this definition, SRM consists on adopting range management systems, approaches and practices, which enable rangeland users/pastoralists to maximize the economic and social benefits from the rangeland while preserving or improving the ecological support functions of the rangeland resources.

The productivity and sustainability of rangelands and pastoral systems are determined by the interaction among land resources - the vegetation community and soil -, animal resources -livestock and wildlife -, climate and human activities. Such interactions and their response to natural events such as droughts, wild fires, and diseases have been throughout history the warrant of a natural ecosystem balance, assuring resilience and sustainability.

However, with the human activities intensification at the expense of the environmental resources, as result of population increase, progress in exploitation technologies and continuous quest for development, and with the new challenges represented by the climate change, rangelands in particular and global land resources in general, are suffering from land degradation, desertification and biodiversity loss. SRM, which balances the economic and services outputs from the rangelands with the social and environmental components, is the solution to the current rangelands miss management and abuse.

Among the mistakes made is to manage rangelands for a single or limited number of services, especially livestock production. Holistic approaches are necessary to take into account ecological, economic, social and cultural aspects, as well as all the all components, including soil, vegetation, livestock, wildlife, and the pastoral communities, in addition to all ecosystem dynamics and services.

3.3.1. Pastoral systems in the Arab region

Four main pastoral systems are practiced today by livestock producers in the Arab region; nomadic, semi-nomadic, sedentary and agro-pastoral (Figure 16). These systems are based on common access to rangeland and are distinct from each other by the degree of herd mobility, feeding strategies, herd size, livestock performance and the type of herding labour utilized (Darfaoui, 1998 and Al-Haj, 2014).

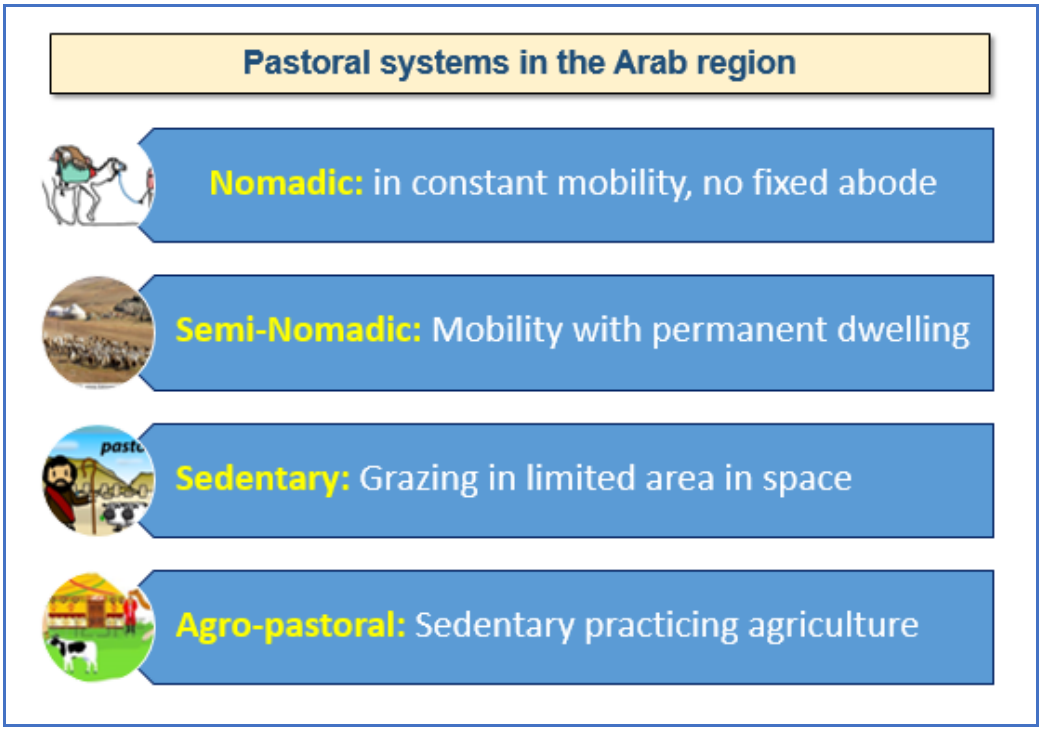


Figure 16. The Main pastoral systems in the Arab region

i. Nomadic pastoral system is traditionally the most widely practiced system. It consists of pastoralists generally without fixed abode in constant mobility in search of range and water for their livestock. This system is in constant regression in Arab countries, but still in practice by pastoralists grazing about 50% of small ruminant in the Arab region and more than 70% of livestock population in Sudan.

ii. Semi-Nomadic pastoralism also called transhumance is when pastoralists/herders have a permanent dwelling, but move about from place to place, usually seasonally and often between limited numbers of pastures ecologically complementary, such as mountain/plain, desert/grassland, according to the water and food supply.

iii. Sedentary pastoralists graze their flocks within pastures of limited areas, generally not exceeding 10-20 km in diameter. The low mobility that characterizes this pastoral system makes livestock less dependent on rangelands and relies more on large amounts of tracked feed and water. Sedentary pastoralism is believed to lead to rangeland degradation, as consequence of heavy stocking rates and permanent overgrazing.

iv. Agro-pastoralism is a system practiced by sedentary pastoralists who graze their animals on rangelands, and at the same time practice rainfed or irrigated agriculture, generally to produce cereals and/or fodder crops. Pastoralists in this system supplement their livestock by grains, agriculture residues and sometimes fodder crops such as alfalfa.

In Jordan, Abu-Zant and his co-workers (2005) reported the percentage of livestock producers adopting the sedentary, transhumant and nomadic systems at approximately

30.4, 59.2 and 10.4 %, respectively. In eastern Morocco, nomadic pastoralists represented approximately 10% of the entire pastoralist population of the area and owned 23% of the total range livestock. Semi-nomadic pastoralists represented 36% and controlled 41 % of the livestock, while sedentary livestock producers represented about 53 % of total number of pastoralists in the study area and held 37% of the livestock. According to Darfaoui (1998), the people of the study are becoming increasingly sedentary, and the reasons behind this phenomenon are mainly related to increasing food shortages and the attractive forces of modem life, such as needs for education and availability of health services.

The analysis of the dynamics of the pastoral systems in the Maghreb, as is the case in most Arab countries, shows an acceleration in sedentarisation of nomadic and semi-nomadic pastoralists, as result of policies followed by Arab countries since colonial intervention and with the advent of independence at the end of the 1950s. Such policies resulting in agricultural development, exodus and emigration, change in consumption patterns, increasing feed shortages, and the attractive forces of modem life, such as needs for education and availability of health services (Darfaoui, 1998 and Abaab et al., 2000).

Among the experiences worth mentioning is the sedentarisation of the Western Savanna's nomads in Sudan. Seven settlements containing 300-400 families each, benefited from farms of about 30 hectares per family, surrounded by collective pastures. Dug wells supplied the water. In addition, the settlements were provided with social infrastructure and services (schooling, health, women and youth centers), and agricultural extension services and infrastructure. This initiative was welcomed by beneficiaries and generated request for more settlements. The project was concerned with the sustainability of the services it provided, and therefore set real prices for these services even before the national liberalization policy. For this reason, and others, as soon as the project's funding ended, its assets were dispatched and it became history (*Fadlallah et al., 2018).*

Despite the many disadvantages of the traditional nomadic grazing system, it remains the best option currently available in Sudan when compared to other systems, such as ranches or mixed farms. The traditional system is most suitable for fragile environments, as it takes advantage of the ecological and agro-pastoral diversity in the region and allows better pastoral loads distribution over large areas. Furthermore, mobility, which is the keystone in the traditional communal grazing, provides solutions to tribes that do not own land, and who can exercise usufruct rights without entering into ownership complications. The challenge now is to maintain and develop this system, which is a way of life and means of livelihood for many families, in a way that keeps its advantages and benefits, as communal mobility-based system, while minimizing its disadvantages and reinforcing its strengthens (Khatir, 2014).

3.3.2. Global practice of rangeland management and theoretical advances

3.3.2.1. Grazing plans/systems

Grazing plans or grazing systems are ways of raising and handling livestock within a particular area. Their objective is to achieve one or more of the following objectives: increase productivity and therefore income, improve quality of products, improve range condition and health, adjust stocking rate and improve animal distribution, assure uniform

forage utilization and control selectivity of forage, and coordinate livestock, wildlife and other rangelands uses (Heady and Child, 1994).

The Hima system is the first grazing system documented in history, and practiced for centuries in the Middle East (Draz, 1978). Rotational grazing systems have been advocated in Europe, America and in the world for more than 250 years now. In Saudi Arabia was known to harbor around 3,000 Himas till 1960's, clear decline in local decision making and participation in Himas' land management followed the government decision to take over land management

Continuous grazing involves one pasture where animals are grazing year round. Rotation grazing plans are schemes involving rotation of grazing animals through two or more pastures, which are then allowed to rest for any given period to allow natural regeneration of the vegetation community and soil. There are several rotational grazing plans practiced worldwide, namely (Heady and Child, 1994):

- Deferred-rotation plans, where at least one pasture is ungrazed until after seed production each year.
- Rest rotation plans, where more than three pasture, usually of different range types, are utilised to rotate one or more herds to control stocking density, frequency and grazing time, and to optimize fodder and animal production and conserve/improve the rangeland.
- High-Intensity/low frequency plans also known as unselective grazing involves heavy grazing pressure on pasture for a short period of two weeks or less followed by ungrazed periods of 6 weeks to 5 months. The objective is to reduce unpalatable species, favour the palatable ones, allow enough time for recovery for defoliation, reduce fire hazards by reducing standing dead material in the dry season, and loosening the soil surface by hoof action.
- Short-duration grazing plans, also called the Savory Grazing Method or Holistic ranch planning (Savory, 1988), is similar to non-selective grazing plan, involving 4-40 cells (pastures), and a rotation of 1-5 days grazing and 30-60 days ungrazed period, and both longer during vegetation dormancy. The high densities of animals were claimed to exert favourable effects of even distribution, trampling, chipping of soil and distribution of dung and urine. The system recommends increased stocking rates for the cell, sometimes more than 50%.

Each of these systems has application in different environments and for specific objectives and each of them has strong points and weaknesses. Such systems also may require fences, intensive labour and heavy investments. Rotations are easier to apply in ranching operations.

In the situation of pastoralism, in the Arab region and in the world, the multiplicity and the complexity of the system's intrinsic factors related to land tenure, collective land use, historic, traditional and cultural load, multiplicity of regulation and institutions, and harsh environment, lead to the development of pastoral systems described earlier.

In the efforts by Arab countries and others to adapt certain of these grazing plans to the pastoralism situation, they have adopted certain traits and practices, such as pasture rest, deferment rotation, which in fact are ancient practices part of the local Hima system. However rotations as are applied in the ranching operations are simply hard to apply, unless

rangelands of adequate size managed by individuals or communities/cooperative with full control over their tenure rights and with full government support.

3.3.2.2. Theoretical advances and there implications

Ecological advances during the last three decades have demonstrated that the Clementsian concept of single equilibrium rangelands vegetation communities and deterministic succession pathways do not apply in arid and hyper-arid ecosystems. Current ecological theory allows for alternative stable states, discontinuous and irreversible transitions, referred to as non-equilibrium communities, State-and-Transition, and stochastic effects in succession (Westoby et al., 1992). The animal and plant populations, which rangeland ecosystems can sustain, will fluctuate unpredictably with annual shifts in the three amount, timing and spatial distribution of rainfall, fire, disease outbreaks, etc. These grazing systems may be in constant disequilibrium (Behnke, 1992).

This paradigm shift has three main implications on the management of drylands pastoral resources in Africa and in the Arab region, on the carrying capacity, herd mobility and tracking and management strategy issues (Behnke, 1992).

Carrying capacity/stocking rate

Confusion between ecological and economic carrying capacity can be misleading and result in erroneous carrying capacity estimates. Ecological carrying capacity can be defined as the point at which livestock populations cease to grow because limited feed supplies produce equal death and birth rates. Economically optimal stocking rate vary, however, according to producers' husbandry practices and management objectives. Determination of the correct stocking rate in a particular area is a process of reconciling the multiple production objectives and the environmental requirements. This implies that local communities must contribute to determining stocking rate levels and be ultimately responsible for enforcing agreements on stock numbers. Authorities must provide technical assistance, rather than attempt to impose centralized control.

Herd mobility and opportunistic management

Rangelands in the Arab region are ecologically heterogeneous at various spatial and temporal scales. The heterogeneity among different range types, landscapes and sites (patch, valley, mountain, plain, riparian vegetation, desert) and seasons provide a complementarity among pastures and offers year round livestock feed, varying in nature and nutrition. The most appropriate way to benefit from this variation and complementary is through herd mobility, by being in the right place at the appropriate time with the appropriate number of animals. This is the rationale behind opportunistic management. In this context, land tenure, and laws and regulation must favour herd mobility and allow for safe and durable tracks and corridors, rather than be an obstacle to transhumance and nomadism. This should be the case at local, national and regional scales. As mentioned earlier transboundary mobility can be beneficial and sometimes necessary, and can be regulated through establishing mechanisms such as bilateral and multilateral treaties and agreements on transhumance.

Tracking and management strategy

Ecosystems at non-equilibrium are characterized by fluctuations in production in both time and space, as result of variability in rainfall amount and spatiotemporal distribution, soil characteristics, fire occurrence, disease outbreaks, etc. Effectively tracking fluctuations in rangeland productivity requires the ability to rapidly destock and restock rangelands, the provision of feed supplements to cover temporary shortfalls in forage production from natural rangelands, and the provision of credit, insurance or other social security measures which will dampen the economic impact of unavoidable environmental fluctuations. Planning for drought and the provision of a degree of security against impoverishment would be essential features of range management in dry and highly variable regions, where producers are at risk.

Grazing plans

3.3.2.3. Recommended pastoral grazing plans/systems.

In the Arab countries, where rangelands are ecosystems not at equilibrium, favouring livestock mobility is a necessity, as means of making benefit of the ecosystems diversity and variation in forage and feed quantity and quality and water availability, and as deferment and rest rotation strategies. Mobility reduces risks for pastoralists to suffer from the impact of fluctuations in production related to climate variability and change, and from drought and disasters and it increases resilience. The tracking and management strategy described above, within a holistic approach embracing multiple use and multisector synergies , and involving reliable criteria and indicators, is recommended, with the enabling policies, strategies, regulations, practices and incentives, especially those related to CBRM, participation, control of pastoralists over the resources and assuring infrastructure, and professional and social services. Such tracking and management system is in fact in practice in most Arab countries, but in diverse forms, and lacking scale, tracking vigilance, holistic approach, adequate response to drought, and enabling conditions for CBRM and SRM.

Reviving Hima and Agdals and benefiting from traditional knowledge and traditional governance of rangelands can be appropriate solutions when applied at the appropriate scale and involving community-based management and partnership among all stakeholders in good synergy.

3.3.3. Biodiversity conservation and reinstatement ecosystem services

3.3.3.1. Biodiversity and biodiversity conservation in Arab rangelands

Recognition of biodiversity importance came from its impact on ecosystem's resilience, functioning and services. Ecosystem services can be grouped into four categories; provisioning, regulatory, sustaining and cultural/aesthetic services (MEA, 2005).

Rangelands include various vegetation types including grasslands, scrublands, woodlands, wetlands, and deserts, and are found in all continents. Rangelands' fauna, especially herbivores, and flora have co-evolved over history, where some of rangelands are among biodiversity the world's richest systems (Alkemade et al, 2010; Mannetje, 2002).

Arab countries are located within different continents and reveal tremendous geological and climatic variations, which lead to the development of various bioclimatic zones and considerable biological variation. These diverse bioclimatic regions supported the development of rich biological diversity, and healthy rangelands with large number of palatable species. Furthermore, many species recorded in Arab countries are endemic (occurs only in that specific country). Arab countries embrace around 12,000 plant species forming rich habitats for diverse fauna. Additionally, the Arab world is rich in agro-biodiversity, as it comprises one of three crops hotspots on the global level and three Vavilov centers of diversity (Regions where a high diversity of crop wild relatives can be found, representing the natural relatives of domesticated crop plants, they are in number of 12). Two of these centers are the origin of more than 150 cultivated crops (AOAD, 2014). Table 10 shows some examples of flora diversity in Arab countries.

Table 10. Examples of Arab countries with number of registered plant species

Country	Egypt	Kuwait	Lebanon	Libya	Oman	Palestine	Somalia	Syria	UAE	Yemen
Number of species	2,145	386	3,790	1,750	1,200	2,000	5,000	3,000	731	2,871

Source: Compiled from Arab States Strategies and National reports (CBD, 2020a).

Rangelands in the Arab world are of six main types:

a. Artemisia herba alba pastures
b. Stipa tenacissima pastures
c. Anabasis sp. pastures
d. Halophytes pastures
e. Psamophytes pastures
f. Acacia sp. pastures

There is a consensus on the fact of rangeland degradation results in direct loss of biodiversity, in all its forms fauna, flora, microorganisms and ecosystem diversity. Change in biodiversity is one of the criteria for land degradation tracking adopted by the UNCCD's as part of its PRAIS system. Rangeland degradation also affects ecosystem productivity, land cover, soil and carbon stocks. The causes of rang degradation, as reviewed earlier are driven by anthropogenic activities and exacerbated by harsh environmental conditions and climate change. Population growth, urbanization, agricultural expansion and lifestyle shifts increased the demand on livestock products in unprecedented way. This pressure associated with poor rangeland management and governance resulted in overgrazing, tree and shrub cutting, fires, invasive species and ultimate rangeland resources degradation.

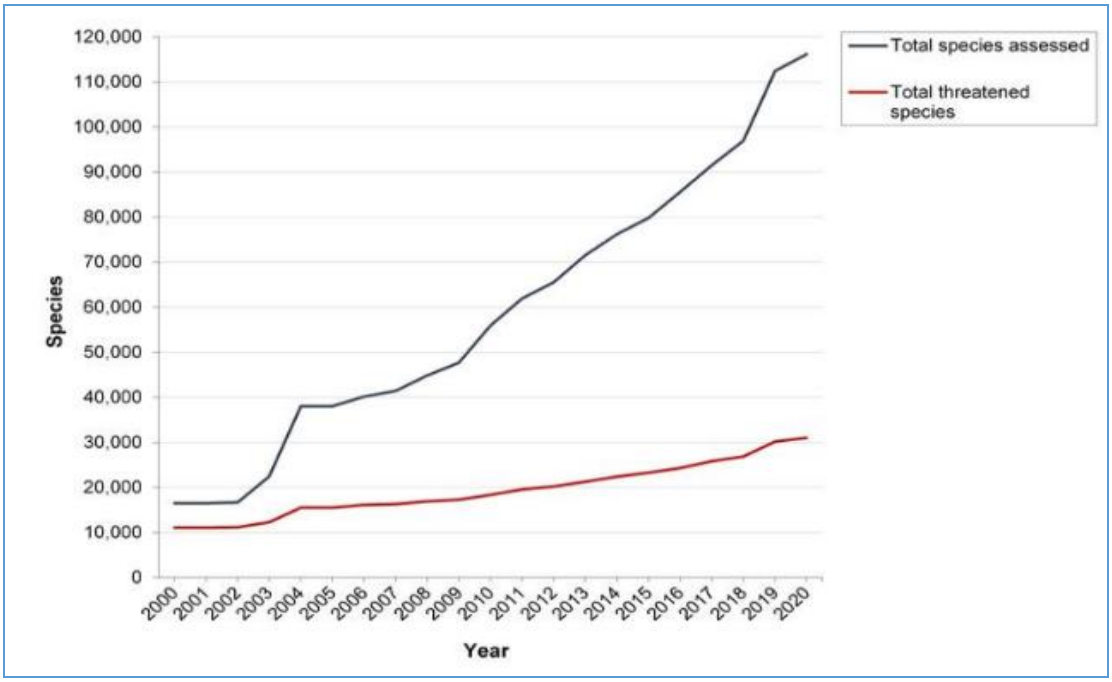
Disputes, conflicts, wars and occupation have been among of the direct causes of rangeland degradation in the Arab region, as in the case of Jordan, following the gulf war and during the Syrian crisis, and in Sudan, with increase of the grazing pressure on the remaining rangelands, after the separation of South Sudan. Internal disputes and conflicts in many countries, including Iraq, Libya, Somalia, Sudan, Syria and occupation in Palestine, all had

tremendous negative impact on rangelands in these countries and caused their degradation, resulting in biodiversity loss (AOAD, 2006 and 2014).

Although rangeland degradation occurs at various levels and can be assessed using natural vegetation, soil and watershed indicators, those of flora biodiversity are very important as they provide habitat for other species and affect other indicators significantly. Furthermore, change in vegetation mix, loss of desired palatable species and dominance of non-palatable, poisonous and invasive species are key aspects affecting rangeland health and productivity. Some suggested indicators for rangeland deterioration include (AOAD, 2006):

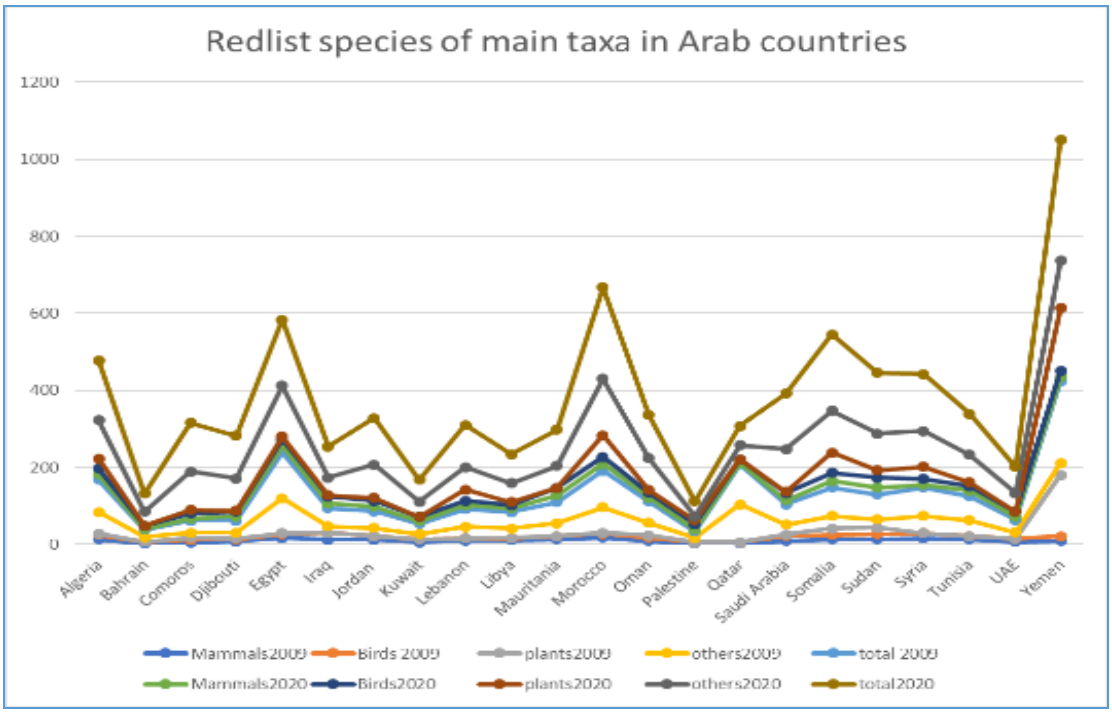
1. Natural vegetation deterioration indicators
    - Natural vegetation extent
    - Natural vegetation composition
    - Desertification
    - Watersheds disruption
    - Species extinct
    - Increased supply -demand gap
2. Soil deterioration indicators
3. Watershed deterioration
    - Destruction of natural vegetation
    - More agriculture pressures
    - Gullies formation
    - Wind erosion and sand movement
    - Conflict over water resources
    - Drought

Assessment of biodiversity in Arab countries showed that number of threatened species increased between 2008 and 2020. Although this shows degradation in biodiversity status, it can be also reflecting the efforts to inventory species and assess their situation. Figures 17 and 18 show global trend of threatened species in comparison to assessed species, and comparison of number of threatened species in major taxa between 2008 and 2020.



Source: (IUCN, 2020)

Figure 17: Global trend in number of threatened species compared to total species assessed



Source: (IUCN, 2020)

Figure 18: Comparison of red list species of main taxa in the Arab states

In terms of measures taken by Arab countries to protect and revitalize biodiversity of the flora and fauna, they have been diverse, including both *in-situ* conservation in the form of reserves and restored/improved sites/landscapes/ecosystems and *ex-situ* in gene banks, nurseries, arboretums etc. Table 11 provides some of the practices adopted by Arab states.

Table 11. Common *in-situ* and *ex-situ* biodiversity conservation measures in Arab countries

In situ	*Ex situ*
Reserves and protected areas	Seed banks
Restoration activities (protection, planting, seedlings)	Nurseries
Reintroduction of extinct fauna and flora (Arabian Oryx for example)	Arboretum
Improved management practices	*In vitro* propagation
Improved governance	Herbarium
	Establishment of mother tree stands

Source: (AOAD, 2014).

Furthermore, most Arabic countries, including Algeria, Comoros, Iraq, Jordan, Kuwait, Mauritania, Morocco, Palestine and Saudi Arabia, targeted biodiversity conservation and restoration as part of their rangelands sustainable management and restoration programs, and their voluntary targets to achieve LDN (Darfaoui, 2019).

Regionally, AOAD contributed to the Arab efforts for biodiversity conservation and development by establishing the Arab network for genetic resources conservation, with the objective to conserve important plant species and facilitate knowledge exchange among member states. AOAD also supported two studies to identify promising species with beneficial traits and potential for rangeland rehabilitation. The studies were conducted in 2006 and 2014, based on reports from Arab countries and identified 466 species of promising tree, shrub, and grasses recommended for rangeland rehabilitation, and emphasized the importance of using indigenous species for range restoration for their high adaptation to the environment and forage production and quality potential. Table 12 presents the summary of these species (AOAD, 2006 and 2014).

Table 12. Promising species for Arab rangelands' rehabilitation

	Trees	Shrubs	Grasses	forbs	Total	%
Leguminosae	34	16	0	121	171	36.5
Gramineae	0	0	142	0	142	30.3
Chenopodiaceae	0	38	0	2	40	8.5
Others	12	65	0	36	113	24.2
Total	46	119	142	159	466	100

Source: (AOAD, 2006)

The United Nations Convention on Biological Diversity comprises 196 member states including all Arab countries. Furthermore, 17 Arab countries submitted their National Biodiversity Strategies and Action Plans (NBSAP's) to the convention secretariat with activities relevant o rangeland biodiversity. Many of these countries aligned their NBSAP with the global biodiversity strategy and committed to participate in achieving the targets set by the convention secretariat (known as Aichi targets), and currently engaged in the post 2020 targets setting process.

Ethnic botany and use of medicinal native species have long roots in the Arabic culture. Furthermore, Arabic countries show high degree of endemism, which gives these countries

a comparative advantage to benefit from CBD provisions and protocols. For example, Nagoya protocol on access and benefit sharing would acknowledge a country right to benefit from their genetic resources and traditional knowledge, if they are used to develop products for commercial use.

3.3.3.2. Recommendations concerning range biodiversity

The lessons learned from this review reveal the importance of rangelands' biodiversity in Arab countries, their threat from overexploitation and degradation, and the necessity of their monitoring and conservation. Recommended measures include the strengthening of SRM to avoid/prevent/restore biodiversity loss, the enforcement of both *in-situ* and *ex situ* conservation in range reserves and protected areas, and gene banks etc., and consideration of traditional and tribal management systems and traditional knowledge for biodiversity conservation and sustainable management.

Unfortunately, traditional management systems will not operate as they have in the past due to population growth, urbanization, lifestyles shifts, decrease in land productivity and changes in modern land management and governance. So, a blend of traditional management practices and modern knowledge is required to develop suitable management systems. Reviving the essence of Hima can restore communities' interest and engagement in land management, but requires ensuring reestablishing pastoralists rights and responsibilities over land resources.

Protection of biodiversity in rangeland areas must be a main target when designing and implementing SRM plans and when seeking to upgrade/improve pastoral systems to increase productivity and diversify services and assure sustainability. Controlling herbivore pressure and selectivity through management practices, and controlling human destructive activities targeting selected plant species, will maintain a healthy vegetation community and enrich species composition, therefore maintaining a good balance among the vegetation types (grass and trees, decreaser, increaser, invader).

3.4. SUSTAINING LIVELIHOODS AND BOOSTING RESILIENCE

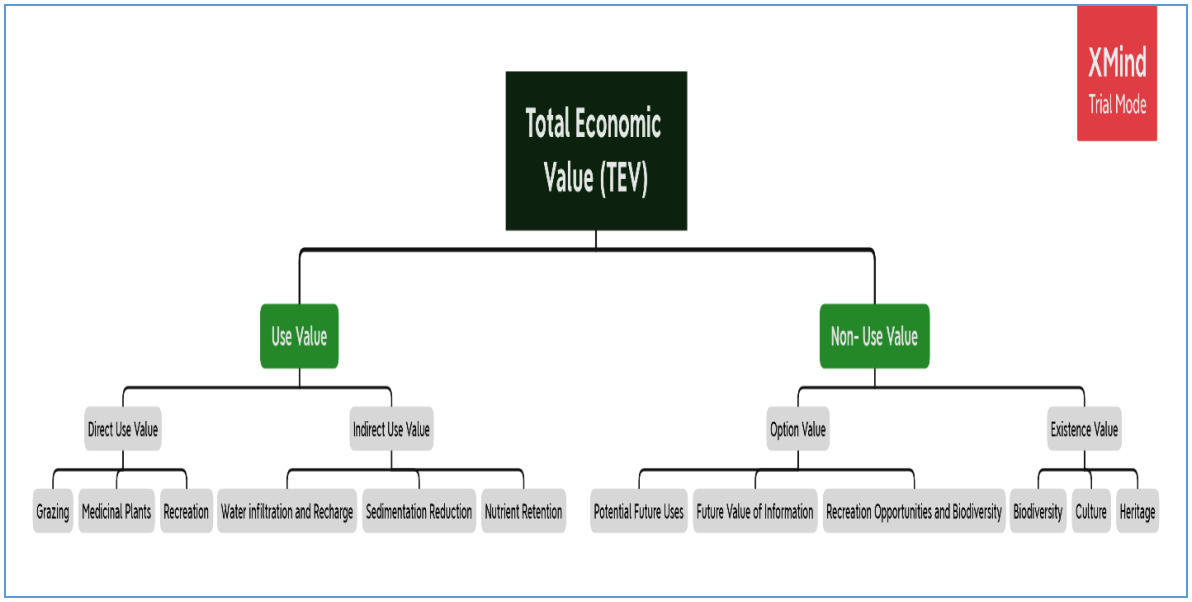
3.4.1. Benefits of sustainably managed rangelands

3.4.1.1. Valuing rangelands benefits

Pastoralists rely in their livelihoods on rangelands livestock products and the other multiple services. Rangelands are valuable for the pastoral communities due to the various services they provide, to their huge geographical extent and to their association with communities' livelihoods. The benefits provided by rangelands are myriad, both on the local and national levels, including food, feed, wood, tourism and recreation, soil and water conservation, shade and biodiversity. Rangelands are mostly managed for livestock production, thus, the real value of their benefits is often underestimated. Thus, estimated calculations can help in shedding the light on rangeland benefits value. Nevertheless, many of these benefits are hard to value. Furthermore, in many countries, rangelands are managed as public commodities, which limits the efforts for their proper valuation (Torell *et al.*, 2013).

Jabarin (2014), classified total economic value for benefits provided by rangelands into: use-value and non-used value. Use value are either direct, including grazing, medicinal plants and recreation; or indirect, including water filtration and avoided sedimentation. The non-

use value is either option value, including potential future uses, future value of information, recreation opportunity and biodiversity, or existence value including biodiversity, culture and heritage (Figure 19). An estimation conducted on HIMA area in Jordan showed that one hectare can generate around 24 USD of direct use values, but non-use values need to be estimated and added. In Jordan, rangeland ecosystems have the potential to produce around 190 Million USD. Evaluation of ecosystem services are important as an innovative tool to ensure sustainable management of natural ecosystems. Globally, ecosystem services are valued by 347 Trillion USD (Costanza *et al*, 2014).



Source: (modified from Jabarin, 2014)

Figure 19. Options to calculate Total Economic Value

ValuES, is an initiative supported by GIZ for developing knowledge and various modalities for valuing services of different ecosystems. The initiative has a well-developed virtual information platform to valuate ecosystem services and plans to support their integration in decision-making processes (ValuES, 2020).

Sustainable management of rangelands and development of livestock products and the other rangelands products and services, and diversification of income sources for pastoralists are essential to increase their income and combat poverty, improve their livelihoods and boost their resilience. This can only be achieved by assuring sustainable development of these resources via good governance and adequate practices based on scientific and good traditional knowledge, and on government sport through providing infrastructure and professional and social, economic and cultural services. This goes along with achieving LDN, adequate mitigation/adaptation to climate change and achieving all the SDG.

3.4.1.2. Alternative livelihoods for pastoral communities

Pastoral communities' livelihoods are linked with rangelands and livestock production. Even though rangelands are undergoing a continuous degradation associated with decreased productivity, pastoral communities continue, largely, to depend on livestock products as the

basis for their livelihoods. This primary source of living threatened by rangelands degradation, droughts, climate change and various uncertainties, must be enhanced/diversified based on raising opportunities and services rangelands will provide. Some of these opportunities include rangelands value chains improvement, food, aromatic and medicinal plants, and rural/eco-tourism and recreation.

a. **Products added value:** Many initiatives started to identify added-value of traditionally produced products; taste, nutritive value, social value, etc., can be very appealing for the consumer. Consumers in Arab countries and around the world are more and more concerned about food safety and organoleptic traits, and their search for organic, natural local-labelled products. Livestock products respond to these criteria, and comply with environment friendly production systems, making them more appealing for consumers compared to other commercially mass-produced goods. Pastoral products are also known to be healthier and much tastier due to their production system and dependence on native vegetation full of aroma and healthy compounds. Consumers tend to be willing to pay more for these products knowing that beside their investment in quality, they will support some most disadvantaged community groups. and improve their livelihoods.

   In Jordan, an initiative aimed to produce branded products under the name "Awasi" reflecting the local sheep breed. This initiative is expected to improve the marketing and therefore, the revenue of the pastoral communities.

b. **Eco-tourism, recreation and hunting games:** There is an increasing trend in a "back to the roots movement", where populations residing in urbanized areas enjoy visiting rangeland areas to experience Bedouin lifestyle, enjoy landscapes, and some enjoy participating in hunting games. These activities are associated with a long chain of service providers including catering, accommodations, handcrafts, local products, etc. Many well-established tourism modalities over the globe and within Arab countries have already developed such products. These models can be capitalised and up scaled to maximize the benefit for local community and improve their income and livelihoods.

c. **Innovative environmental financing mechanisms:** International agreements and conventions entails strong support to indigenous communities and traditional management systems to support their livelihoods. Some opportunities can be summarized in the following:

   Carbon markets: Rangelands are known for being one of the largest terrestrial carbon reserves. There is an opportunity to generate income to pastoral communities by supporting carbon markets both by minimizing degradation and improving rangeland restoration efforts (Hasan, 2017; Jabarin, 2014).

   Payment for ecosystem services schemes: Similar to the carbon markets, which can be included under this broader category, but other services can be included here as well. The payment for ecosystems services (PES), by consumers to communities maintaining these services through management practices to assure adequate levels and quality of the products. Water supply and quality

might be the most relevant to dry land countries. Here, communities living downstream should pay (or part of what they pay), is directed to support communities living up stream, so that they continue supporting healthy watershed management practices. The same concept can be applied to various relevant services. Although this approach appears very relevant and has a great potential, adequate implementation methodology is required, as these market-based mechanisms with spatial and temporal extent might require a very strong and complicated implementation and monitoring mechanisms (URS, 2013).

Nagoya protocol (Equal Access and benefit sharing): The Nagoya Protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilization, related to the CBD, acknowledges the value of traditional knowledge and genetic resources. For example, countries are entitled to claim their rights in profits/ benefits generated from commercialized products that are based on well-documented local knowledge of certain endemic rangeland species being utilized for medicine. Food, industry, etc. Nevertheless, this requires proper documentation of this local knowledge to support these claims. Pastoral communities have relied on natural products for ages as source for medicine, food and livelihood, so this can be a good opportunity to use this knowledge as potential income generating possibility (CBD, 2020a).

d. **Restoration value chain opportunity:** Rangelands in the Arab countries are undergoing degradation. Nevertheless, restoration of these degraded lands can provide an opportunity to improve the livelihoods of local communities. Restoration value chain can be perceived as a good income generation possibility, since it provides a myriad of income generating activities and green jobs for males and females. These opportunities include collection of seeds and other propagation materials, community nurseries can generate various green jobs, especially for women, green jobs for landscape restoration, including planting, irrigation and guarding. These communities will benefit from national and international support to restore degraded rangelands. Eventually, restored rangelands will provide myriad of benefits to ensure the sustainability of generated benefits to the community.

3.5. REGIONAL LIVESTOCK DEVELOPMENT POLICY FRAMEWORKS

In the majority of the dry and semi-arid areas, livestock is often the main source of income and food security for rural households. The livestock sector's contribution to the gross value of agricultural production (in US$) varied in 2015 from 24 in Tunisia to 45 % in Kuwait. The global livestock population expanded by 16 percent between 1993 and 2013, while, it increased by 25% in the Near East and North Africa region, from 77 million livestock units to 96 million through the same period (FAO, 2016a).

This expansion of livestock population may put the rangelands under critical pressure, which in turn may affect the food security. Livestock are not competing with humans, since they can convert the nonedible products, such as grass in pastures, to edible material such as milk and meat for human consumption. This chapter reviews the livestock sector in the Arab Region and its relationship with rangeland, aiming to strengthen SRM.

3.5.1. Livestock population in the Arab region

The total World livestock population size was estimated in 2018 at 3,993.69 million head, in which 8.72 % (348.31 million heads) found in the Arab World (Table 13). The Arabian livestock number increased by 9.37 percent compared to the estimated number in 2011. Diverse livestock species survive and produce in the Arabian region under harsh conditions. The total number of the Arabian economic farm animals are estimated (in millions) to be; 54.52 cattle, 3.66 Buffalo, 182.45 Sheep, 91.07 Goat and 16.62 Camels. The high percentage (78.5 %) of the small ruminant's population; sheep (52.4%), goats (26.2%) may be attributed to the main dependency of the majority of livestock on traditional pastoral systems (AOAD, 2019). During the 2011-2019 nine-years-period, the livestock population in the Arabian Region recorded a decrease in goat and cattle populations, estimated at 3.45 % and 0.65 % respectively, but increased by 3.58 % for sheep (AOAD, 2011 and 2019).

Table 13. Change in livestock populations in the Arab region and worldwide between 2015 and 2018 (million head)

Year	Arab countries						World					
	Cattle	Buffalo	Sheep	Goat	Camels	Total	Cattle	Buffalo	Sheep	Goat	Camels	Total
2015	54.22	3.9	179.22	91.8	16.22	345.37	1489	196.4	1176.9	1,000.5	33.1	3,895.9
2016	54.91	3.65	182.16	92.35	16.42	349.49	1468.1	199.4	1188.5	1,025.6	33.8	3,915.5
2017	54.89	3.82	181.82	91.48	16.49	348. 5	1491.7	201	1202.4	1,034.4	34.8	3,964.3
2018	54.52	3.66	182.45	91.07	16.62	348.31	1485.7	203.5	1214.8	1,054.1	35.6	3,993.7

Source: (AOAD, 2019)

FAO statisticians revealed a dramatic increase in the numbers of cattle, sheep, goat and camels when they pursue their count through the years 1967, 2007 and 2016 in certain MENA countries. The biggest increase was observed in sheep population especially in Algeria that was estimated to be 7.13 at 1967 and was elevated to 28.14 million in 2016 (Table 14).

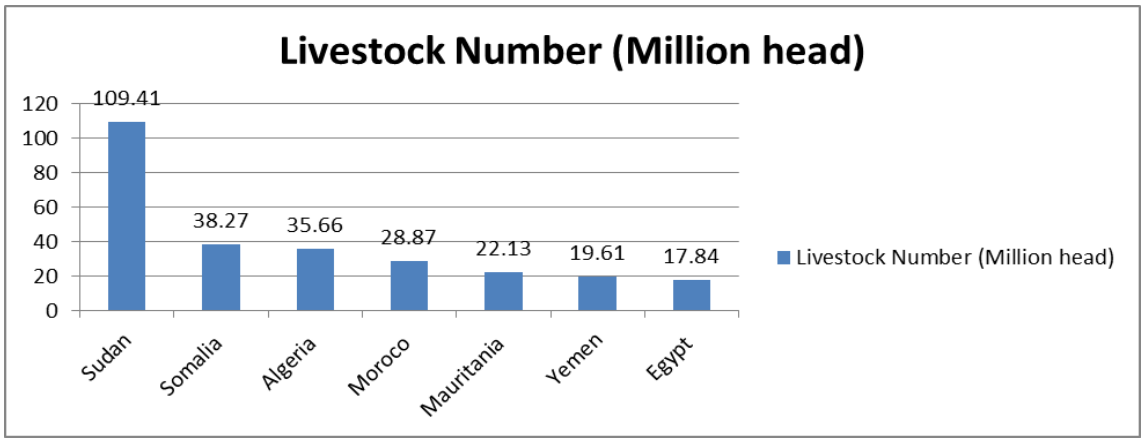
Table 14. Change in the major livestock numbers (million heads) in selected MENA countries in 50 years

Country	Cattle			Sheep			Goats			Camels		
	1967	2007	2016	1967	2007	2016	1967	2007	2016	1967	2007	2016
Algeria	0.80	1.59	2.08	7.13	19.50	28.14	2.32	3.7	4.94	0.175	0.265	0.379
Iran	4.95	9.78	5.66	30.47	52.22	42.5	13.33	25.86	19.1	0.195	0.146	0.101
Morocco	3.38	2.7	3.3	13.41	17.25	19.87	7.63	5.30	5.60	0.222	0.036	0.058
Saudi Arabia	0.12	0.37	0.361	2.11	7.00	11.01	0.70	2.20	2.597	0.091	0.260	0.248
Syria	0.47	1.15	1.144	5.74	21.0	17.92	0.83	1.35	2.496	0.010	0.024	0.070
Yemen	1.26	1.48	1.81	2.57	8.42	10.21	3.20	8.22	9.156	0.236	0.361	0.480

Sources: (FAO, 2020a).

The changing demands for the livestock products is largely affected by the growth of human population, its income and urbanization, which encouraged animal scientists and the livestock production sector to adopt new technologies contributing to the increase in the livestock numbers (Thornton, 2010). Many factors also may contribute to the change in livestock numbers such as the availability of rangeland and feed Subsidy policies.

Sudan hosts the majority of the Arab livestock population (31.41 %) while the following countries Somalia, Algeria, Morocco, Mauritania. Yemen and Egypt contribute by only 10.99, 10.24, 8.29, 6.35, 5.63, and 5.12 % of the total Arab livestock population (Figure 20).



Source (AOAD, 2019)

Figure 20. Livestock Numbers in the major Arab countries

3.5.1.1. The Importance of livestock

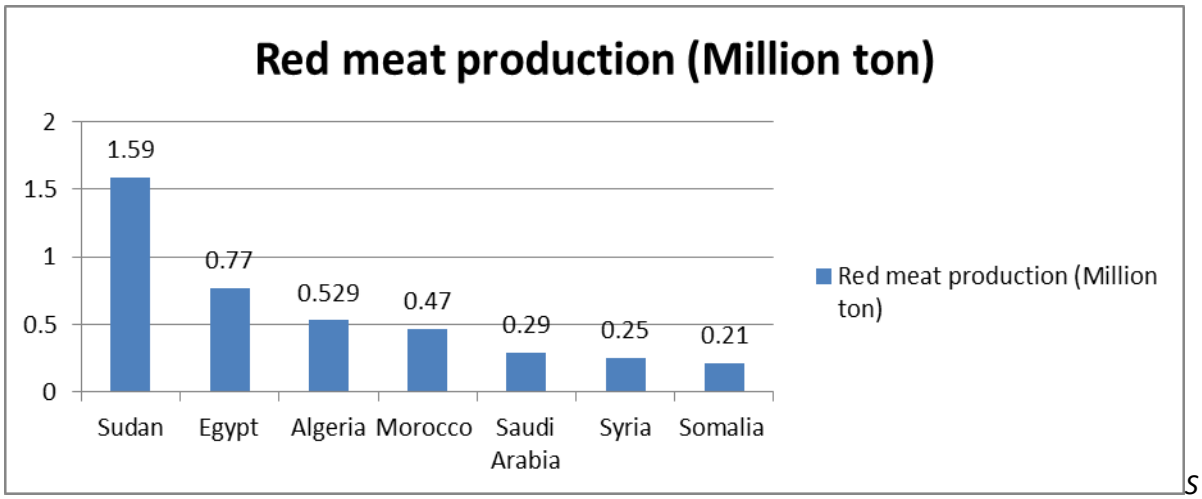
The high number of livestock found in the Arabian region along with massive importing of live animals and/or animal products in many countries may be attributed to many factors, including the low productivity of animals and rangelands the majority of which (90%) are arid and hyper arid (FAO, 2015a).

The major Arab countries' red meat producers are Sudan on top of the list, with the production of about 31.9% of the total Arabian red meat production (estimated to be 5.0 million tons at 2018) (Table 15), followed by Egypt (15.5%), Algeria (10.6%), Morocco (9.4 %) and Syria and Somalia with about 4 percent each (Figure 21) .

Table 15. Total meat and milk production in the Arab region during 2015 - 2018 (Million ton)

Animal product	2015	2016	2017	2018*
Red meat	4.43	4.44	4.50	4.98
Milk	27.25	2.78	28.12	28.37

Source (AOAD, 2019)



Source: (AOAD 2019)

Figure 21. The major Arabian countries contributors to red meat production (Million ton)

3.5.1.2. Forage sources in the Arab countries

The Arab countries differ in the sources of livestock feed. This difference is due to natural conditions and the availability of natural pastures, their area, and productivity, as well as economic and social factors, which play a major role in fodder sources from a country to another. In addition, the availability of agricultural areas and water resources are key factors for cultivating forages.

Natural pastures are an important forage source because they represent an easy and accessible natural fodder resource. Furthermore, their forage trees and shrubs are of great importance in the dry season. Other fodder sources represent an important food source in some countries; including roughage feed (crop residues or byproducts), agricultural industrial byproducts, irrigated forage, compound feed, and cereals, especially barley.

Forage crops are good source for countries with adequate rainfall and/ or abundant resources of irrigation. AOAD data for the period 2004 - 2016 showed that the total fodder crops area in the Arab world increased by 12.6%. It increased from 2,333.6 thousand hectares in 2010 to about 2,627 thousand hectares in 2016 (Table 16).

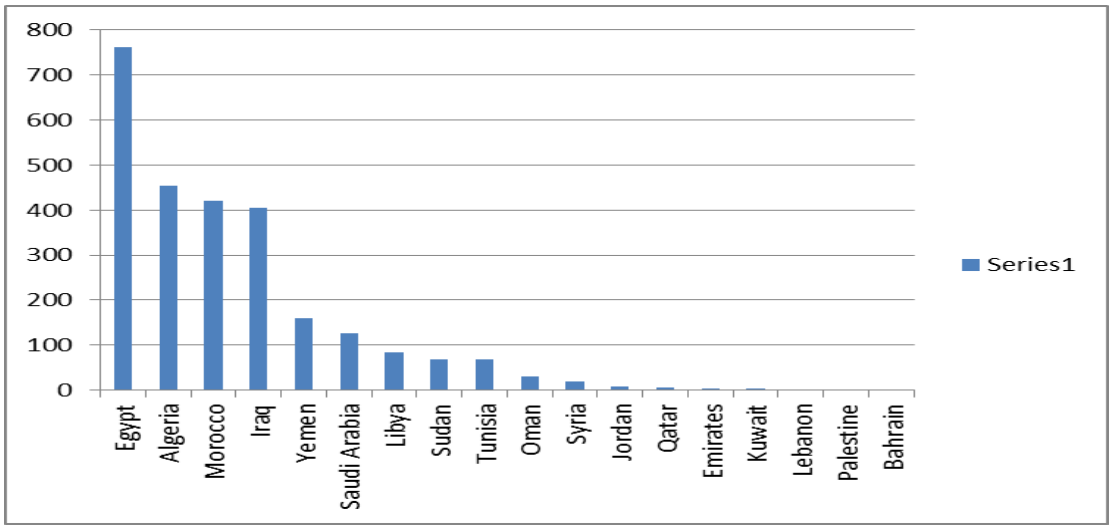
Table 16. Areas cultivated with irrigated Forage in Arab countries (2010-2016) (1000 ha)

Country	2010	2011	2012	2013	2014	2015	2016
Algeria	121.3	378.5	425.9	364.9	426.8	384.5	454.1
Bahrain	0.57	0.6	0.6	0.56	0.7	0.67	0.66
Egypt	994.9	1005.8	924.6	839.7	788.4	774	761.1
Emirates	29.26	29.3	4.5	4.6	4.6	4.63	4.6
Iraq	39.25	41.2	84.5	106.2	405	404	404
Jordan	6.58	2.2	4.4	5.9	2.5	2.6	8.9
Kuwait	3.17	3.2	4	3.8	4	3.7	3.7
Lebanon	3.03	3.03	3	3	3.03	3	3.0
Libya	86.00	86	86	85	86	84	84
Morocco	507.6	440.3	424.4	427.4	488.3	420	420
Oman	21.80	20.3	18	20.4	19.4	30.7	30.6
Palestine	1.30	1.3	5.2	14.5	14.5	3.4	2.8
Qatar	4.83	3.90	5.2	7.09	6.1	6.7	6.7

Saudi Arabia	122.5	123.8	125.6	126.6	498	126.9	126.9
Sudan	101.6	103.7	104.2	106.7	73.5	66.8	68.5
Syria	68.1	84.9	84.9	83.9	25.4	53.9	20.5
Tunisia	55.80	55.8	55.8	55	84.2	54.8	68
Yemen	166.0	122.7	178.6	158.4	158.4	159	159
Total	2333.6	2506.6	2539.5	2413.8	3088.8	2583.3	2627

Source: (AOAD, 2019)

During 2016, Egypt recorded the largest fodder crops area by 671 thousand hectares, which is about 25% of the total cropland surface in the country, followed by Algeria, Morocco, and Iraq with 454, 420, and 404 thousand hectares, respectively (Figure 22).



Source: (AOAD, 2019)

Figure 22. Area planted with irrigated Forage in Arab countries in 2016 (1000 hectare)

There are differences among Arab countries in the quantity and the quality of the crop residues or by-products used as animal feeds. Sources of such residues include agricultural field residues and the manufacturing by-products that resulted during processing. The total Arab agricultural residues were estimated in 2004 at about 98.7 million tons, including 82.2 million tons of plant crop residues and 16.5 million tons of plant food processing residues (AOAD, 2019).

In addition, concentrate feeds, especially barley, corn, and mixtures of compound feed, are of important feed source for livestock in the Arab world. In a number of Arab countries, the usage of feeding blocks has been increased significantly in the recent years, as they are used as complementary feeds for intensive livestock production (Mashreq Maghreb project, 2011).

3.5.1.3. Livestock production systems and grazing patterns

In addition to their role in human nutrition, livestock plays important economic, social, environmental and cultural roles. The diversity within and among livestock species is the key for their ability to cope with environmental variability and to provide for consumer preferences and demands. The local Livestock breeds and mainly small ruminants play a significant role in the livelihoods of human kind. In the Second Report of the State of the

World's Animal Genetic Resources for Food and Agriculture (FAO, 2015b), 681 goat breeds were reported, 20 of which were characterized by their high adaptability to dry environment and water scarcity, 7 to high humidity and 30 to heat. While 1283 breeds of sheep were reported, 55 of which were adapted to dry environment, 21 to water scarcity, two to high humidity and 83 breeds were reported as heat tolerant sheep breeds.

In the developing countries, the low input production systems (nomadism and transhumance) are the prevailing systems. The resilience of local communities in the rural areas is linked to the wellbeing of small ruminants and their ability to covert the low feed pasture quality in the arid and semi-arid environments to products suitable to human consumption (FAO, 2015a).

3.5.1.4. Contribution of the Natural rangeland in animals diets in some Arab countries

In the Arab world, the contribution of rangelands to animal diets varies from one country to another and from one ecosystem to the other. For instance in Palestine they contributes only 14% of the total feed required for livestock (Bani Oudah, 2015), in the Comoros not less than 35% in most pastoral environments (Zobeir, 2015), 25-30% in Jordan (AlRashdan, 2014). In Algeria, Alehar, (2014) reported that each hectare of rangeland produces approximately 10 tons of dry matter, with carrying capacity ranged between 60 to 150 Animal Units/ha/year.

The Animal Unit (AU) is defined by AOAD (2016) in the context of the Arabian pastoral environment as "the equivalent of one local tropical cow, of 300 kg as average weight (with her suckling calf), and which produces 500 liters of milk (5% fat percentage) per lactation season ranging between 150 - 180 days.

In Algeria, Shieḥ (*Artemisia herba alba*)'s rangelands produce 500 to 4,500 kg of dry matter per year, with carrying capacity ranging between 150 to 200 AUs/ha/year while one hectare of Algerian Sunagh (*Lygeum spartum*) pastures produce 300 to 500 kg dry matters, with a carrying capacity ranging from 110 to 190 fodder units/ha/year. Note that 1 fodder unit is the equivalent of the energy provided by 1 kg of barley (Elehar, 2014).

In Saudi Arabia, Taqiuddine and Darfaoui (2015) estimated the edible and available pasture production for grazing animals at about 7.75 million tons of dry matter per year, which allows to feed 1.8 million AUs. The average dry material production from the available natural feed was estimated to be 48.1 million tons and it may drop to less than 30 million tons in drought years. Also, 75% of trees and shrubs are used as fodder sources as they provide 33% of the requirements of the national **Sudan** herds requirements (khair, 2014).

In several Arab countries, including Jordan, Lebanon, Iraq, Syria Palestine, Tunisia, Algeria, Morocco and Libya, livestock, and mainly small ruminants, usually graze natural pastures during the spring (January to April) and field crop residues in summer (May to October). The uncontrolled grazing pressure on rangeland, both in terms of livestock numbers, grazing time and duration led to overgrazing and degradation (Abu-Zanat et al., 2005).

3.5.1.5. Range livestock infrastructure and related policies

Arab countries adopted various policies and made important efforts to support and sustain rangelands' infrastructure, through implementing numerous development projects to achieve this goal. Such efforts were generally focusing on securing water resources for animals through various forms of surface and acquirers' sources and rainwater harvesting projects, and through pastoral fencing, fire lines, grazing tracks opening. The following summarizes some examples of such efforts:

In Algeria, during 20 years the public authorities restored 1,600 transformational dams, completed more than 9,000 livestock water points equipped with more than 6000 solar and air energy slices, and established 3 regional slaughter houses. The Algerian government conducts free annual vaccination programs against infectious diseases, such as foot and mouth disease (FMD) and other diseases. (Lakhdar, 2014 and 2015 and Elehar, 2014).

In Egypt, since 2015, the Ministry of Agriculture and Land Reclamation, in cooperation with the AOAD, established 122 mountain lakes in the Sinai governorate to collect rainwater with the aim of settling livestock owners and providing drinking water for livestock (AOAD, 2017)

In Iraq, since 2012, the Ministry of Agriculture has established natural pasture stations in most of the Iraqi provinces, with areas of up to 1,200 acres. 23 stations have been established in nine governorates equipped with wooden shades to produce pastoral seedlings and a water tanks for herders and sheep flocks (Ghaleb, 2015).

In Palestine, through the community resilience support program, in areas named "C" and Jerusalem, the Ministry of Agriculture implemented 11 projects in the areas of water harvesting, livestock watering networks, and alternative feeds (Bani Odeh 2015).

In Sudan, during 2012, fire lines were opened in nine federal states, focusing on the states considered as shephered's summer areas. In this regards 15,720 km of fire line networks were opened, to protect a total natural pasture area of 9 million hectares, and providing food to about 11 million animal units (Table 17). The Main fire lines ranged between 8-20 meters in width, and sub-lines of width ranging between 8-12 meters, depending on the pasture density. In addition, a total length of 6,973 km were opened in 2013 (Khatir 2014).

Table 17. The nomadic paths/tracks in Sudan (km)

State	Track number	Length
Darfur	11	4,871
Kudofan	12	4,668
Blue Nile, Sennar, Aljazeera, White Nile	8	1,022
Qardofan	7	860
Kasala	7	720
Total	**45**	**12,141**

Source: (Khatir 2014)

In Saudi Arabia, the Ministry of Agriculture established a number of 55 fenced sites, ranging in size from 25 to 8,700 hectares. It also constructed a large number of wells and dams to provide drinking water for breeders and their herds, in addition to establishing a research center for rangeland in the Al-Jouf region, equipped with all necessary facilities through the collaboration between the FAO (Adar and Darfaoui, 2015)

In Syria, the Government executed a national rangeland development program in the Syrian Badia, including, the establishment of 10 sheep breeding centers aiming at improving the Awassi sheep milk, meat and wool production, creation of 82 specialized organizations as lambs fattening centers (feed lots), management of 186 wells and digging more than 20 well yearly. Currently there are more than 3500 wells, 36 dams and in the Syrian Badia for herders and livestock watering.

In Tunisia, since 2002, the Tunisian government has launched a new national strategy for forest and rangelands development, which includes (Souissi, 2014):

- Subsidy of 50% of the cost of rangeland infrastructure established by the small livestock owners and free vaccination campaigns against selected animal diseases.
- Creating new water points, solar energy equipped wells, shelters, centers for fodder storage, and opening and managing shepherd tracks.
- Establishing dams and water harvesting projects to create lakes and hills for livestock and wildlife.
- Establishing wastewater treatment stations to provide water for feed production.

3.5.1.6. Balancing stocking rates options and policies

- ***Feed subsidies policy***

The majority of the Arab countries support livestock sector through feed subsidy. This type of support is practiced in Algeria, Palestine, Jordan, Saudi Arabia and Egypt. The governments import barley and wheat bran and sell them in subsidized prices to the livestock owners.

It is worth recalling the 2018 feed crises related to the expansion of biofuel crops at the expense of food and feed crops, causing inflated cereals prices and resulting in discontinuing feed subsidies in Some Arab countries, and in high pressure on rangelands. In such circumstances, a large number of livestock owners were affected, and, were constrained to destock at low prices. Destocking reached a rate of 46 % in certain governorates in Jordan (Al-Barakah et al., 2009).

- ***Breeding strategies as a policy for improving the productivity and reducing sto*cking rate**

Many genetic improvement projects were implemented to increase the productivity small ruminants in Arab countries. Among such project the ones targeting Beni Guil, Sardi and Timahdit sheep breeds in Morocco, and Barbari breeds in Tunisia. Recently IFAD funded a breeding program to improve the productivity of Awassi sheep in Jordan through SIGHT project. All these efforts aimed at improving animal performance, but at the same time rearing only fully productive animals and culling animals of low performance. The ultimate goal from this is to improve the productivity, but at the same time reduce the high pressure on the rangelands by rearing low number of high productivity animals, giving the rangeland the opportunity to recover (SIGHT, 2017).

Oman also applied a destocking strategy to reduce camels' population by culling, through purchasing high number of camels from the local breeders and selling them for slaughtering at lower prices, as means of reducing the pressure on the rangelands to avoid overgrazing and its consequences (Ghawas, 2014).

- ***Animal health policy:***

Pastoral livestock health condition varies from one Arab country to another. Although it might be satisfactory in some countries, many other have been unable to overcome the challenges represented by epizootic outbreaks and various health problems. All countries implement prophylactic programs in relation with pests and diseases outbreaks, anti-parasite campaigns and assure, along with the private sector, health care to sick animals. Countries also established animal health infrastructure, including fix and mobile veterinary clinics, anti-parasite baths, etc.

However, the health coverage and the efficacy of vaccinations and treatments are variable greatly among countries. Although in countries such as the Golf states and Maghreb, the health situation is relatively under control, in some other the prophylactic actions and treatments provided are far from preventing outbreaks and responding to the international norms and standards in this domain.

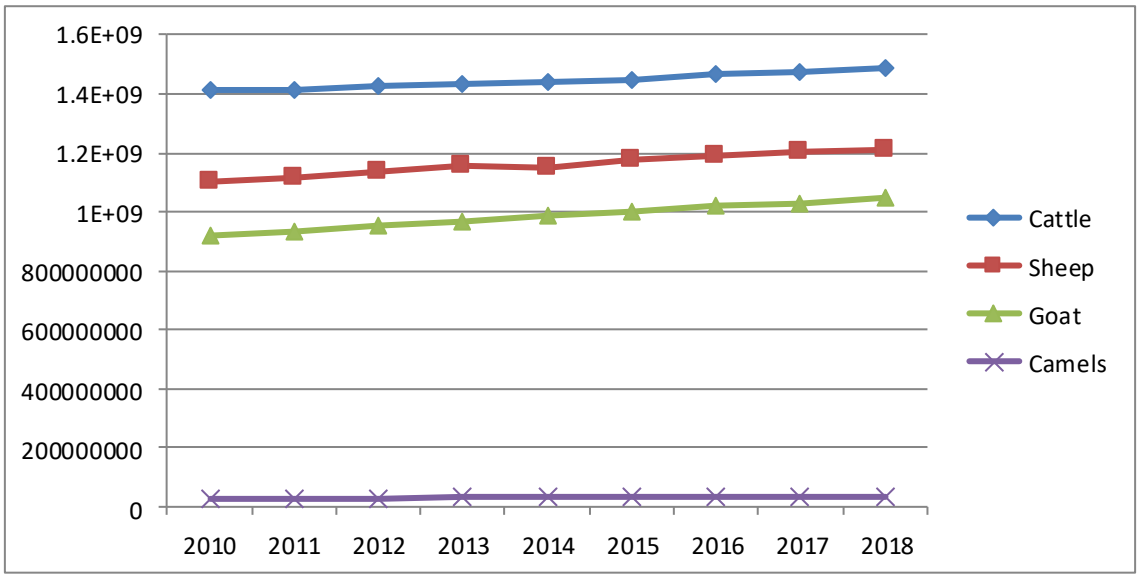
Some of the exporting countries, such as Sudan, have been unable to control diseases outbreaks, therefore, failing to assure the international export requirements. This situation has been the source of great economic losses for the country and for livestock producers, whose livelihoods are directly affected by this shortcoming.

At the regional level, it is worth mentioning that AOAD's Executive Council, composed of Arab ministers of Agriculture, recently approved a resolution on the transboundary management of animal genetic resources and their exchange among Arab countries. AOAD's Council also approved lately a new artificial insemination resolution emphasizing the prevention of infections through insemination by using subsidized disease semen straws (AOAD, 2016).

3.5.2. Global livestock development policy frameworks

3.5.2.1. World livestock population

Livestock is raised in all the worlds' regions, and each region has its specific major livestock species. Figure 23 shows the total number of world livestock, cattle being the largest population followed by sheep, goats and camels. Livestock population has increased between 2010 and 2018 by 14% for goats, 10% for sheep, 5.5% for cattle, and 19% for the camel population. Asia region hosts the majority of sheep population followed by Africa, Europe, Americas then Australia and New Zealand (FAO, 2020b).

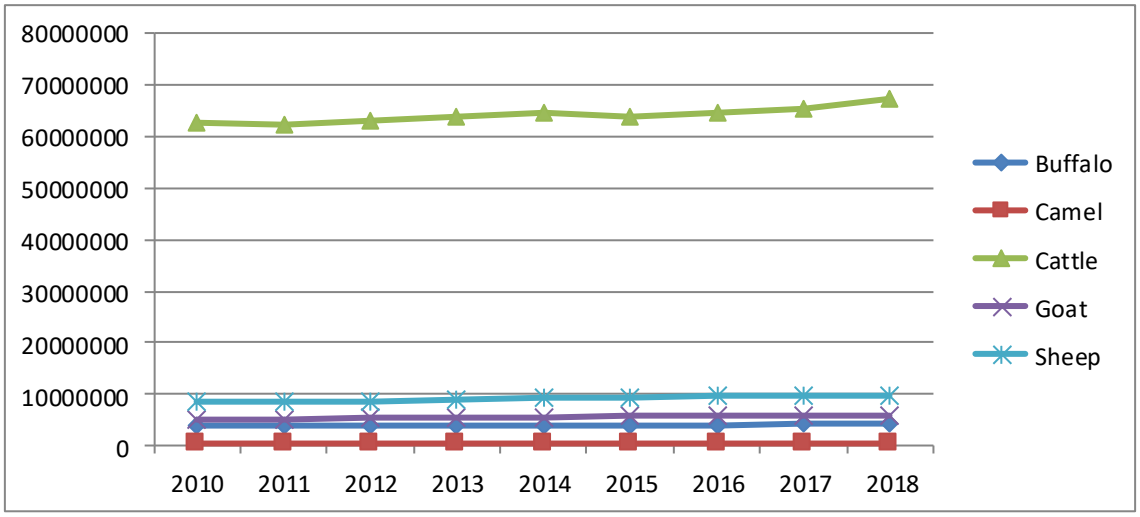


Source: (FAO, 2019)

Figure 23. Change in world Livestock population (head) during 2010-2018

3.5.2.2. Global Livestock meat and dairy production

The total red meat quantity produced through nine consecutive years is shown in figure 24. The major quantity of red meat is produced from cattle (4,699,512 tons), which increased by 0.08% between 2010 and 2018. Sheep came second as red meat producer, and increased by 0.15 %, then goat (0.14 %), Buffalo (0.089) and Camels (0.10%) within the same period. The major meat production increase was observed in small ruminants. In 2018, 90% of Buffalo's meat was produced in Asia, 73% of Camel meat was produced in Africa, and 48 % of cattle meat was came from the America's.



(Source: FAO, 2020b)

Figure 24. The world red meat quantity (tons) produced from the 5 major livestock species through 2010 -2018

The total world whole-fresh milk produced was estimated in 2018at 843 million tons. The livestock species that contributed the most to this production were cows with 81%, Buffalos

with 15%, camels (0.3%), goats (2.2%) and sheep with 1.3%. Cows, followed by Buffalos produced the majority of the whole-fresh milk. A considerable increase in the whole-fresh milk production was observed in cow's milk (13.5 %) during the period from 2010 - 2018, while Buffalo's milk increased by 27.4 % during the same period (Table 18).

Table 18. World's whole-Fresh milk production (million tons) from different animal species

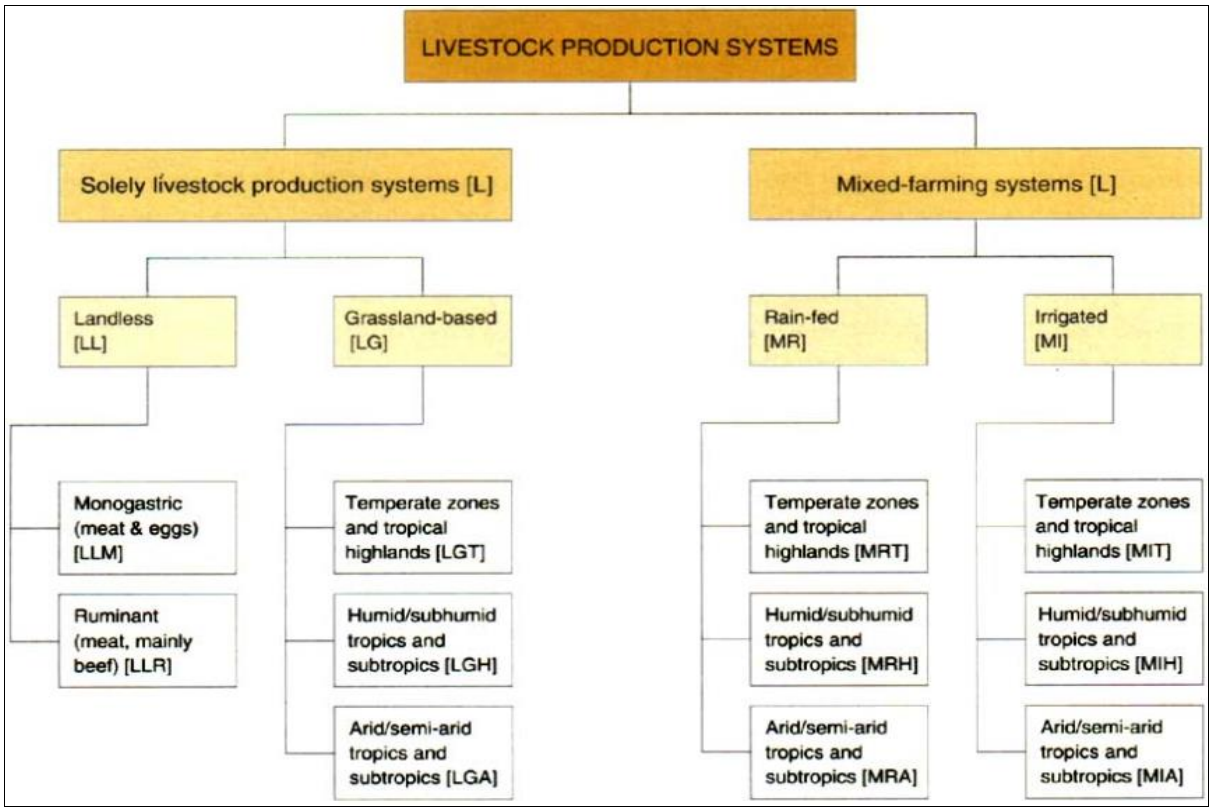
Year	Buffalo	Camel	Cow	Goat	Sheep
2010	92.5	2.9	601.9	16.2	10.0
2015	109.5	2.8	661.4	17.6	10.3
2018	127.3	3.1	683.2	18.7	10.6

Source: (FAO, 2020b)

At the region level, Asia produced the major amount of milk from Buffalo, Goat and sheep, while Africa produced the highest percentage of whole-fresh milk from Camels. The highest proportion of cow's milk is produced in Europe, Asia, the America's, Africa, and Australia and New Zealand (FAO, 2020b).

3.5.2.3. World Livestock Production Systems

Carlos and Steinfeld (1995) investigated the global livestock production systems using quantitative statistical methodologies (cluster analysis and related methodologies), including 150 countries geographically classified into regions. The classification revealed ten systems (Figure 25)



Source: (Carlos and Steinfeld, 1995)

Figure 25. Global livestock production systems

A. Solely Livestock systems (L), in which more than 90% of dry matter fed to animals comes from rangelands, pastures, annual forages and purchased feeds and less than 10 percent of the total value of production comes from non-livestock farming activities.

A.1. Landless Livestock Production Systems (LL): A subset of the Solely Systems where less than 10% of the dry matter is farm produced and annual average stocking rate is above ten livestock units (LU) per hectare. There are two LL subsystems: monogastric and ruminant.

A.2. Grassland Based Systems (LG): A subset of solely livestock systems in which more than 10 percent of the dry matter fed to animals is farm produced and in which annual average stocking rates are less than ten LU per hectare of agricultural land. LG has three subsystems: Temperate and tropical highland, Humid/sub-humid tropics and sub-tropics and Arid/semi-arid tropics and sub-tropics.

B. Mixed Farming Systems (M), in which more than 10 percent of the dry matter fed to animals comes from crop by-products, stubble **or** more than 10 percent of the total value of production comes from non-livestock farming activities.

B.1. Rainfed Mixed Farming Systems (MR): A subset of the mixed systems in which More than 90 percent of the value of non-livestock farm production comes from rainfed land use, including the following classes.

B.2. Irrigated Mixed Farming Systems (MI): A subset of the mixed systems in which more than 10 percent of the value of non-livestock farm production comes from irrigated land use, including

Both MR and MI systems have subsystems related each to Temperate and tropical highland, Humid/sub-humid tropics and sub-tropics, and Arid/semi-arid tropics and sub-tropics.

The grassland system accounts for more than three quarters of the world meat production.

Selected production systems in some countries

Brazil and its agriculture production

Brazil is among the largest meat producers in the world. The common production system in the Brazil is producing animals under pasture condition (FAO,2009). Animals are usually kept in pastures until 18–21 months, and part of them are fed, with diets of average growth potential and medium level of energy for only 3–4 months, and then slaughtered between 21 and 25 month. Those animals spend more than 82% of their lives in pasture conditions, (Quintiliano & Paranhos Da Costa, 2008). The remaining 18% is spent in feedlots consuming fiber-rich, and medium energy level diets. The vast majority of Brazilian beef production, (more than 83% of animals), are kept in grass pastures.

Kenya's Livestock Production systems

Njaru and his colleagues (2016), distinguished four livestock production systems in Kenya, based on landscape, ownership and feed sources.

- Coastal lowlands system, where about 71% of farmers own cattle and goats. In this system, rangeland grazing was prevalent (57.5% of livestock),

- Mid-altitude eastern system , where 60-70% own dairy cattle and Zebu, with an average herd size of 3.1 and 4.7 animals, respectively. Stall-feeding was predominant (65%).
- Central highlands system, where 81-100% of the farmers own dairy cattle, and only 2-17% raise zebu cattle.
- North western highlands systems, where 45-50% of the farmers kept their dairy cattle under semi-intensive grazing system.

Cattle production systems in the developed countries,

Dairy farms in The Netherlands, Germany, Denmark and Sweden are typically intensive compared to UK and Ireland, where the production is grassland based and more extensive. More than 80 % of all robotic milking farms in the world are located in North-Western Europe (de Koning & Rodenburg 2004). Dairy production in New Zealand differs from other parts of the other developed countries being very extensive with seasonal calving, almost purely grassland based and with a low milk production per cow.

Beef cattle major production systems are: beef production from Suckling herds and beef from dairy herds (Veal) (Jarrige & Auriol 1992). Bull calves are traditionally used in young bull production, production of steers or in veal calf production. In UK and Ireland, USA and Australia, most male dairy calves are produced on pasture up to 2 years of age. The predominant beef production from dairy cattle is young bull production (typically intensively fed on grain until a carcass weight of 250 to 350 kg) and cull cows.

Beef production from suckler herds, cows are bred only to produce calves suckling up to weaning at 6-10 month of age. Suckler herds typically live on marginal pasturelands. This type of production is the predominant source of beef in the USA. Calves are typically sold after weaning and finished in feedlots on high-energy diets.

3.5.2.4. Range livestock Infrastructure

Drinking water for Range animals in developed countries

Water is a crucial nutrient for cattle, accounting for 50 to 80 % of the animal's live weight. For livestock to maximize feed intake and production, they require access to palatable water of adequate quality and quantity. The required drinking water per day for cattle varies according to the animal weight, physiological status (gestation, maintenance, growing, lactating), ambient temperature, the size of the animal, water quality, air and water temperature, humidity, moisture content of feed/forage, and cattle type (calf, yearling, bull, cow) (Braul and Kirychuk, 2001). In Average cattle requires 15 gallon of water and may increase or decrease according to the above factors. Through different seasons, herders may face problems in offering the water for range animals, especially in the summer in dry areas and during droughts, and in winter in cold ranges, where they may need force to break the ice.

Proper water network density, distribution and quality are of paramount importance in the rangeland, to optimize the distance traveled by animals to meet their drinking requirements, improve herds' distribution, make the best use of forage resources and avoid land degradation around the water sources and in the range as a whole. For instance, water sources should be located so that cattle can access it without travelling over 240 meters to

avoid overgrazing in areas close to water or under grazing in areas located further away from water sources (Gerrish, and Morrow. 1995).

The benefits of well-designed water systems that provide a quality water source include:

- increased weight gain,
- improved herd health and reproductive performance,
- safer watering sites,
- increased longevity of water source,
- enhanced wildlife habitat,
- environmental benefits, including improved riparian health and reduced erosion,
- improved pasture utilization,

Veterinary services and rangelands' animal Health and Trace ability systems

The health status of Range animals is of high importance, all countries are struggling for reaching the disease free status, but this requires applying strong disease control programs. Vaccination programs are applied in all countries, and many distribute the vaccines free of charge especially with the apparition of outbreaks.

In developed countries, all animals are usually vaccinated against the major animal disease such as Foot and Mouth Disease (FMD), tuberculosis and brucellosis and many pandemic diseases , and Usually the OIE release reports on the outbreaks detected in the world. Developed countries control diseases through application of accurate traceability systems. These traceability systems allow pursuing the animals from birth to culling or death/slaughtering. All information's are available. Their movement is controlled; each animal has its own passport that cannot move from farm to another unless having the permission and the cause of movement. That requires animal identification and registration, which allows following an animal or group of animals during all stages of life (OIE, 2006).

The European Union (EU) started implementing the individual animal identification and traceability system, in compliance with the EU regulation (EU 1760/2000) passed in the year 2000 (EU, 2000). With this system, all bovine animals must be ear-tagged and given passports. Registries are kept at each premises, and in electronic databases.

Due to strict importing requirements of the EU, countries, including Namibia and Botswana have implemented bovine animal identification and traceability programs to maintain access to their main export markets in 1999 (Bowling, 2008).

Bovine animal traceability system have been established in many countries. Among them Australia since 1960s, when the government implemented the Brucellosis and Tuberculosis Eradication Campaign (DAFF, 2006). South Korean Beef Traceability System initiated in 2004 and becoming mandatory in 2009 (BTS, 2006; MAFRoK, 2006). The Brazilian System (SISBOV) was created in 2001, and Argentina introduced its traceability program (SENASA) in 2007(Resolution 754/2006).

3.5.2.5. Monitoring and Legal frameworks

There are many monitoring and legal frameworks at national, sub regional, regional and global levels, which regulate all aspects of animal production, health, trade and all the other

related matters and sectors. Among these frameworks, established at the regional and global levels, we mention the following:

- FAO Domestic Animal Diversity Information System (DAD-IS), which is an online system for gathering all information on Animal Genetic resources (FAO, 2007a).
- IUCN's Red List of Threatened Species has been established in 1964. It has evolved to become the world's most comprehensive information source on the global extinction risk status of animal, fungus and plant species.
- OIE releases the outbreaks found in the world, regulates animal trade, and bans import of live animals from countries experiencing pandemic diseases.
- Guide for developing sustainable value chains for small-scale, livestock producers (FAO,2018),
- Guidelines for artificial insemination and Cryo-conservation of animal genetic resources (FAO, 2017d)
- Conservation of animal ;genetic resources guide lines has been published by the FAO, in addition to the guide lines for in situ and ex-situ procedures and guide lines
- Guide lines for recording systems has been released by FAO

3.5.3. Recommended livestock development policy frameworks

The review of the animal production frameworks in the pastoral systems in the Arab region and in the world, allow making the following recommendations, if the sector is to contribute in SRM, improving livelihoods quality and resilience and in achieving the SDGs, including LDN target and climate change mitigation/adaptation.

- Assure co-generation and co-sharing of knowledge and information related to pastoral livestock management and development.
- Build local capacity and institutions, and facilitate community-based initiatives, especially indigenous management of natural resources;
- Support Arab countries in starting their animal registration and traceability systems.
- Select animal breeds that are adapted to environmental conditions and can utilize efficiently available feed resources in a sustainable way .
- Enforce the veterinary know how and transboundary disease prevention in the Arab region.
- Improve resilience of pastoral and agro-pastoral systems in response to climate change and variability, and strengthen pastoral safety nets as means of dealing with uncertainty.
- Strengthen Arab pastoral infrastructure, including water sources, shelters, feedstocks, veterinary units.
- Strengthen marketing infrastructure to link pastoralists and agro-pastoralists to regional and global livestock markets
- Promote alternative sources of employment without losing cultural identities.
- Strengthening collaboration and synergy among all International and regional organizations such as AOAD with FAO, IUCN active in pastoralism and livestock production.

- Increase the capacity of the livestock owners in grazing and livestock management to improve the productivity, improve range health and prevent range degradation.
- Establish Herd Books for all livestock species in Arab countries.
- Develop destocking/restocking approaches and mechanisms adopted to the Arab countries, based on herd management, incentives and appropriate tracking and action strategies and plans.
- Improve the rangeland contribution in livestock diets, via restoration and SRM, and improve the supplementation strategies and implementation to increase feed use efficiency and improve livestock and pastoralists resilience.
- Use of technologies and machinery should be envisaged, whenever possible, based on the economic, social, cultural and environmental conditions.
- Develop and use the traditional knowledge related to pastoral livestock management.

IV. RANGELAND RESTORATION IN ARAB COUNTRIES: ACHIEVEMENTS, APPROACHES, POLICY BARRIERS AND OPPORTUNITIES

4.1. Rangeland Restoration and improvement in Arab Countries

Throughout this review, we established that rangelands in the Arab region are under a tremendous pressure from overexploitation, harsh environment and inadequate governance. This situation resulted in rangelands in very low condition, degraded in proportions reaching up to 60% in certain countries, with low productivity, eroded soils, shrunk biodiversity, and marginalized pastoral communities, suffering from poverty and facing climate and socioeconomic changes with reduced resilience. In the previous chapters, we reviewed the constraints and governance approaches and options to address range and pastoral systems constraints and achieve SRM, LDN targets and resilient livelihoods. In this chapter, we address restoration/rehabilitation and improvement of degraded rangelands and in Arab countries in terms of initiatives, achievements, adopted approaches, policy barriers and opportunities at the national, regional and international levels, both in terms of funding and knowledge and technology transfer.

Range improvements/restoration are therefore treatments, developments, and structures implemented to increase range forage resources and to facilitate their use for grazing, for recreation and other services, and for their conservation. Rangelands store up to about 30 percent of the world's soil carbon in addition to the substantial amount of aboveground carbon stored in trees, bushes, shrubs and grasses (Grace, et al., 2006). In view of the vast extent of grasslands and rangelands and the degraded nature of large areas of these systems, the potential to sequester carbon through restoration and improved management of these lands is highly significant (FAO, 2009).

It is possible to achieve great deal of rangeland rehabilitation and improvement simply through rational livestock grazing management plans, optimizing stocking rate, grazing time, the grazing period, in addition to animal species selection and controlling animal distribution, for instance through fencing, water and salt-blocks distribution, and multiple use.

However, when the rangeland degradation reaches advanced stages, translating into drop in productivity to unacceptable levels and soil loss, and into poverty and loss of community resilience, it becomes necessary to plan direct interventions to improve/restore/rehabilitate the pasture's vegetation cover, composition, density and productivity, and the soil's structure, texture, fertility and vitality and controlling erosion. Such interventions may include seeding/reseeding, planting with fodder shrubs or trees or other plant species, fertilization, erosion control, sand fixation, rainwater harvesting, fire control, and weed and invasive species control.

In Algeria, several rangeland rehabilitation/development programs and activities have been implemented, including (Brouri, 2014):

a. Rehabilitation of degraded rangelands through favouring natural regeneration, via rest from grazing for specified periods ranging from 2 to 3 years. This technique concerned 3,000,000 hectares, and increased species composition and vegetal cover

from 10% to more than 30%, as well as forage productivity from less than 30 forage unit (fu) per year to 100 fu/year, and allowed the strengthening of seed stock in the soil. Improvement through resting for natural regeneration has several advantages, including low cost, applicability at large scale, easy implementation, and contribution in organizing the management of rangelands.

b. Planting degraded rangelands concerned 450,000 ha, 30% of which accomplished by the private sector and employed mainly alfalfa shrub, cactus, Acacia and Tamarix species. These improvements increased forage production by more than 600 fu/year.
c. Assuring sustainable management of the improved pastures through payment by herders of fees for grazing their animals to the municipal treasury. Techno-administrative committees decide the opening and closure of improved pastures to grazing, based on monitoring-evaluation processes.
d. Developing a network of 7,000 water points for watering livestock,
e. Intensifying fodder production by harnessing runoff water through the creation of 1,200 diversion dams.
f. Improving the living conditions of 4,500 rural families with solar energy.
g. Controlling soil erosion by completing 2.1 million m3 of soil and water conservation works.

These restoration actions induced positive social and economic impact on the communities, including creating 121,000 direct jobs, increasing livestock numbers by 55%, which improved livelihoods and strengthened their stability and resilience. Introducing grazing fees' payment has contributed to the state treasury and to establishing sustainable management practice.

Morocco's actions to restore/improve rangelands aimed at promoting the development of the pastoral sector to strengthen its production potential, improve livelihoods, while safeguarding and sustaining the natural resources. During the last three decades, about 10 million hectares of rangelands have been subject of studies and/or pastoral development actions in Morocco. Such actions included the creation of over 86 pastoral cooperatives and professional associations, planting over 52,000 ha by different fodder shrubs species, reseeding of 40,000 ha of degraded rangelands, and creation of reserves (rested pastures) on nearly 600,000 ha and the creation of around 3,000 water points (Darfaoui, 2005 and MADR, 2007).

Reviving and improvement of the Moroccan mountain Agdals is an experience worth mentioning is this regard. Agdal is a Berber term designating a customary practice, much like Hima, which consists in assuring sustainable management of pasturelands. Pastoralists of different ethnic groups agree on dates for the closure and opening of these pastures and on their management options. They are either high mountain prairies rested in the spring to be used as grazing or fodder reserves during the dry season, or village's riparian forest sites, where cutting fuel wood or branches for feeding livestock are banned, and only opened for use in snowy periods. The Jmaa (tribe's lead) fixes the opening and closing dates of Agdals and limits the maximum quantities of branches and firewood allowed for collection and enforces its decisions, through the customary law and traditions. A number of these Agdals

have been improved/restored through reseeding, fertilization and improved management during the last three decades (Dominguez, 2014 and Naggar, 2018).

Tunisia's rangeland rehabilitation activities during the period 2010-2019, consisted of establishing a total surface of rested areas of 516,000 ha, with a yearly average of 43 areas and 51,600 ha per areas per year. During the same period the country reseeded 190,000 ha (19,000 ha / year) and planted in fodder shrubs 197,000 ha (19,700 ha/year). The area of rangelands planted by trees in this country during 2010-2019 was 49,152 ha (4,915 ha/yr.) and the area reserved to medicinal and aromatic plants was 42,560 ha (4,256 ha/yr.) (Qhiss and Kailan, 2020 Survey data).

Table 19 shows the planned range restoration activities and the achievements during two plans. We note a progress from the first plan 1990-2001 to the second plan 2002-2013 with a rate of achievement passing from only 19% to 62%. The progress was mainly in resting and reseeding pastures (11 to 80%). However, there is still a great potential for increase in the achievement ratio (Qhiss, 2014).

Table 19. Rangeland restoration in Tunisia during the 1990-2013 period.

Type of action in 1000 ha	1990-2001 Plan			2002-2013 Plan			Total (1990-2013)
	Objective	Done	%	Objective	Done	%	
Fodder shrubs planting	400	182	46	210	95,4	45,4	277,4
Planting cactus	200	174	87	165	84,8	51,4	258,8
Rest and seeding	2200	236	11	275	221,1	80,4	457,1
Total	**3120**	**592**	**19**	**650**	**401.3**	**61.7**	**993,3**

Source: (Qhiss, 2014)

The discrepancy in planning and achievements has been attributed to diverse reasons of different natures, including; environmental factors (climate and soil), land tenure, lack of resources (funds), low institutional performance, lack of holistic approach, lack of sufficient seeds of the desired plant species. Among the other reasons is the lack of pastoralists' involvement, absence of incentives and absence of rangelands strategy and specific regulations (Qhiss 2014 and 2020).

Sudan implements every year several rangeland's management and restoration activities. During the period 2010-2019, Sudan created a yearly average of 143 rested areas of a total surface of 908,230 ha (90,823 ha/year). During the same period the country reseeded 734,896 ha (73,490 ha / year) and planted in fodder shrubs 26,125 ha (2,612 ha/year). The area of rangelands in Sudan, where soil conservation and rainwater harvesting was performed during 2010-2019 attained 16,972 ha (1,697 ha/yr.) (Khair, 2020 Survey data).

Sudan also implemented several projects, both at the national and the local scales, aiming at:

- Range seeds collection, production and sowing.
- Mapping and rehabilitation of a great proportion of livestock transhumance tracks, which count 45, with a length of 12,141 km.

- Management of 38 range-seedlings' nurseries with an average capacity of 40,000 seedling/year.
- Establishment and maintenance of seasonal fire lines networks, which attained during the period 2011-2013 a total length of 1,801 km.
- Creation and management of water points (wells, ponds, dams) for livestock watering and for improving herds' spatial distribution.

The National voluntary targets of Sudan to achieve LDN target by 2030 are as follows:

- Increased productivity of 9.2 million hectares of degraded rangelands.
- Rehabilitation of 506,610 hectares of degraded national forests.
- Rehabilitation of 70,520 hectares of wetlands in various states.
- Planting trees and shrubs of high nutritional value to increase the productivity of rangelands to 2.5 tons of dried material / ha in a sustainable manner.
- Reinforce afforestation/reforestation to increase the soil organic carbon stock to reach 305,742 tons by 2030.

However, there are numerous constraints impeding Sudan's rangelands restoration and improvement programs of various environmental, anthropogenic-activity-related and governance nature (Khair, 2020).

Saudi Arabia created and managed, annually between 2015 and 2018, a number of 38 range reserves of a total size of 22,668 ha per year. This number has increased in 2019 to 45 reserves totalling 71,444 ha. The rangelands' area reseeded since 2010 and planted by fodder shrubs and trees is 4,800 ha. Range soil conservation actions and rainwater harvesting were performed on 3,200 ha (Al-Ghamdi and Al-Yami, 2020).

Furthermore, Saudi Arabia has created four range-seed propagation centers, with a total producing capacity of about 40 tons of raw seed per year, of 16 shrubby and grass species (Adar and Darfaoui, 2015).

With regard to the immense rangelands areas in the Kingdom and their high degradation rate, these efforts are far from being sufficient to overcome the huge challenges facing Saudi's pastoral sector. The constraints leading to this situation are numerous, and of various nature, including environmental austerity; immenseness of the surface area (146 million hectares); inadequate land tenure, where the "tragedy of the common" in its worst face prevails; and very weak institutions, severely understaffed and with reduced budget. Furthermore, law enforcement fails to stop violators from disrespecting the range resources, infrastructure and management decisions.

Saudi Arabia's 2020-2040 rangeland strategy aims at restoring 300,000 hectares of degraded rangelands, through resting, seeding/reseeding, planting fodder shrubs, rainwater harvesting, etc. Saudi Arabia is planning to achieve this objective by building the infrastructure to produce the seeds and seedlings necessary for the program and by mobilizing the funds and incentives, via the new environmental fund created to benefit the rangelands and forest among other resources, in addition to building the necessary capacity (MEWA, 2019b). Saudi Arabia is also in the process of adopting new legislation and law

enforcement mechanisms to improve the environment for the implementation of the new strategy.

In Syria, and in the framework of the National Program for Developing and Improving Badia's Natural Rangelands and Sheep Husbandry, a number of 68 pastoral reserves has been established on a total area ranging from 500,000 to 975,000 hectares from year to year depending on the rainfall. Direct reseeding of rangelands in Badia evolved from 70 hectares per year during the period 1985-1992 to about 5,200 hectares in 2004, then reseeding stopped since then due to insufficient humidity. A number of 7 range seed propagation centers have been established in Badia with an area of 500 hectares, producing 60 to 100 tons of seed per annum, which are sowed at a rate of 15kg/ha in the pastoral reserves to favour rapid regeneration (Fayad, 2016).

Fodder shrubs planting has been part of the National Program for Badia Development, through the creation of 13 pastoral nurseries producing annually about 15 million seedlings of various adapted species, such as *Atriplex sp.* and *Salsola vermiculata*, among others. The seedlings are distributed free of charge to the pastoral cooperatives for planting within the pastoral reserves to contribute in range improvement.

In terms of infrastructure, the Badia Program established 10 research/extension centers for *Awassi* sheep breeding and pasture improvement; and about 3,500 wells (20 per year), 3,000 reservoirs and 36 dams operated and maintained to provide Badia dwellers and livestock with water resources. Management of improved pastures and infrastructure in accomplished in partnership between the government institutions and over 600 cooperatives created to contribute in SRM (Fayad, 2016).

These Syrian efforts resulted in the improvement of soil properties, regeneration of the vegetation and biodiversity, increase in productivity up to five times than the baseline, wildlife return and a better environmental balance. Among the positive results also, the support gained by the participatory approach, the adoption of the "tribal honour code", and the empowerment of Badia woman, who found in the Hima system feed for her livestock and opportunities to benefit from natural medicinal and aromatic plants and from work and earning opportunities (Fayad, 2016).

In Jordan, and starting in 2011, the Ministry of Agriculture embarked with IUCN, and the Association of Arab Women, on reviving the Hima system in the villages of *Bani Hashim* in *Zarqa* Governorate. The project was established on 100 Ha, to be scaled up to 1,500 ha, and aimed at restoring range vegetation cover and increasing forage productivity, increasing awareness of the local population about the dangers of overexploitation of rangelands and improving the residents' livelihoods. A similar experience was conducted on the Shraif Reserve of about 6,000 hectares, located in Karak Governorate, south of Jordan. The most important activities carried out in the Bani Hashim Hima and Sharif reserve included: resting from grazing, planting of fodder shrubs, rainwater harvesting.

These experiences are considered by IUCN and the Jordanian authorities' a success story, to be up scaled, especially with regard to the community-based approach used in reviving the Hima, improving its pastures and assuring their sustainable management.

All the remaining Arab countries have implemented programs and projects aiming at rehabilitating/restoring/improving rangelands, through resting and natural regeneration, seeding/reseeding, planting with fodder shrubs or other trees or shrubby species, namely medicinal/aromatic plants. Countries developed infrastructure, watering points, veterinary facilities, feed storage, seed centers, nurseries, research/development stations, inventory, tracking and early warning initiatives, etc.

Certain countries such as Jordan, Morocco, Tunisia, Mauritania, Somalia, Sudan, Syria, have accumulated good experience through implementing projects funded by loans and grants from international institution, such as IFAD, the Global Environment Facility (GEF) and other institutions. Most of these projects adopted integrated, community-based-management approaches, and were able to accomplish significant achievements in terms of rangeland restoration/improvement and equipment, in addition to establishing grounds for SRM and LDN.

In terms of policies aimed towards rangelands restoration and achieving LDN targets, Arab countries in their LDN reports, NDCs and VNRs mentioned some of such policies, including (Darfaoui, 2019a):

a. Reinforcing the rangelands restoration, afforestation/reforestation and therefore carbon sequestration programmes,
b. strengthening the national and local institutions,
c. development/update of laws and regulations,
d. Strengthening the participative approach, involving the private sector, NGOs, professional organization, and gender approach.
e. Improving range/environmental education, building capacity and raising awareness.
f. Reinforcing infrastructure, social services, marketing and income generating projects, to increase livelihoods' resilience.
g. Developing and implementing integrated Management plans for wetlands.
h. Conducting studies and research to identify and analyse the risks and vulnerability of the Range/forest Sectors to Climate Change and increase resilience.
i. Strengthening the soil and water conservation, sand dune fixation and watershed management.
j. Expanding number, area and coverage of wild reserves and national parks.
k. Establishing information systems and databases for data management and sharing.
l. Establishing Firewall systems to protect rangelands and forests from fires.

However, in all countries, many shortages exist and constraints are hindering the efforts to upscale the success stories as well as internationally proven solutions. These include:

- Environmental constraints (extreme temperatures and poor soils),

- lacks of accurate data/maps necessary for the planning and implementation of rangelands' restoration/improvement and management ,
- Institutional weakness and lack of sufficient skilled capacity,
- Absence of policies and separate strategies for the rangelands in many countries,
- Insufficient financing, both public and private.
- Inadequate laws and or law enforcement mechanisms to assure sustainability of the resources and investments in restorations/improvements.
- Fragmented thinking, planning, and lack of holistic approaches at the landscape, ecosystem scales, and low integration of the socioeconomic and cultural components.
- Low involvement of the pastoralists and their communities and institutions.
- Land ownership of common/collective rangeland's resources is a strong obstacle to investment and sustainable management in many countries. Without control of pastoralists and their communities on their resources, it is impossible to assure their involvement, participation and respect of the public policies and projects and actions aiming to achieve SRM.
- Insecurity due to pastoralists' disputes and conflicts over pastures and water resources and with farmers on transhumance tracks and overlapping areas of cultivation and grazing, causing instability and distress.
- Low research outputs and low application of the archived results,
- Reduced technical solutions available to overcome the dig challenges facing restoration/improvement efforts, namely the limited choice in adapted productive and resilient plant species.
- Insufficient seed stocks and seedlings to implement the restoration/improvement programs.
- Insufficient funding,

4.2. Regional and global initiatives and approaches for Rangeland Restoration

4.2.1. Regional and global initiatives

There are currently many global and regional initiatives under implementation, aiming at forest and rangelands' restoration; Arab countries adhere to some of them. Among these initiatives, we mention the flowing:

- **The Global dryland initiative (GDI)** is IUCN's focal point to the UNCCD. The Initiative's programme collaborates with governmental and nongovernmental partners as well as intergovernmental bodies like the League of Arab States, the African Union, and the Southern African Development Community. The GDI's goal is to restore and sustainably manage dryland ecosystems and conserve dryland biodiversity, with particular emphasis on dry rangelands, which cover more than three quarters of the drylands. The Global Drylands Initiative strategic priorities are grouped under three key result areas, namely (i) Evidence-based targeting of dryland restoration and sustainable management, (ii) Improved governance for sustainable land management, and (iii) Scaling up dryland restoration through policy and investments (IUCN, 2020 Global dryland initiative).

- **UN Decade on Ecosystem Restoration** 2021–2030 declared by the UN General Assembly in March 2019. It is led by UNDP and FAO and partners, and aims to massively scale up the restoration of degraded and destroyed ecosystems as a proven measure to fight the climate crisis and enhance food security, water supply and biodiversity. It aims to accelerate existing global and regional restoration initiatives, such as the Bonn Challenge, the Trillion Trees, AFR1000 and others (UNEP, 2020).

- **The Bonn challenge** is the global effort to bring 150 million hectares of the world's degraded and deforested lands into restoration by 2020 and 350 million hectares by 2030. IUNC and the Government of Germany launched this initiative in 2011, and IUCN acts as its secretariat.

- **The Trillion Trees Initiative** (**TTI**) is directed towards action to conserve and restore forests. Its vision is "*One trillion trees have been re-grown, saved from loss, and better protected around the world by 2050, thanks to determined and collective action by all sectors of society".* The approach adopted relies on ending deforestation, improving protection and advancing restoration, to stop climate change, whilst maintaining the planet's vital support systems, including biodiversity, and supporting sustainable development for local people. . The TTI provides opportunities for countries to take part of the efforts to achieve the set target and benefit from the funding, technology and capacity it develops in collaboration with its global partners (Trillion trees, 2020).

- **The Global Partnership on Forest and Landscape Restoration (GPFLR)** is a proactive global network uniting governments, organizations, academic/research institutes, communities and individuals under a common goal; to restore the world's lost and degraded forests and surrounding landscapes, responding directly to the Bonn Challenge. A small consortium of organizations spearheaded by IUCN initiated GPFLR in 2003, aiming to catalyze dynamic, voluntary action through sharing experiences on restoration efforts that deliver benefits to both local communities and nature through a landscape approach (Gichuki, et al., 2019).

- **The Forest Ecosystem Restoration Initiative (FERI)** launched by the CBD in 2014, focuses on ecosystem restoration and conservation. It supports Developing-Countries Parties to the CBD as they develop and operationalize national targets and plans for ecosystem conservation and restoration. Through capacity building, national assessments and direct support to restoration activities, FERI provides countries with best practices and fosters exchange of experiences including challenges and opportunities to contribute towards the planning and implementation of ecosystem conservation and restoration (Gichuki, et al., 2019).

- **The AFR100 initiative,** responding to the African Union mandate to bring 100 million hectares of degraded land into restoration by 2030. The initiative contributes to the achievement of domestic environment and development commitments, the Bonn Challenge, and LDN target-setting process among other targets. AFR100 contributes to the African Resilient Landscapes Initiative (ARLI), and complements the African Landscapes Action Plan (ALAP) and the broader

Climate Change, Biodiversity and Land Degradation Program of the African Union. AFR100 accelerates progress towards achieving the Sustainable Development Goals (SDGs) and the Paris climate agreement (WRI, 2020).

- **The 3S Initiative**, or initiative on Sustainability, Stability and Security is an inter-governmental initiative, investing in the restoration and sustainable land management of ten million hectares of degraded lands by 2025. The objectives of the 3S initiative are to create two million green jobs for vulnerable groups, strengthen access to land and tenure rights, and to prevent displacement by improving preparedness and early warning systems for drought and other natural disasters (UNCCD, 2018).
- **The Great Green Wall (GGW)** is an African-led movement with an epic ambition to grow an 8,000 km natural barrier to halt land degradation and desertification across the entire width of Africa. The initiative started in 2007, and currently groups 21 countries, including seven Arab States namely Algeria, Djibouti, Egypt, Mauritania, Somalia, Sudan and Tunisia. By 2030, the GGW aims to restore 100 million hectares of currently degraded land, sequester 250 million tons of carbon and create 10 million jobs in rural areas (GGW, 2020).

These initiatives represent opportunities and frameworks for Arab countries to strengthen their efforts and capacity to restore their rangelands and forests and assure their sustainable management. The GDI, the Bonn Challenge and the GPFLR and FERI are global and benefiting to all interested countries. The Arab African countries are all members of the AFR100, 3S and GGW initiatives.

4.2.2. Regional and global approaches

Approaches that consider rangeland management, agriculture, forestry, biodiversity, and community development as separate issues or in “silos” have shown their failure to achieve the aimed targets. The magnitude of the challenges faced at all the scales, from the local village to the global perspective are great and complex, making it fundamental to adopt genuinely integrated approaches.

Countries worldwide, and regional and international organizations and development institutions, are today all thinking integration and adopting holistic approaches, at different levels and scales. The integration concerns all the technical, economic, social, cultural and environmental aspects, in addition to policy, planning, regulations, tenure, finance, gender and related crosscutting issues. Most approaches currently centre their approaches on human populations and their livelihoods and the surrounding environment. The international community has put forward several approaches, among which LDN, the Forest Landscape Restoration (FLR), the ecosystem and landscape approaches.

The LDN framework proposed by the UNCCD finds its basis on the LDN Target Setting Program (LDN TSP), as a global multi-partner initiative to provide assistance to affected countries. The program helps countries formulate voluntary targets to achieve LDN, according to their specific national context and development priorities. The LDN TSP relies on the following environmental and social principles (Gilbey et al., 2019):

- Engaging stakeholders and providing governance, including establishing national LDN working groups;

- Implementing a “response hierarchy” in land use planning, to Avoid > Reduce > Reverse land degradation, to prioritise cost effective responses;
- Counterbalancing responses to land degradation with restoration actions in the same biome or land category;
- Establishing synergies with other social, economic and environmental objectives,

The ecosystem approach is the primary framework for action under the CBD. It is a strategy for the integrated management of land, water and living resources, that promotes conservation and sustainable use in an equitable way. The CBD defines the "Ecosystem" as a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit" (Article 2 of the Convention). The ecosystem approach is based on the application of appropriate scientific methodologies focused on levels of biological organization, which encompass the essential processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of ecosystems (CBD, 2020).

Nature-Based Solutions (NbS) approach uses ecosystems and the services they provide to address societal challenges such as climate change, food security or natural disasters. IUCN defines NbS as; “Actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.” The NbS concept is increasingly being developed and applied (Cohen-Shacham, 2016)

Landscape approaches provide “a framework to integrate policy and practice for multiple land uses, within a given area, to ensure equitable and sustainable use of land while strengthening measures to mitigate and adapt to climate change.” (Reed et al., 2017). Landscapes are large-scale physical areas comprising overlapping ecological, social and economic activities and values. They generally have multiple functions, as they provide a variety of services to society, such as biodiversity, food, water, shelter, livelihood, economic growth, and human well-being. All these services are interlinked; so if any land use expands, it will have repercussions for the entire landscape. This makes landscapes an ideal unit for planning and decision making, as it allows for the integration of various sector plans and programmes into one single spatial context and for a better understanding of trade-offs, options and scenarios around proposed decisions and desired outcomes (Gichuki, et al., 2019).

The GPFLR, for instance adopts the landscape approach to assure sustainable development, where natural resources (forests/rangelands, energy, agriculture, water, etc.) use, conservation and livelihoods within a given area are considered in an integrated manner.

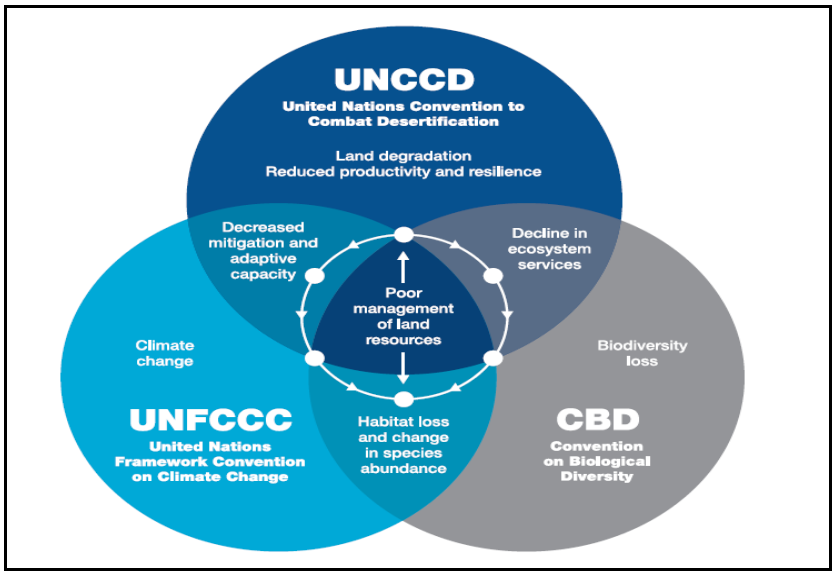
The Forest Landscape Restoration (FLR) approach is defined as a long-term process of regaining ecological functionality and enhancing human well-being across deforested and degraded landscapes, comprising overlapping ecological, social and economic activities and values. In the FLR approach, stakeholders with diverse perspectives together identify, negotiate and implement practices that restore an agreed balance of ecological, social and economic benefits within a broad range of land uses. The approach is based on seven principles, namely; focusing on landscapes, participatory governance, restoration for multiple functions and multiple benefits, maintaining and enhancing natural ecosystems within landscapes, tailoring to the local context and managing adaptively for long-term

resilience (Gichuki, et al., 2019). The FLR approach involves seven best practices that help ensure that restoration is successful, lasting and beneficial. These are:

i. Involving trees and other woody plants in landscapes where appropriate,
ii. Scaling up successes from individual sites,
iii. Restoring functionality, ecosystem services, not "original" forest cover,
iv. Balancing local needs with national and global priorities,
v. Employing a range of restoration strategies,
vi. Adapting to circumstances over time,
vii. Avoiding strategies that lead to the conversion of natural ecosystems.

4.2.3. Capturing LDN, biodiversity and climate change mitigation/adaptation

Restoration and sustainable management of rangelands, forestlands following landscapes /ecosystems approaches at the appropriate scale allow to restore ecosystems' services and sustain livelihoods in a durable manner, and to address climate change and land degradation issues, also contribute in conserving biodiversity (Figure 26). Conservation actions, in turn, contribute to climate change mitigation and adaptation and to addressing land degradation. Ecosystems such as forests and grasslands are biodiversity-rich habitats; conservation and restoration of these ecosystems benefit biodiversity and create carbon sinks that protect biodiversity from adverse impacts of GHG emissions. Restoration combats land degradation and desertification by reducing soil erosion, stabilising soils and maintaining soil-nutrient cycling. In addition, goods and services derived from forest and rangeland ecosystems can potentially reduce vulnerability of resource-dependent populations and the impacts of land degradation and enhance their resilience to climate change. Furthermore, desertification, and the associated loss of vegetation, causes biodiversity loss and contributes to climate change through reduced carbon sequestration (Joint Liaison Group, 2009).



Source: Gichuki et al. 2015.

Figure 26: Landscape restoration and synergies between Rio conventions

Adequate restoration and sustainable management of rangelands and forests are consequently, the warrants of healthy and productive ecosystems, and therefore sufficient and resilient communities, and of a neutral land degradation, well-sustained biodiversity and suitable action towards mitigation/adaptation to climate change, in addition to achieving the SDGs.

4.3. Recommendations concerning rangelands' restoration/improvement

The review of the efforts deployed by Arab countries to restore/improve degraded rangeland and the examination of the current approaches and initiatives adopted globally, show that most if not all countries adopted policies and apply techniques to improve the vegetation cover, density, species' diversity and productivity. Such techniques include natural regeneration by pasture resting, in addition to reseeding and planting fodder shrubs and trees, and other species. Direct seed sowing is applied rarely due to the dominant dry climate and shallow poor soils in the region. Soil conservation practices and rainwater harvesting techniques are utilized. Restoration/improvement efforts also include pasture resting, with or without fencing, and infrastructure for water supply for pastoralists and their livestock, shelters, feedstocks, nurseries, markets, transhumance tracks, fire lines, etc. With regard to SRM and pastoral communities' livelihoods, Arab countries are making efforts to establish the necessary infrastructure (schools, hospitals etc.) and provide the socioeconomic services and income generating projects and activities.

These efforts are positive steps in the right direction; however, they are applied at very limited scale, generally not reaching 10% of the rangeland areas in the best scenarios in the Arab countries. In most cases, they are insignificant (less than 0.1%). In the current situation, where rangelands degradation continuous to progress at an alarming rate, and where the challenges are numerous and diverse, it is of the ultimate necessity for Arab countries to adopt adequate and strong policies and plans and strategies to scale up and speed up the restoration programs and actions. It is of great importance to remove the constraints, especially those related to governance of land tenure, institutional capacity, finance and participation of the communities and various stakeholders. The regional and international institutions can play an important role by supporting the countries efforts.

In terms of incentives for restoration/improvement and management of rangelands, some countries adopted policies for compensating pastoralists for the rested or restored pastures during the rest period, such as Morocco and Syria. Such policies have contributed in involving further rangeland users in the restoration programs, and led to increased extant of restored/improved pastures. They could be appropriate to recommend at large scale in all countries, depending on the specific conditions of each country. Actions towards the assessment of the impact of such practice and the opportunity of its application in the other countries deserve attention.

Some countries established fees for grazing in improved pastures (Algeria, Morocco, Tunisia and Sudan). Such fees might constitute a source for funding further restoration actions, as long as they are reinvested in the pastoral sector. In some of the reviewed case the fees amounts were deposited into the country's general treasury, which does not benefit directly to the pastoralists and their sector. Pastoralists usually accept to pay grazing fees in improved pasture, especially during the dry and winter seasons. These fees however, must be well adapted and managed to produce the expected positive benefit.

Some Arab countries established centers and databases for rangeland inventory; monitoring; and project planning, implementation and evaluation purposes. They made some efforts toward strengthening their institutions, capacity and regulations to support restoration/improvement programs and activities. All countries are recommended to establish their database and management systems.

Regarding rangelands' restoration approaches and ties with the regional and global initiatives, Arab countries are members in some of these initiatives, such as the GDI, the Bonn Challenge, the UN Decade on Ecosystem Restoration, the GPFLR, the FERI, the AFR100 and the 3S, still the extant of rangeland and forest restoration in these countries remain modest. It is almost insignificant, when

compared with the 402.6 million hectares forming 30% of the Region's total landmass. It is therefore, recommended to adhere to these initiatives and try to make the best of the opportunities they might represent.

Rangelands' restoration/improvement activities in the Arab states are implemented either in fragmented manner or in the best scenarios, as components of integrated rural development projects funded by loans and grants from regional and integrational institutions. The integration within these projects itself in many cases is more an aggregation of sectoral components lacking cohesion and the necessary synergic interaction among them, than a real integration.

It is therefore, recommended that SRM and restoration be implemented in a holistic integrated manner involving all the technical, socioeconomic, environmental and cultural aspects of the pastoral system and its vegetal, soil, animal (domestic and wildlife) and human components. The appropriate integration and approach (ecosystem/landscape) and scale must be selected based on the site's socioeconomic environmental characteristics, in a participative way, involving all the partners (government agencies, pastoralists and their institutions, NGOs, private sector), without exclusion of any of the stakeholders.

As highlighted throughout this review, the land ownership of common/collective rangeland's resources can be a strong obstacle to investment and sustainable management in many countries, and it is more so for the restoration/rehabilitation efforts. Pastoralists and their communities must obtain control over resources to assure their involvement in the restoration efforts. This will also limit pastoralist's disputes and conflicts over grazing resources and enhance the restoration and SRM efforts.

On the technical side, the review of the Arab countries available information showed a limited number of restoration/improvement solutions available for developers, both in terms of techniques and restoration species diversity. The harsh environment is a limiting factor in this regard, however, countries and regional and international institutions must reinforce research/development programs and capacity building to provide improved and efficient technical packages and appropriate adapted species for reseeding/planting rangelands. Efforts must also be directed towards establishing the necessary infrastructure and produce enough seeds and seedlings for the restoration activities.

Countries Policies and regulations must reflect these priorities to go forward with appropriate scale rangelands' development and sustainable management.

4.4. Promoting private sector involvement and leveraging funds for SRM *initiatives: global and Arab perspectives and recommendations*

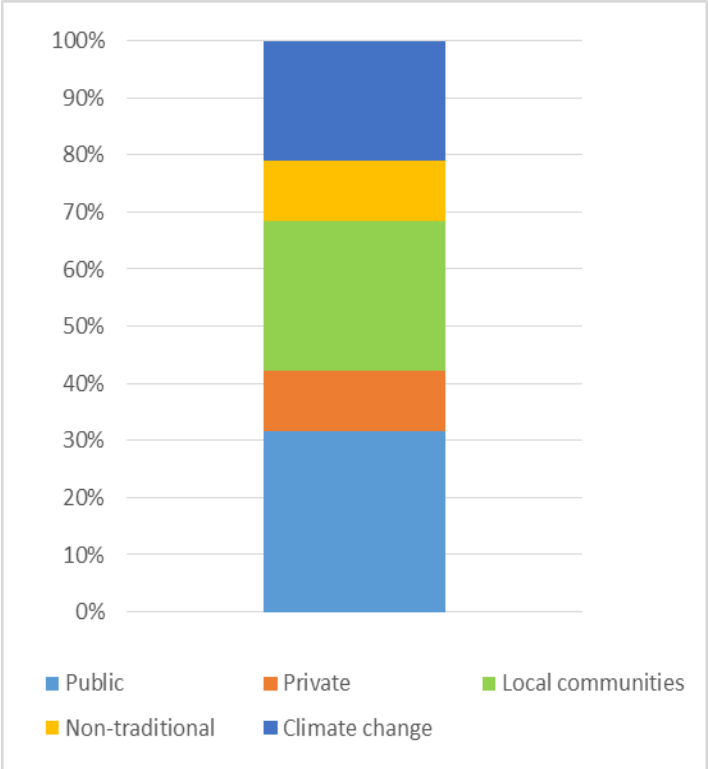
Three distinct groups invest in pastoralism: communities, central and local government and private investors from outside the community. Down-stream beneficiaries are a distinct investor group, in relation to some specific ecosystem services (Davies et al., 2015).

Central and local governments essentially invest in public goods, for instance infrastructure and education, through sectoral budgeting, and project interventions. Community investors include primary land users as well as those who invest in local value chains. Land users in the rangelands traditionally invest natural, human and social capital with limited use of financial capital, such as labour in herding, watering and breeding livestock. Whilst

community members themselves are often significant investors in sustainable range management, private investors from outside the community can also find investment opportunities depending on changing markets and conditions established by the government (World Bank, 2006; Pagiola and Bosquet, 2009).

Figure 27 shows the trend in Arab countries of mobilizing financial and non-financial resources to implement programs and projects for to achieve LDN, including SRM, from international and national sources, public and private, as well as from local community sources, and non-traditional sources of funding. About 53% of Arab countries depend on public and local financing, while 30% of them benefit from international and unconventional financing, including the Global Environment Facility and the climate change financing mechanisms. Local communities contribute to financing LDN activities in 12% of the Arab world, whereas the private sector only contributes 11% of the countries (Darfaoui, 2019).

Significant opportunities for the private investor can be found in livestock sector, both productive and services, such as veterinary pharmaceuticals, processing of livestock products (dairy, meat, fibre and hides), in financial services, and in marketing of natural resources and their products and tourism. Enabling investment environment is however necessary to leverage more private funds, including secure tenure, good and transparent governance, decentralization, adequate institutions, skilled capacity, information networks, incentives in forms of subsidies, tax incentives, empowered community-rangeland-management associations and inter-sectoral working groups in local government.



(*Source: Darfaoui, 2019*)

Figure 27. Trend of mobilizing financial resources to implement programs and projects to achieve LDN and LDN targets

4.4.1. Arab rangelands' sector projects funded through GEF, GCF and AF

4.4.1.1. GEF National projects

GEF funded 52 national and five regional projects related to the rangelands sector, in 13 Arab countries, during the six replenishment cycles, since the year 2000. This number of projects represents 11% from the 456 projects implemented in the Arab region. Table 20 shows the distribution of the implemented projects and the grants and Cofinancing. The total funds attributed to these projects were 1.0 billion US dollars, with 220.368 million USD as grant (22%) and 777.226 million dollars as Cofinancing (78%).

The funded projects entered in the three GEF focal areas; Climate Change, Land Degradation and Biodiversity, and were mainly through the GEF trust fund, in addition to the Least Developed Countries Fund (LDCF) the Special Climate Change Fund (SCCF). They concerned the sustainable management of resources, sustainable pastoralism, land restoration, afforestation, ecosystem restoration and management, knowledge production and sharing, protected areas, soil and water conservation and capacity building.

Table 20. Forest and range projects funded by GEF in the NENA Region

Country	Number of Projects	Funding source	Implementing Agencies	GEF Grant (million $)	Co-financing (million USD)	Total financing (million USD)
Algeria	3	GEF TF	FAO, UNDP, WB	13.337	27.471	40.982
Comoros	2	LDCF, TF	UNEP, IFAD	6.140	18.352	24.492
Djibouti	4	LDCF, TF	UNEP	16.914	68.078	84.993
Egypt	2	GEF TF	UNDP	4.936	24.316	29.385
Iraq	3	GEF TF	UNDP	5.506	25.893	31.624
Lebanon	4	GEF TF, SCCF	FAO, UNDP	13.279	45.505	58.900
Jordan	5	GEF TF	UNDP/IUCN, IFAD, WB	22.121	63.023	85.763
Mauritania	5	LDCF	ADB, UNDP, WB, FAO	31.573	129.530	162.228
Morocco	7	GEF TF, SCCF	UNDP, IFAD, WB, FAO	34.342	97.886	133.243
Sudan	10	GEF TF, LDCF	IFAD, UNDP, WB, ADB	38.413	168.043	206.879
Syria	1	GEF TF	UNDP	3.292	3.434	6.920
Tunisia	2	GEF TF	IFAD, WB	10.330	31.930	42.860
Yemen	4	GEF TF, LDCF	IFAD, WB, UNDP	20.185	73.765	94.080
Total	**52**			**220.368**	**777.226**	**1,002.349**

Source: Analysis of the GEF Projects database (GEF, 2020)

4.4.1.2. GEF regional projects

Five regional GEF projects related to the rangelands sector have been funded through multilateral trust funds, in nine Arab region, during the six replenishment cycles, since 2000. The total financing and co-financing of these projects amounted to 848.910 million dollars, including 9.838 million US$ as grant (1.2%) and 839.022 as Co-financing (98.8%). The five regional projects and their beneficiary Arab countries are as follows:

MENA - Desert Ecosystems and Livelihoods Program MENA-DELP	**Algeria, Egypt; Jordan**
Promoting Best Practices for Conservation and Sustainable Use of Biodiversity of Global Significance in Arid and Semi-arid Zones	Egypt, Jordan, Kuwait, Morocco, Syria, Tunisia
Enabling Sustainable Dryland Management Through Mobile Pastoral Custodianship	Argentina, Benin, Burkina Faso, Iran, Kyrgyz Republic, Mali, Morocco
Enabling Sustainable Dryland Management Through Mobile Pastoral Custodianship: World Initiative on Sustainable Pastoralism	Iran, Morocco
GGW Sahel and West Africa Program in Support of the Great Green Wall Initiative	Mauritania, Sudan

4.4.2. Green Climate Fund and Adaptation Fund

The Green Climate Fund (GCF) financed six projects targeting water resources and agriculture (1 in Bahrain, 2 in Egypt and 3 in Morocco), for values representing 5.2% of the total number of projects funded by this institution worldwide in the same period and 4.0% of the granted funds. Only one Project on the "Development of Argan orchards/forest in Degraded Environment concerned the forest/rangelands sector and it was implemented in Morocco. This Project financing was entirely through a grant of 49.2 million Dollars from the GCF (GCF, 2019).

Between 2013 and 2016, only three Arab countries, Jordan, Mauritania and Morocco, submitted project for funding to the Adaptation Fund (AF), and no more than five projects were approved; 2 for Jordan and 3 for Morocco.

4.4.3. Conclusion and recommendations

Arab countries need to mobilize additional financial and non-financial resources at all levels (local, national and international, public and private) to leverage more funds for achieving SRM and LDN targets. This requires raising the pastoral sector in the priority ranking. Bringing rangelands management issues at the forefront of countries' national priorities, which will require documenting the economic importance of rangelands through the valuation of the range of goods and services that they provide. These include, among others documenting the contribution of pastoralism to food security and jobs creation (along livestock value chains); the role of rangelands in carbon sequestration; the importance of rangelands for wildlife, conservation of biodiversity, herbal and medicinal plants. In addition to the importance of rangelands for eco-tourism and recreation; and importance of rangelands as gene banks for feed and plant crops of global significance (FAO, 2015).

Arab countries are evidently not making the best use the GEF, GCF and AF sources of financing. Rangelands restoration and sustainable management is an effective tool of sequestering carbon, conserving biodiversity and contributing in LDN target. Furthermore, it increases productivity restores ecosystem services and boosts livelihoods and ecosystem resilience. All these are strengths of the rangelands' sector to benefit from these institutions and funds.

There is a need for more efforts to mobilize enough resources to plan and implement appropriate and efficient policies, programs and projects to achieve SRM and LDN targets set by countries in their strategies and national plans, as well as in their LDN voluntary

targets and NDCs and SDGs. It is of great importance for states to build capacity in dealing with the funding institutions and in the preparation of adequate project documents.

V. ROLE OF THE LEAGUE OF ARAB STATES (LAS) IN SUPPORTING MEMBER STATES IN ENTRENCHING RANGELAND RESTORATION AT THE NATIONAL LEVEL

5-1 The LAS and its organizations

The League of Arab States (LAS) is an intergovernmental organization established in 1945, grouping all the Arab countries. Its charter provides for coordination among member states in political, economic, social, cultural, environmental and communication affairs. The permanent headquarters of the League of Arab States is located in Cairo, the capital of Egypt. Since its creation, the LAS played roles in four main issues (i) Arab states independence, (ii) settling of some Arab-Arab disputes, (iii) representing Arab countries in various international forums and organizations, (iv) in addition to promoting Arab-Arab and Arab-rest-of-the-world cooperation, through a group of specialized organizations formed at various levels within and outside the LAS (LAS, 2020).

The LAS has established a number of specialized Arab organizations, financial institutions, ministerial councils and coordination committees, on which it relies to accomplish the joint Arab action. With regard to activities related to SRM and environment, the LAS relies mainly on:

- The Arab Organization for Agricultural Development (AOAD),
- The Arab Centre for the Studies of Arid Zones and Dry Lands (ACSAD),
- The Arab Council of Ministers Responsible for Environmental Affairs (CAMRE),
- The Arab Ministerial Water Council (AMWC).

AOAD is the LAS's technical arm in the fields of sustainable development of agriculture, natural resources, and the environment. All Arab countries are members of AOAD, and represented in its executive council by their ministers of agriculture . ACSAD is LAS's institution specialized in research related to dry agriculture, including rangelands and the livestock sector and combating land degradation.

CAMRE was established in 1987, and it deals with various environmental issues, such as desertification, biodiversity and climate changes. In 1994, CAMRE established the Joint Committee on Environment and Development in the Arab Region (JCED), including environmental representatives in all the Arab countries in addition to the related Arab and international organizations. The committee established specialized working groups, including the Arab Group on International Environmental Conventions to Combat Desertification and Biodiversity (AGIEC).

With regard to the importance the water issue in the Arab region, the LAS established the Arab Ministerial Council for Water in 2008. This institution works towards developing water resources and assuring their conservation and sustainable management in the Region (Figure 28).

AOAD is member in CAMRE and AMWC, and all their committees and specialized task forces. AOAD is the link between the agriculture, environment, and water sectors in the Arab region and in turn coordinates the programs and joint activities among these sectors.

AOAD also plays a fundamental role in coordinating and following up on the implementation of the international environmental conventions at the Arab level, in coordination with AGIEC

and the General Secretariat of the LAS, especially the UNCCD, the CBD, and the International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGR) (Figure 29).

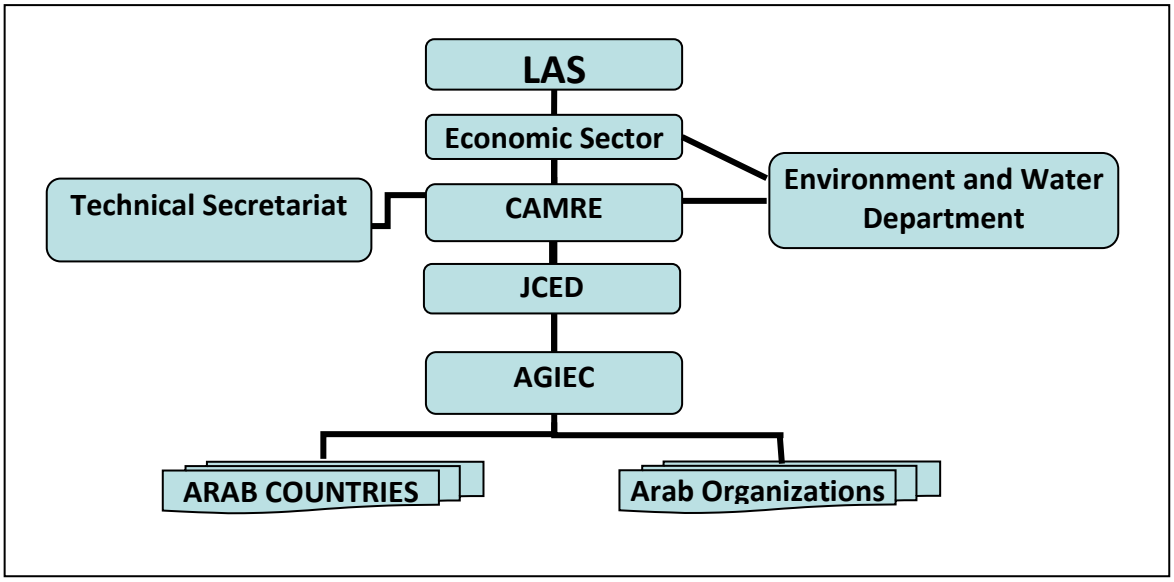


Figure 28. LAS structure related to the environment

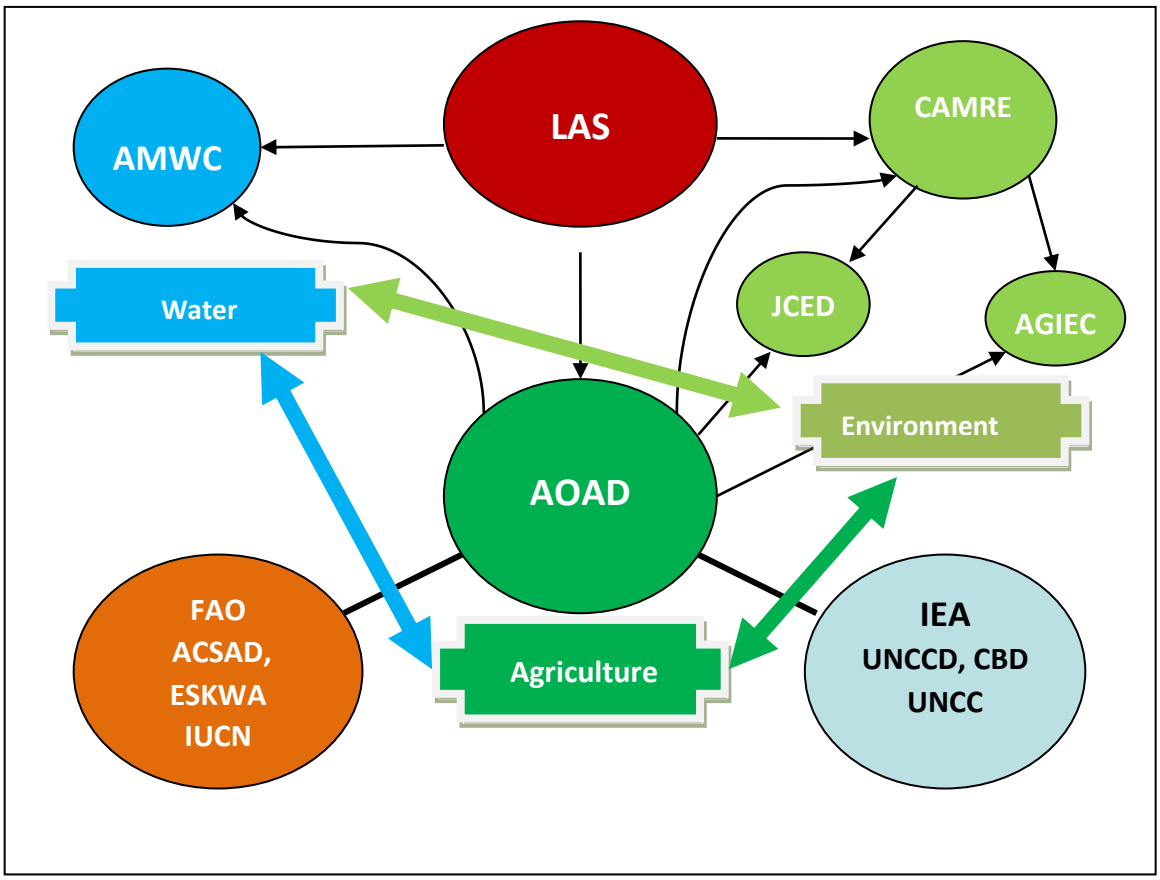


Figure 29. AOAD's relationship with LAS and other Environmental sectors and organizations

5-2 Achievements of the LAS and its organizations and councils in SRM and LDN

5-2.1 League of Arab States

The LAS performs its tasks for the follow up and decision making in matters related to the environment and the SRM through its subsidiary bodies, namely CAMRE, JCED and AGIEC, and with the support of AOAD, ACSAD and the other concerned Arab organizations and task forces, in addition to the other concerned regional and international organizations, unions, and conventions. LAS now has uses two frameworks to achieve this task, which are:

- The Arab plan to follow up on the implementation of the international strategy to combat desertification 2018 - 2030 and the 15th goal of the sustainable development goals (SDGs).
- Arab Network to Combat Desertification (under establishment).

5-2.2 Arab Organization for Agricultural Development

AOAD works on the SRM and development issues as a part of its agricultural strategy and the recently adopted 2020-2040 Arab strategy for the sustainable management of pastoral resources. AOAD included SRM in its structure under a number of departments related to natural resource management and the environment. AOAD's work plans include continuous programs related to rangeland development in various fields.

The most important AOAD's activities and programs related to rangelands include essentially planning, transfer of technology, capacity building, networking, studies and expert meetings as follows:

5-2.2.1 Capacity building and institutional support programs

- Diploma of the Arab Institute for Forests and Rangelands:

The Arab Institute for Forests and Rangelands was established by FAO in Latakia, Syria, in 1959 under the name of the "Regional Forestry School for the Near East". In 1976, it was placed under the umbrella of AOAD, and in 2010, its name changed to "The Arab Technical Institute for Agriculture and Fisheries". The institute provides technicians diploma in three specializations: Forestry / Range management / Environment and Biodiversity. The duration of the curriculum is 2 academic years. More than 1,600 technicians from various Arab countries graduated from this institute until the end of 2017.

- Regional and national training courses:

AOAD has carried out training courses on rangeland management, development and sustainability in the Arab countries as part of its annual training programs in the following subjects:

- Integrated Pastoral Resources Management.
- Rangeland ecology, Rainwater harvesting techniques.
- Rangeland rehabilitation.
- Rangeland animal nutrition.

5-2.2.2 The Arab Network for Sustainable Rangelands Management Resources

The ANSRM was established in 2014, and was adopted by the Arab Council of Ministers of Agriculture in 2015. The main goal of the network is to strengthen the cooperation and coordination among Arab countries to achieve SRM and development, and increase their contribution in bridging the Arab-food-security gap, preserving biological diversity and mitigating the effects of climate change and poverty, by achieving the following sub-goals:

- Enhancing Arab cooperation among SRM scientists and specialists.
- Providing data and information about natural rangelands in Arab countries.
- Capacity building and development of Arab skills in the field of SRM.
- Facilitating, and exchanging results of research, and studies, among Arab countries.
- Increasing awareness on the importance of natural rangelands and pastoralism.
- Developing Arab regulations to protect and develop natural rangelands in Arab countries.

5-2.2.3 AOAD's Studies and publications related to SRM

Through its annual programs and activities, AOAD conducted a number of expert meetings and studies, and issued a number of important reports, proceedings and publications, including:

- Development and coordination of rangelands and forest legislation (2002)
- Promising Pastoral plants species in the Arab World (2006).
- The Arab Guidelines for Law making for SRM (2016)
- Guide of nomenclature, terminology, and units for rangeland measurement in the Arab world (2017).
- Proceedings of three meetings of the National focal points of the Arab network for rangelands sustainable management.
- Proceedings of the national meeting on the role of civil society institutions and NGOs in SRM and development in the Arab region
- Proceedings of the national workshop on pastoral extension in the Arab countries
- Proceedings of the Arab regional meeting on SRM.

5-2.2.4 The Arab Strategy for the Sustainable Management of Pastoral Resources (2020 – 2040)

AOAD drafted the Arab Strategy for the Sustainable Management of Pastoral Resources 2020-2040, and its Executive Council adopted it in 2020, making of it the LAS's framework for SRM in the region. This strategy's vision is to attain "Balanced pastures contributing significantly to food security and improving the livelihood of pastoral communities". The Arab rangelands strategy adopts three strategic objectives and four operational objectives, as mentioned earlier in this review (AOAD, 2019). It includes a number of programs and

components aimed at contributing to support member states in achieving SRM and LDN, including:

- Development and strengthening of rangeland management institutions.
- Updating and enhancing the rangelands Legislation.
- Documenting and utilizing traditional knowledge.
- Survey and monitoring program, and building rangeland database.
- Developing and activating drought early warning and mitigating systems.
- Capacity building.
- Scientific Research Development.
- Rangeland Extension and Awareness.
- Organizing rangelands uses and setting mechanisms to reduce their negative impacts.
- Rangeland rehabilitation and improvement.
- Livestock systems and production-chains development.
- SRM and the Participatory approach.
- Organizing livestock producers and pastoralists in cooperatives/associations.

Arab Strategy for the Sustainable Management of Pastoral Resources 2020-2040 is in line with the major environmental conventions, namely UNCCD, CBD and UNFCCC, and the UN SDG, adopting their principles and targets, including LDN, biodiversity conservation and development and benefit sharing and climate change mitigation/adaptation measures.

5-2.3 The Arab Center for the Studies of Arid Zones and Dry Lands

ACSAD is the LAS organization specialized in agricultural research. SRM programs are integrated in ACSAD's Plant Resources Department, along with Forestry. The Program includes the following two main projects (ACSAD, 2020).

- Rangelands management and restoration.
- Forest resources management and rehabilitation in the Arab arid and semi-arid Ecosystems.

5-3 Recommendations on how the LAS can support member states in domesticating regional and global policies in support of SRM

The LAS is concerned with sustainable management of rangelands resources and the wellbeing of the pastoral communities. Its planning and implementation tasks in this domain are performed through its technical bodies, namely AOAD concerning development projects and programs, and ACSAD with regard to studies and research, in addition to specialized ministerial councils and task forces.

The outcome and numerous recommendations made throughout this review represent an opportunity for the LAS to upgrade its strategies, programs and working approaches,

solutions and methodologies to serve better its member countries and the Arab Region in achieving SRM, LDN, climate change mitigating/adapting and the SDGs.

The LAS and its organisations and task forces can play an important role in the implementation of the recommendation made in this review in coordination with member states and in cooperation with relevant regional and international organizations. This role needs to concern all the SRM components, including governance, knowledge, management and restoration/improvement, and livestock production in addition to capacity building, extension and awareness.

5-3.1 Governance for SRM

The proposed programs to enhance the role of LAS, and AOAD in matters related to rangelands governance concern developing adequate national and regional policies, strategies, legislation and strong and efficient institutions capable of achieving RSM and LND targets through the following:

- Drafting and developing national policies, legislations, strategies, and action plans for pastoral resources.
- Working towards securing pastoralists land tenure rights, and adopting appropriate solutions to the communal use of pastoral lands; through participatory community based management, leasing, distribution, allocation, etc., in harmony with the political, economic, social, and environmental characteristics of each country, taking advantage of the traditional management systems such as Hima Agdal schemes.
- Establishing and developing law enforcement mechanisms and technology to monitor rangelands and protect them from encroachments.
- Enhancing the utilization of the Arab extension system on sustainable rangeland management prepared by AOAD.
- Establishing mechanisms - in the form of national and local committees or other appropriate forms - and legislation aimed at improving governance, and promoting complementarity and synergy among the rangeland users.
- Strengthening Arab regional coordination mechanisms to achieve common Arab pastoral policies.
- Encouraging partnerships between the public and private sectors to invest in SRM.
- Strengthening institutions in terms of appropriate organizational structure and provision of trained human resources and adequate financial resources.
- Improve transboundary movements among Arab countries and with the neighbouring states through bilateral and multilateral agreements and regional mechanisms on transhumance.

5-3.2 Knowledge

The proposed programs to enhance the role of LAS, AOAD and ACSAD in developing and disseminating knowledge related to RSM and LDN can be grouped in five categories, namely studies and scientific research, technology development and transfer, traditional knowledge, capacity building and extension and Awareness

Studies and scientific research

- Conducting surveys, preparing pastoral resource maps, and establishing national and regional rangeland databases.
- Economic and social studies related to pastoral resources and societies.
- Establishing programs in universities and scientific institutes to prepare engineers and technicians in the ecological, management, and sustainable development of rangelands.
- Studying the economic, social and environmental cost of rangeland degradation and resulting losses for national and regional economies.
- Documenting rangeland plants by updating and developing existing herbariums and creating new digital herbariums.
- Develop rangeland tree, shrub and grass species adapted and suitable for rangelands restoration/improvement in the Arab environments.
- Developing school and university curricula and introducing concepts about the importance of rangelands in the national development plan.
- Support scientific research in fields of rangeland rehabilitation and development.

Technology development and transfer

- Using modern technologies in inventory and monitoring operations, especially remote sensing and geographic information systems (GIS).
- Develop appropriate technologies for rangelands restoration.
- Develop research and technology for range seeds and seedlings production, handling and use.
- Establish an early warning mechanism with a membership of all relevant agencies such as meteorology, research institutions, and others.
- Find alternatives to firewood, including other energy sources, especially renewable energies, including solar energy, and rationalize their use.

Knowledge dissemination

- Develop adequate knowledge sharing and dissemination platforms, and with the assistance of the regional and international institutions make the best use of the available regional and international knowledge sharing networks.
- Encourage all Arab countries to adhere to the Arab Network for Sustainable Range Management, which represents an opportunity for the region to share knowledge and strengthen its common efforts to achieve SRM and LDN goals.
- Improve the efficiency of communication and knowledge/information sharing and dissemination by developing and using up-to-date technologies and media.

Capacity building and training

- Strengthen the on-going training programs on rangeland management and rehabilitation.

- Provide training in the preparation of projects to conserve genetic resources, combat desertification, and climate change.
- Provide training on the preparation of projects for financing through the GEF, the Green Fund (Paris Agreement) and other environmental funds.
- Training educators and producers in the fields of production, transformation, and marketing of the various pastoral products.
- Supporting educational and training institutions with qualified trainers and appropriate, modern, and necessary equipment and technology.

Rangeland Extension and Awareness

- Raising public awareness of the importance of pastoral resources, and the significant effects of their degradation and desertification on food security, biodiversity, climate change, and all environmental, economic, social, and health sectors.
- Linking research and extension in SRM.
- Establishing and strengthening pastoral guidance devices in governmental, semi-governmental, and private agencies and supporting them with qualified experts in sufficient numbers.
- Adopting a participatory extension approach in the extension and awareness-raising processes.
- Prepare instructional and awareness material in brochures, films, television and radio programs, etc. with sufficient quality and quantity to cover the educational and instructional needs.
- Use modern methods of communication, including social media, to communicate informative and informational messages to targeted groups and individuals.

Conservation of genetic resources, biodiversity, and traditional knowledge:

- Establish and develop a database of pastoral plants and studies concerning rangelands' biodiversity.
- Survey, document, and develop the use and disseminate pastoral traditional knowledge related to biodiversity in the Arab region.
- Protect the intellectual property of local communities over their traditional knowledge within the framework of relevant national and international laws, and regulations.

5-3.3 Restoration and sustainable management and development

The recommended programs to enhance the role of LAS and its subsidiary bodies in the field of sustainable development and management of pastoral resources in member countries are the following:

- Adopt and apply the appropriate sustainable management concepts, approaches, initiatives and techniques to restore/improve rangelands and organize grazing.

- Implementing national programs and projects for afforestation and rehabilitation of degraded rangelands.
- Upscale successful stories in rangeland restoration and improvement through seeding/reseeding, planting with fodder shrubs and trees.
- Upscale water and soil conservation techniques to control erosion, and harvest rainwater as means of range improvement and drinking water for pastoralists and their livestock.
- Establish pastoral and biodiversity monitoring sites.
- Develop and apply appropriate rest rotation grazing systems, and upscale successful experiences.
- Create and develop centers and nurseries for propagating appropriate pastoral seeds and seedlings, and encourage exchange of seeds/seedlings among Arab countries.
- Encourage governments to support rehabilitation efforts on private rangelands, by providing incentives, material and technical support.
- Rationalising and enforcing mining and quarrying laws to limit their negative impact.
- Establish/develop infrastructure, gene banks and institutional bodies responsible for conservation and development of pastoral-plants' genetic resources.

5-3.4 Livestock development

The proposed programs to enhance the role of LAS and its organizations in developing livestock in member states to enhance SRM and LDN are as follows:

- Create/strengthen the pastoral infrastructure to enforce the pastoral livestock sector, including water points, veterinary facilities, feed stores, snow shelters in mountainous areas, etc.
- Assure adequate supply of the necessary services in the rangeland sites, namely feed, veterinary medicines, etc.), and benefit from their distribution in strengthening the grazing organization and SRM processes.
- Applying scientific methods in animal selection regularly to exclude weak, unproductive, and sick animals, as means of increasing profitability and balancing animal stocking rate.
- Support breeding programs for local breeds' conservation and development in cooperation with local communities and livestock keepers.
- Choose adapted highly efficient animal breeds to optimise the use of the range forage production.
- Apply livestock numbering for statistics and management purposes, including health monitoring and mobility.
- Control and improve the reproductive process, in terms of management and the use of modern technologies in reproduction and selection of stallions.
- Provide and improve animal nutrition, especially supplementing during the sensitive times of the productive cycle.

- Produce fodder in suitable rainfed and irrigated areas, and utilize agricultural and industrial by-products for livestock supplementation.
- Improve the infrastructure, technology and management for confined intensive animal husbandry for fattening and for reducing the rangeland-stocking rate.
- Encourage the private sector to invest in manufacturing industries related to animal products (meat, frankincense, wool, leather).
- Increase the value added of pastoral animal products through processing and manufacture.

5-3.5 Sustaining livelihoods and boosting resilience

The suggested programs to enhance the role of the LAS and its subsidiary bodies in developing livestock in member states to enhance sustaining livelihoods and boosting resilience are the following:

- Implement awareness and extension programs in partnership with local communities.
- Provide basic services to rural people (infrastructure, rural schools, health, etc.) to improve living conditions and ensure the stability of local communities.
- Give pastoral organizations a role in SRM and enhance their capabilities in this area.
- Raise the general environmental awareness of all segments of society, including decision-makers, educators, and hikers, of the importance of range resources and their conservation and sustainable management.
- Strengthen the pastoral communities' institutions, including cooperatives and associations, and support them technically and organizationally.
- Mainstreaming the use of renewable energies in the countryside to provide electricity to isolated rural families and to supply water points.
- Organizing the producers in cooperatives, associations at the local level, integrating, and involving them in the development process and managing rangeland resources.

5-4 Alignment with international environmental conventions and SDGs

The international interest in environmental and rural livelihoods issues, namely combating land degradation, conservation of biodiversity and mitigation/adaptation to acclimate change, in addition to achieving sustainable management of natural resources, including rangelands, and community resilience is currently real and developing continuously. During the last three decades, since the Rio summit, and the adoption by the international community of the environmental conventions, namely, UNCCD, CBD, UNFCCC and the SDGs great developments have occurred in concepts, approaches and mechanisms dealing these issues. Arab countries, like all countries in the world, need to exert efforts to assure harmonization of national policies, legislations, strategies, plans and programs with such concepts and various developments. LAS and its specialized organizations can play an important role in this field through the following guidelines and proposals:

- Aligning national policies and legislation related to SRM and LDN with international agreements and the SDG, focusing on governance, land tenure and land tenure

rights, knowledge, CBRM, gender, rangelands' restoration and on improving livelihoods condition and resilience.

- Aligning rangeland's national strategies with national policies and setting benchmarks for the various national programs and projects.
- Set voluntary LDN goals and indicators for their implementation and follow-up.
- Forming national committees for SRM, combating desertification, LDN, and activating their work.
- Developing mechanisms and financial resources to encourage the participation of specialists from Arab states in international conferences related to SRM, LDN, compacting desertification and related matters.
- Building national capacities for international environmental agreements negotiation, and project financing mechanisms.
- Empowering the Arab Group on International Environmental Convention to Combat Desertification and Biodiversity to allow it to play its role efficiently.
- Developing the national legislation for the protection of traditional knowledge and intellectual property rights for breeders and herders.

5-5 Regional cooperation in promoting SRM and LDN in Arab countries

There are many national and regional strategies, plans and initiatives serving SRM and LDN purposes, adopted in the Arab region by member states and by the LAS and its specialized organizations and councils. Many of the issues and recommendations raised throughout this review are already part of LAS and its organizations strategies, plans and programmes. These include the 2005-2025-Strategy for Arab agricultural sustainable development, the 2020-2040-Arab Strategy for the sustainable management of the rangelands resources, the 2018-2030-Plan to Support Arab Countries combat desertification and achieve LDN (AOAD, 2018), and others, in addition to the countries national strategies, NAPs, NDCS, etc.

Nevertheless, many other concepts, approaches and initiatives recommended in this review still need to be adopted at the national and regional levels or up scaled/strengthened to develop, sustain rangelands and improve pastoralists livelihoods and control on their resources. The LAS and its specialized organisations can play an important role in this process by integrating these recommendations in their strategies, plans, programs, projects and activities.

The LAS and its organisations can as is the case currently, play its role in the implementation of the suggested recommendation in cooperation and collaboration with the regional, international and the UN organizations and funds to benefit and its members from their expertise and resources.

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