

Hydrology of Yemen

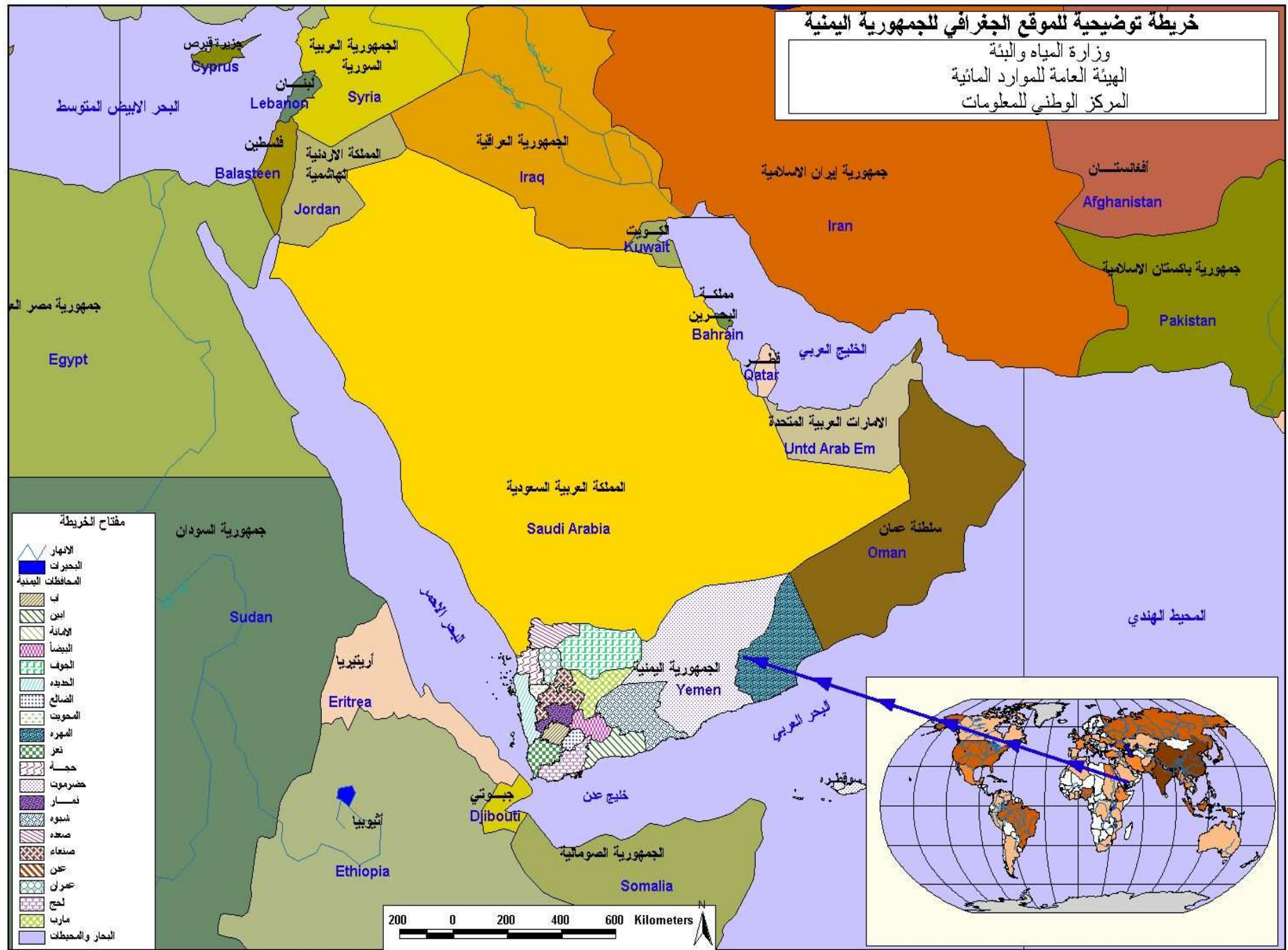
Dr. Abdulla Noaman

INTRODUCTION

- **Location and General Topography**
- Yemen is located on the south of the Arabian Peninsula, between latitude 12 and 20 north and longitude 41 and 54 east, with a total area estimated at 555000 km² excluding the Empty Quarter. Apart from the mainland it includes more than 112 islands, the largest of which are Soqatra in the Arabian Sea to the Far East of the country with total area of 3650 km² and Kamaran in the Red Sea

خريطة توضيحية للموقع الجغرافي للجمهورية اليمنية

وزارة المياه والبنية التحتية
الهيئة العامة للموارد المائية
المركز الوطني للمعلومات



YEMEN: Basic Information

- Area: 555,000 km²
- Cultivated area: 1,200,000 ha
- Population: 22,1 million
 - *Rural* 75%
 - *Urban* 25%
 - *Growth rate* 3.5 % / year
- Rainfall: 50 mm - 800 mm /year
average 200 mm / year

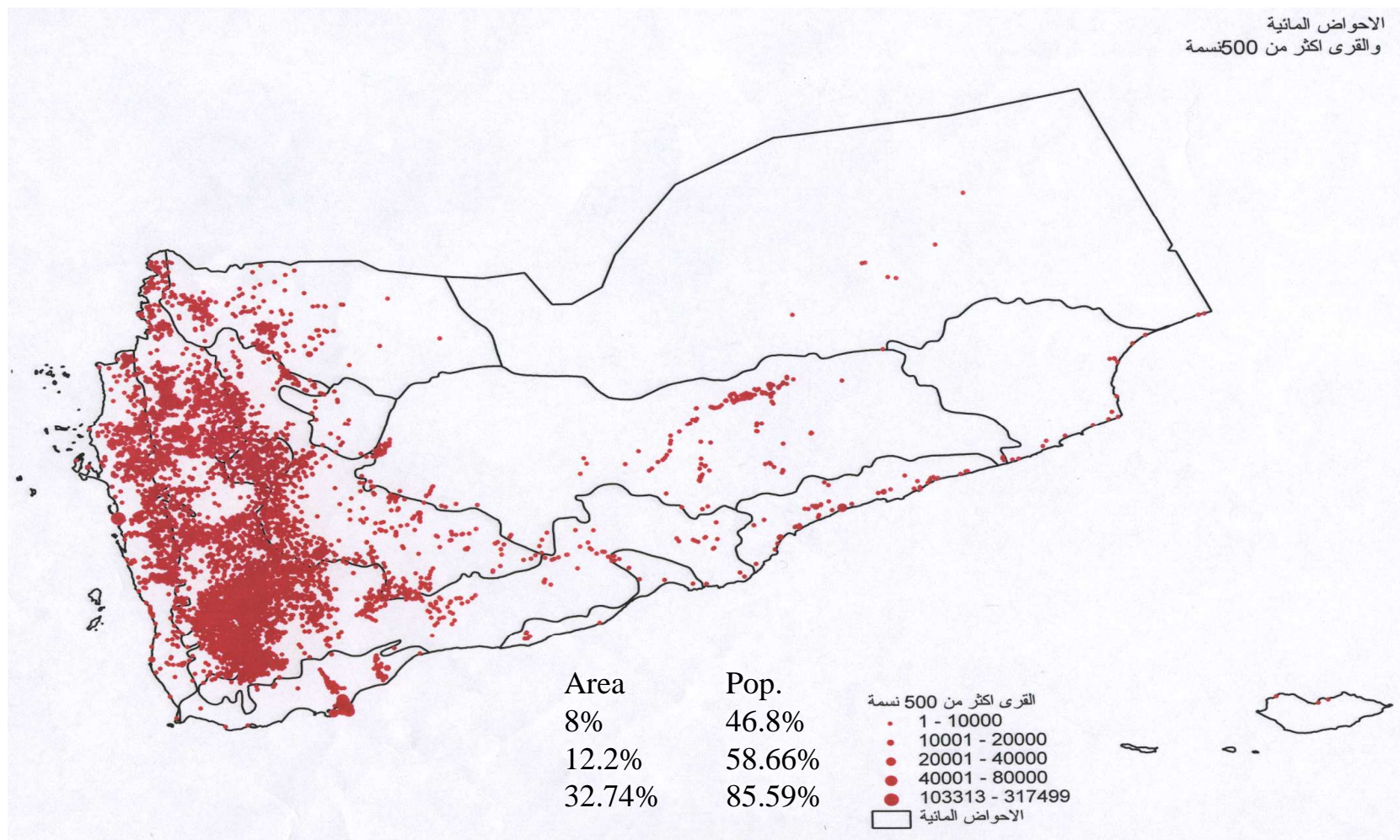
Socio-economic features

- ***Population***
- The total population is around 22.1 million (MPD, 2004), of which 74.4 % is rural. The average population density is about 31 inhabitants/km², but in the western part of the country the density can reach up to 300 inhabitants/km² (Ibb province) while in the three eastern provinces of the country the density is less than 5 inhabitants/km².

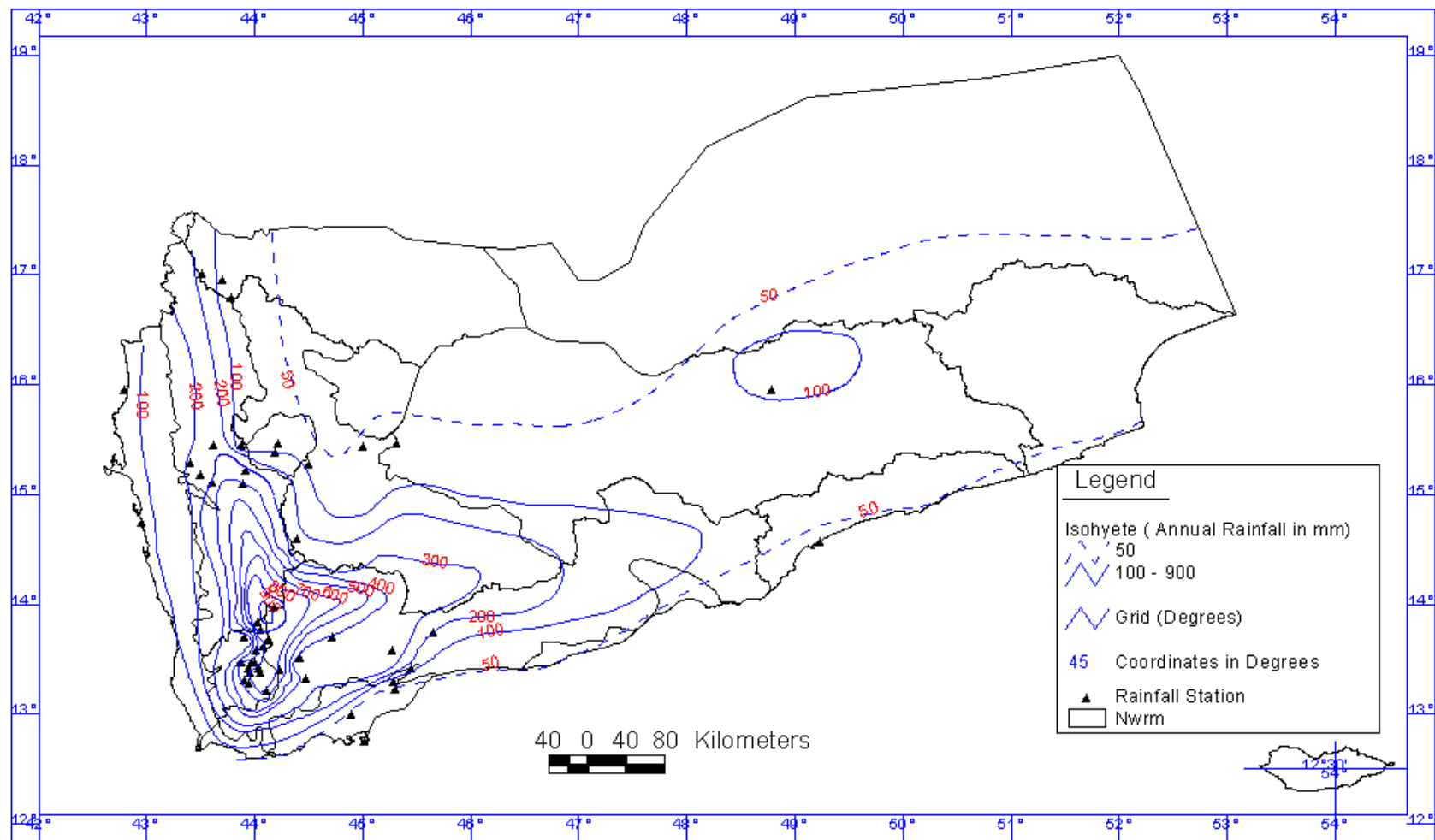
Socio-economic features

- The largest part of the population lives in the Yemen Mountain area in the western part of the country, where rainfall is still significant, although not high in many locations. The hostile environment of the desert and eastern upland areas is reflected by low population density.

Concentration of population in Yemen



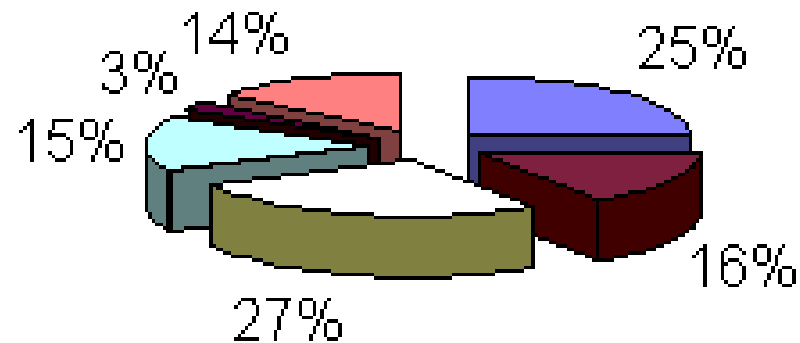
Republic of Yemen
National Water Resources Authority
Yemen Isohytes-MAP (mean 1999-2000)



Socio-economic features

- *Agriculture and economy*
- *Agriculture contributes 25% to the Gross Domestic Product (GDP) in Yemen, employs 60% of the population, and provides livelihood for rural residents who constitute about 76% of the total population. Agriculture is characterised by low and uncertain crop yields due to drought, insufficient and erratic rainfall, declining soil productivity due to soil erosion and poor crop management practices, and crop losses due to damage by insects and diseases, and malnutrition resulting from inadequate supply of feed (Figure).*

Main Economic Sectors of Yemen



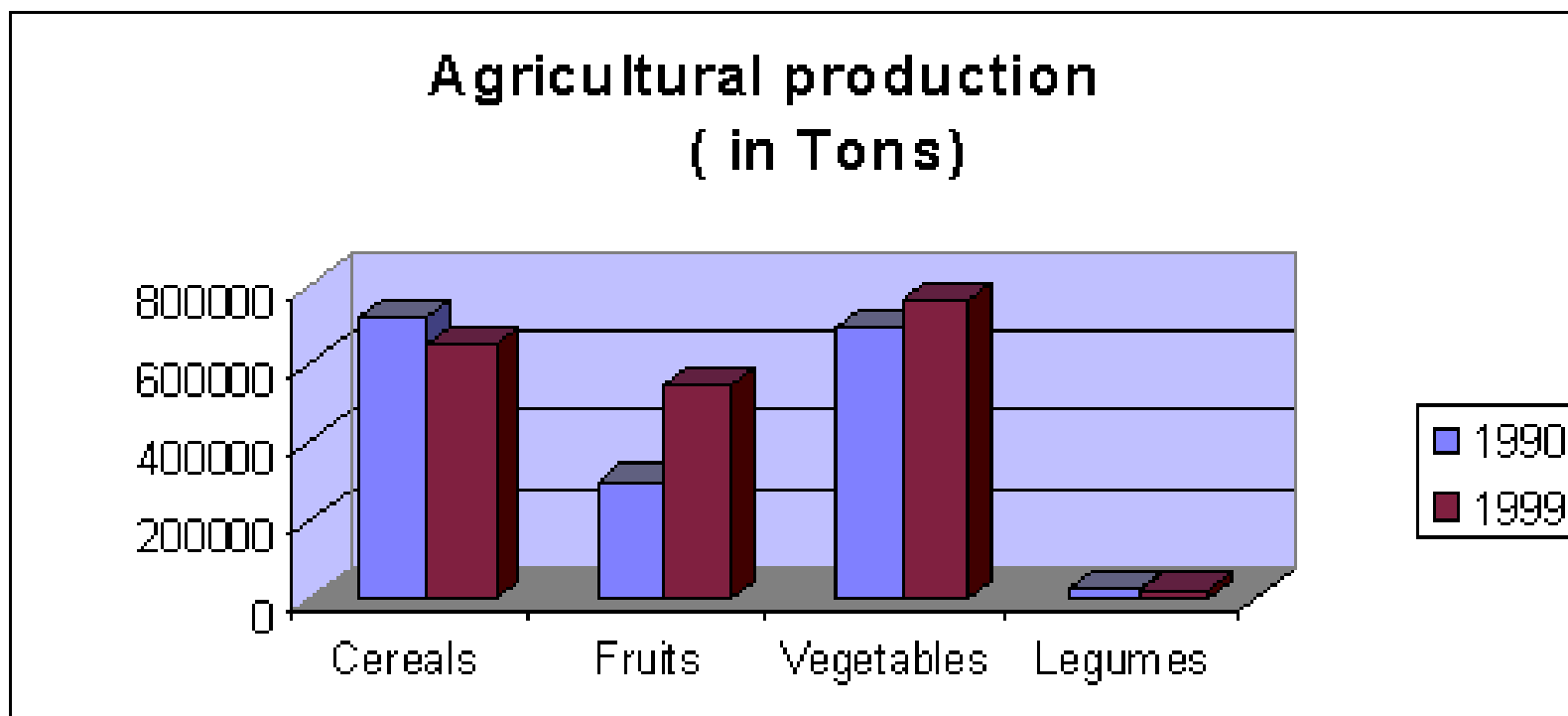
- | | |
|---------------------------|-----------------------|
| ■ Agriculture & Fisheries | ■ Government services |
| ■ Oil | ■ Wholesales & Retail |
| ■ Construction sector | ■ Industries |

Socio-economic features

- Cultivated land has expanded from 1.21 thousand hectares in 1990 to 1.28 thousand hectares in 1999, an increase of 14% of land for cereals crops, vegetables, fruit, cash crops and animal food.

Agriculture and food security

- The contribution of the agriculture sector in realizing food security in Yemen is clarified in the following percentage of production vis-à-vis population needs:
- 100% from thin sorghum consumption.
- 7% from wheat consumption.
- 100% from millet consumption.
- 42 from barley consumption.
- 100% from vegetable consumption.
- 89% from fruit consumption.
- 99% from white meat consumption.
- 68% from red meat consumption.



Source: MPD, 2001

Land resources

- Yemen is among the oldest countries in the world where land and water resources practices have been developed. Terraces erection, rainwater harvesting and dam irrigation techniques were developed since many countries were trackless waste.

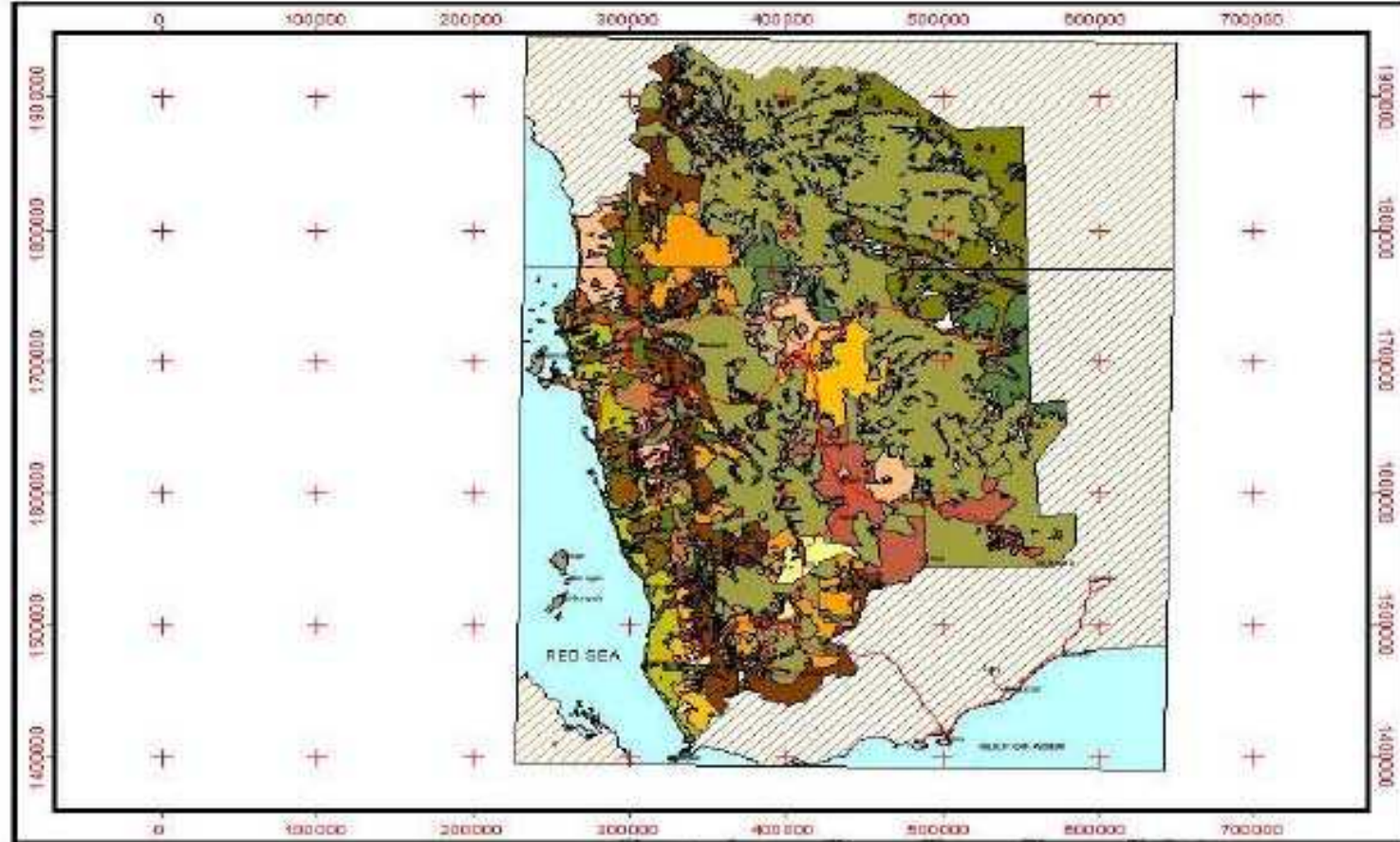
Land resources

- **Soils**
- The country's soils are generally sandy to silty and loamy in the coastal plains, silty to loamy and clay loamy in the mountainous area, and low in nitrogen, phosphorus, and organic matter, In many areas, shallow soils limit the amount of water available for rainfed crops. Soil erosion caused by runoff and/or winds is often serious. Sand and dust storms, which generally blast across the lowlands and highlands, promote soil erosion (ISNAR, 1993).

GENERAL SOIL MAP



Agricultural Research & Extension
 Authority
 Sustainable Natural Resources
 Research Centre
 Environmental Resources Assessment
 for Rural Land Use Planning Project
 GCR/NER/02L/NET



- ▲ Road
- ▲ Irrigated
- ACT
- AGR
- ANP
- AST
- BPT
- BHC
- BHU
- BDU
- BMP
- BSS
- BST
- BTC
- BUC
- BUP
- BUR
- BUT
- BUL
- BS
- BUC
- BLD
- BCT
- BHR
- BHR
- BCC
- BTC
- BTT
- BTV
- BUD
- BUT

Cartography by:
 Yusuf Al-Qubisi
 A. H. Al-Nash

GIS analysis by:
 A. Hamed Al-Hawary

Prepared by:
 GIS and Cartography Units

Dhahran - 2000

The boundaries on this map are not authoritative

Agroecological systems

- Yemen is characterized by varieties of environmental zones. The predominant distinction has given by Bamatraf A. M., 1994 as follows:
 - The Coastal Region
 - The Mountainous Region
 - Eastern plateau

Agroecological systems

- **The Coastal Region:**

This region includes the low coastal plains facing the Red Sea, the Gulf Aden and the Arabian Sea. It makes a coastal strip extending to the Omani border in the east towards the southwest to Bab al Mandab, and north wards to the Saudi border. It stretches over an area 2000km long and 20-60km wide, with an altitude ranges 0-500m a. m. l. Many seasonally flowing wadis dissect the region. An arid sub-tropical climate dominates the region with average annual rainfall in the range of 50-300 mm. The climate becomes semi-arid subtropical in areas adjacent to the foothills of the western escarpment.

Agroecological systems

- **The Mountainous Region:**
- This region includes the most complicated landscapes of the country. It is very irregular and dissected topography, with elevation varies from 500m at the foothills of its western and southern escarpments up to 3700m in the western peaks, then down to 1200m at its north-eastern escarpment. Due to this extreme physiographic diversity, differences in slope and location relative to the Red Sea, Gulf of Aden and Al Rub al-Khali, rainfall varies considerably within the region, with annual averages ranging from less than 300 mm to more than 1000mm. This region is divided into three main catchments, the western slopping towards the Red Sea, the southern towards the Gulf of Aden and the north-eastern towards the empty quarter (Al Rub al-Khali). The climate is characteristic of the semi-arid tropics, with limited areas of dry temperate intermountain plains at altitudes above 2000m.

Agroecological systems

- **Eastern plateau:**

This region is bordered by the mountains zone to the west, the southern coastal plains to the south and the empty quarter to the north. It covers vast expanses of sand desert and dissected plateau with elevation ranging from 500m on its northern and southern sides, to about 2400m on its western side. The average rainfall in this region is generally below 200mm, an arid sub-tropical climate dominates its major agricultural lands.

Agroecological systems

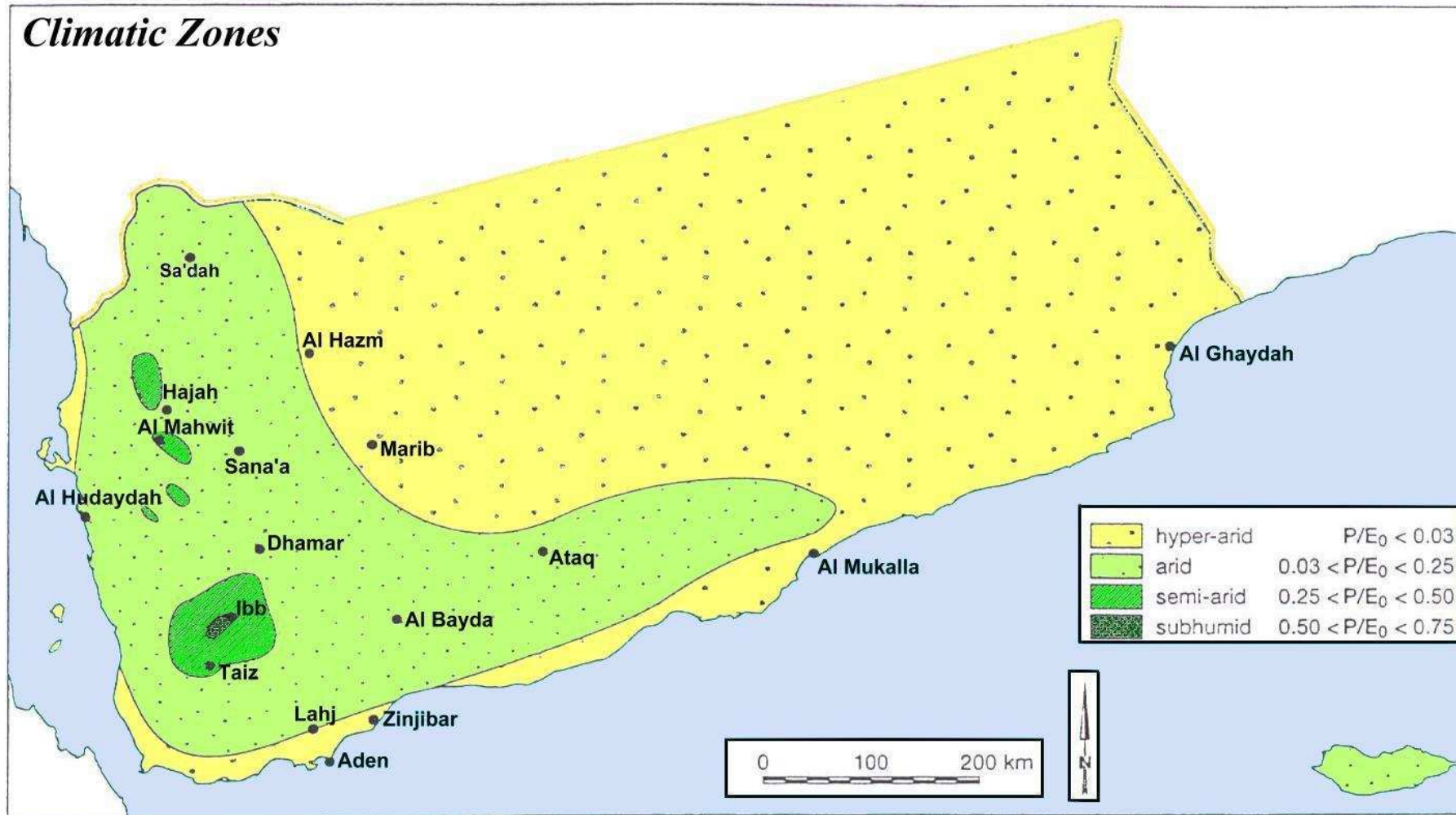
Map 2.3.1: Agroecological zones



Agro-climatic systems

- A classification proposed by UNESCO (1979) can be used. It is based on the ratio between average annual precipitations (P) and annual reference evaporation (E), and in principle marks five different classes:
 - - hyper-arid $P/E < 0.03$
 - - arid $0.03 < P/E < 0.25$
 - - semi-arid $0.25 < P/E < 0.5$
 - - subhumid $0.5 < P/E < 0.75$
 - - semi humid $P/E > 0.75$
- Figure shows the results of this classification. In terms of aridity, the climate in Yemen is shown to vary from hyper-arid (deserts, most of the plateaux, parts of the coastal plains) to subhumid (scattered wetter zones on the Western and Southern Slopes), with perhaps even humid sites on a very small scale in Ibb. Table 2 shows the Physiographic Regions of Yemen

Climatic Zones



Physiographic Regions of Yemen

Physiographic unit	Approx. area (km ²)	% of Total of Land	Major Geological Formation	Predominant Great soil Types	Ecological Zones/Vegetation
Coastal Plain (Tihama)	20,300	3.9	Quaternary alluvial deposits.	<i>Torrifluents, Torrripsamments; Ustifluents, ustipsamments, Ustipsamments, salortheds.</i>	Arid tropical desert; sand dune vegetation of the Red Sea; Acacia spp.
Southern Uplands	12,000	2.3	Tertiary and quaternary volcanics.	<i>Ustifluents; ustiorthents; torriorthents;</i> rock outcrop.	Semi-arid subtropical mountains; Acacia spp., Juniperus spp., Euphorbia scrub.
Highlands slopes	45,500	8.6	Tertiary and quaternary volcanics; sedimentary rocks; quaternary alluvial deposits.	Rock outcrop; <i>ustiorthents.</i>	Arid to semi arid temperate mountains, Acaciaspp., juniperus
					spp., .
Midland slopes	39,200	7.4	Tertiary and quaternary volcanics; Precambrian shield; sedimentary rock.	Rock outcrop; <i>ustiorthents; torrripsamments;</i> calcareous loamy and sand plains.	Arid subtropical mountains; Acacia spp., weed rich vegetation.
Eastern and Northeastern Desert plateau.	250,200	47.4	Quaternary alluvial deposits; sand sheets and dunes; calcareous sedimental rocky; sand plains.	<i>Torriorthents, torrifuents; torrripsamments;</i> calcareous loamy and sandy plains.	Arid subtropical desert; sand dune vegetation; absent vegetation except for grasses after rainfall.
Coastal and foothills	55,000	10.4	Hills, sand dunes and sheets; grace and sandy to loamy plains	Deep to shallow calcareous sandy to loamy; saline in coastal area; light yellowish in eastern part.	Arid tropical; desert and semi desert vegetation absent by sea-saline grasses; vegetation on hills; water cockles in
					wadi.
Middle Montane highland.	84,500	16.0	Volcanic rock basement in the western part, and calcareous rocky plains in the eastern part; sandy to loamy sedimental complex in wadi.	Sandy to loamy in the western part, and calcareous to loamy in the eastern part.	Arid subtropical; vegetation nearly absent, except some in wadi and on soil and rocky plains.
High Montane.	21,000	4.0	Hills, volcanic rocky plains in the west and calcareous rock in the east; sandy loam in wadi.	Sandy to loamy in the west, and calcareous sandy to loamy in the east.	Arid subtropical; vegetation nearly absent; some trees;
					grasses after rainfall.

Land use and cover

- Agricultural land consisting of arable land and land under permanent crops forms about 3% (of which about 450,000 ha of mountain terraces is rainfed, 650,000 ha of relatively flatland in the inter-mountain region). Irrigated lands occupy some 489,000 ha distributed as 98,000 ha spate irrigation, 28,000 ha spring irrigation and 363,000 ha well irrigation.



YEMEN LAND COVER MAP



GENERALIZED LAND COVER CLASSES LEGEND

- | | |
|-------------------------------------------------------|--------------------------------------------------------------------------------|
| 1. Cereals | 120. Bare Rock - Very Stony Soil / Sparse Natural Trees |
| 14. Cereals / Fruit Trees | 120B. Bare Rock - Very Stony Soil / Sparse Natural Vegetation |
| 15. Cereals / Vegetation | 120A. Bare Rock - Very Stony Soil / Open To Sparse Shrubs |
| 16. Cereals / Open | 120C. Bare Rock - Very Stony Soil / Open To Sparse Grassland |
| 17. Cereals / Other | 120D. Bare Rock - Very Stony Soil / Other |
| 2. Cereals | 11. Loose and Blowing Sand / Open |
| 3. Cereals / Fruit Trees | 11A. Loose and Blowing Sand / Open To Sparse Trees |
| 4. Fruit Trees / Cereals | 11B. Loose and Blowing Sand / Open To Sparse Grassland |
| 5. Fruit Trees | 11C. Loose and Blowing Sand / Other |
| 6. Open To Sparse Grassland | 12. Desert |
| 7. Open Pasture / Trees | 13. Salt Flat Areas / Open |
| 8. Sparse Natural Vegetation | 13A. Salt Flat Areas / Sparse Natural Vegetation |
| 9. Coastal Mangrove | 13B. Salt Flat Areas / Sparse Natural Vegetation / Open To Sparse Inland Trees |
| 10. Coastal Wetlands | 13C. Hard Rock Natural Vegetation / Open To Sparse Inland Trees |
| 11. Urban Area | 13D. Hard Rock Natural Vegetation / Cereals |
| 11A. Urban Area / Cereals | 14. Waterbodies |
| 11B. Urban Area - Very Stony Soil | |
| 11C. Urban Area - Very Stony Soil / Open Inland Trees | |

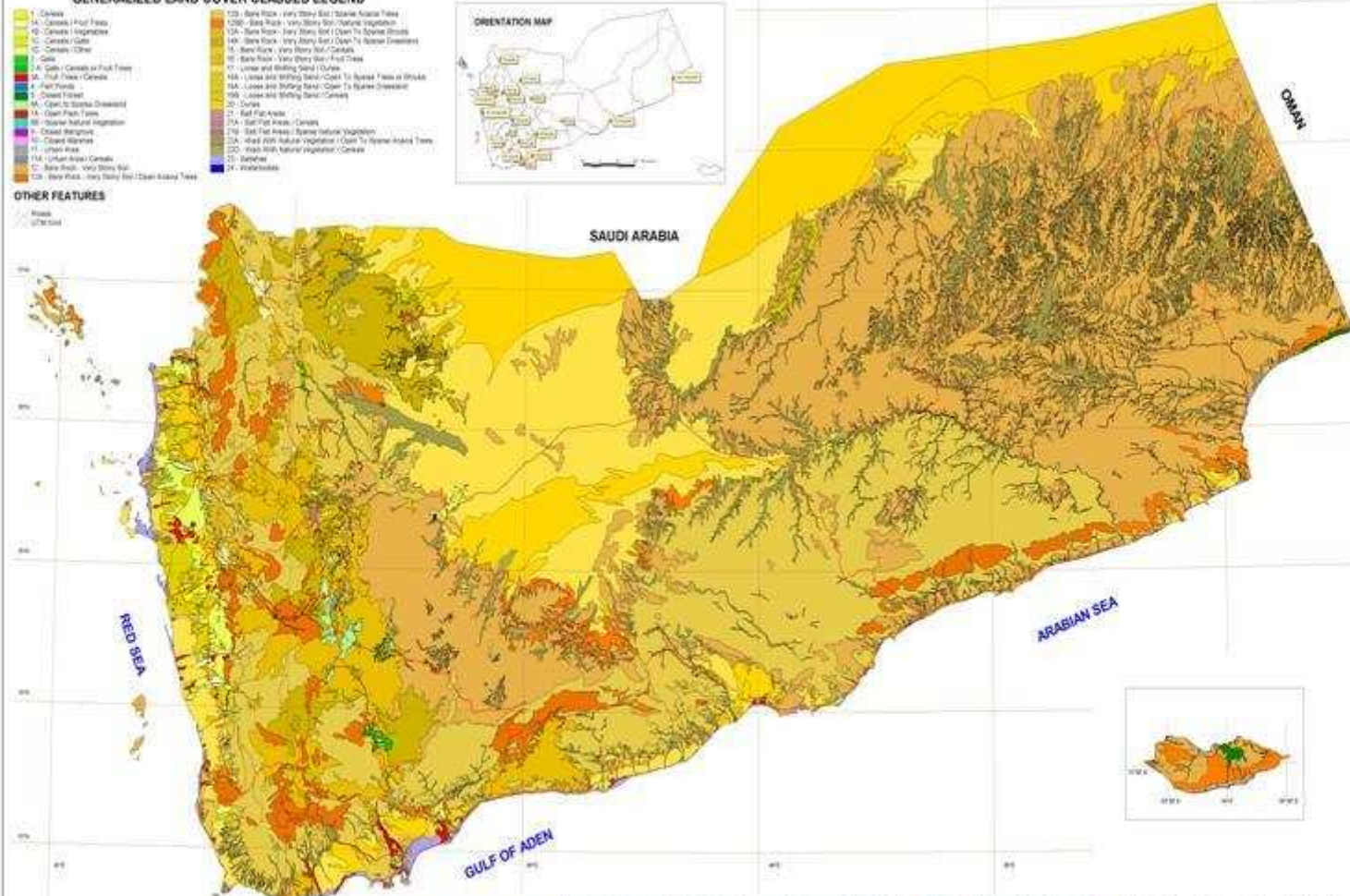


TABLE OF LAND COVER CLASS AGGREGATION

Generalized Land Cover Class	Generalized Land Cover Code	Land Cover Class	Land Cover Code
1. Cereals	1	1010000000000000	1010000000000000
	14. Cereals / Fruit Trees	1010000000000000	1010000000000000
		1010000000000000	1010000000000000
15. Cereals / Vegetation	1010000000000000	1010000000000000	1010000000000000
	1010000000000000	1010000000000000	1010000000000000
	1010000000000000	1010000000000000	1010000000000000
16. Cereals / Open	1010000000000000	1010000000000000	1010000000000000
	1010000000000000	1010000000000000	1010000000000000
	1010000000000000	1010000000000000	1010000000000000
17. Cereals / Other	1010000000000000	1010000000000000	1010000000000000
	1010000000000000	1010000000000000	1010000000000000
	1010000000000000	1010000000000000	1010000000000000
2. Cereals	2010000000000000	2010000000000000	2010000000000000
	2010000000000000	2010000000000000	2010000000000000
	2010000000000000	2010000000000000	2010000000000000

OTHER FEATURES

- Roads
- Urban Area



Scale: 1:1,000,000



FULL LAND COVER LEGEND

Land Cover Class	Code	Area (km ²)	Percentage (%)
1. Cereals	1	...	...
2. Cereals	2	...	...
3. Cereals / Fruit Trees	3	...	...
4. Fruit Trees / Cereals	4	...	...
5. Fruit Trees	5	...	...
6. Open To Sparse Grassland	6	...	...
7. Open Pasture / Trees	7	...	...
8. Sparse Natural Vegetation	8	...	...
9. Coastal Mangrove	9	...	...
10. Coastal Wetlands	10	...	...
11. Urban Area	11	...	...
11A. Urban Area / Cereals	11A	...	...
11B. Urban Area - Very Stony Soil	11B	...	...
11C. Urban Area - Very Stony Soil / Open Inland Trees	11C	...	...
12. Desert	12	...	...
13. Salt Flat Areas / Open	13	...	...
13A. Salt Flat Areas / Sparse Natural Vegetation	13A	...	...
13B. Salt Flat Areas / Sparse Natural Vegetation / Open To Sparse Inland Trees	13B	...	...
13C. Hard Rock Natural Vegetation / Open To Sparse Inland Trees	13C	...	...
13D. Hard Rock Natural Vegetation / Cereals	13D	...	...
14. Waterbodies	14	...	...

Land Cover Class	Code	Area (km ²)	Percentage (%)
120. Bare Rock - Very Stony Soil / Sparse Natural Trees	120	...	...
120A. Bare Rock - Very Stony Soil / Open To Sparse Shrubs	120A	...	...
120B. Bare Rock - Very Stony Soil / Open To Sparse Grassland	120B	...	...
120C. Bare Rock - Very Stony Soil / Other	120C	...	...
120D. Bare Rock - Very Stony Soil / Other	120D	...	...
111. Loose and Blowing Sand / Open	111	...	...
111A. Loose and Blowing Sand / Open To Sparse Trees	111A	...	...
111B. Loose and Blowing Sand / Open To Sparse Grassland	111B	...	...
111C. Loose and Blowing Sand / Other	111C	...	...
112. Desert	112	...	...
113. Salt Flat Areas / Open	113	...	...
113A. Salt Flat Areas / Sparse Natural Vegetation	113A	...	...
113B. Salt Flat Areas / Sparse Natural Vegetation / Open To Sparse Inland Trees	113B	...	...
113C. Hard Rock Natural Vegetation / Open To Sparse Inland Trees	113C	...	...
113D. Hard Rock Natural Vegetation / Cereals	113D	...	...
114. Waterbodies	114	...	...

Land Cover Class	Code	Area (km ²)	Percentage (%)
101. Cereals / Fruit Trees	101	...	...
102. Cereals / Vegetation	102	...	...
103. Cereals / Open	103	...	...
104. Cereals / Other	104	...	...
201. Cereals	201	...	...
202. Cereals	202	...	...
301. Cereals / Fruit Trees	301	...	...
302. Fruit Trees / Cereals	302	...	...
303. Fruit Trees	303	...	...
401. Open To Sparse Grassland	401	...	...
402. Open Pasture / Trees	402	...	...
403. Sparse Natural Vegetation	403	...	...
501. Coastal Mangrove	501	...	...
502. Coastal Wetlands	502	...	...
601. Urban Area	601	...	...
602. Urban Area / Cereals	602	...	...
603. Urban Area - Very Stony Soil	603	...	...
604. Urban Area - Very Stony Soil / Open Inland Trees	604	...	...
701. Desert	701	...	...
702. Desert	702	...	...
801. Sparse Natural Vegetation	801	...	...
802. Sparse Natural Vegetation	802	...	...
901. Coastal Mangrove	901	...	...
902. Coastal Wetlands	902	...	...
1001. Urban Area	1001	...	...
1002. Urban Area / Cereals	1002	...	...
1003. Urban Area - Very Stony Soil	1003	...	...
1004. Urban Area - Very Stony Soil / Open Inland Trees	1004	...	...
1101. Desert	1101	...	...
1102. Desert	1102	...	...
1201. Salt Flat Areas / Open	1201	...	...
1202. Salt Flat Areas / Sparse Natural Vegetation	1202	...	...
1203. Salt Flat Areas / Sparse Natural Vegetation / Open To Sparse Inland Trees	1203	...	...
1204. Hard Rock Natural Vegetation / Open To Sparse Inland Trees	1204	...	...
1205. Hard Rock Natural Vegetation / Cereals	1205	...	...
1301. Waterbodies	1301	...	...

Project: Environmental Monitoring
Year: 2014
Scale: 1:1,000,000
Coordinate System: UTM
Data Source: Remote Sensing
Map Title: Yemen Land Cover Map
Map Scale: 1:1,000,000
Map Sheet: ...

Land cover information derived from interpretation of Landsat TM imagery (1988-2013) using a supervised classification approach.

This database is digital raster information with a resolution of 30 meters.

Yemen Land Cover Mapping Project
 under the auspices of UN-World Food Programme
 Environmental Monitoring Support
 for Rural and Urban Planning Project.

The map database is based on the interpretation of Landsat TM imagery (1988-2013) using a supervised classification approach.

This map database is based on the interpretation of Landsat TM imagery (1988-2013) using a supervised classification approach.

The Republic of Yemen
 Ministry of Agriculture & Irrigation
 Agriculture Research & Extension Authority

Map prepared by:
 Environmental & Remote Sensing Services Center (ERSSC) - Addis Ababa - November 2014

Permission is hereby granted to reproduce all or part of this work for personal or institutional use in a similar format without fee and without a formal request provided that proper use and credit is given to the authors of the map. This permission is granted on the condition that the user will indemnify the publisher in the event of any copyright or trademark infringement, or in the event of any liability for damages or compensation of any kind.

The map database is based on the interpretation of Landsat TM imagery (1988-2013) using a supervised classification approach.

Main Geographical region in Yemen

- **The Coastal Plains:**
- The Plains are located in the west and south-west and are flat to slightly sloping with maximum elevations of only a few hundred meters above sea level. They have a hot climate with generally low to very low rainfall (< 50 mm/year). Nevertheless, the Plains contain important agricultural zones, due to the numerous wadis that drain the adjoining mountainous and hilly hinterland.

Main Geographical region in Yemen

- **The Yemen Mountain Massif:**
- This massif constitutes a high zone of very irregular and dissected topography, with elevations ranging from a few hundred meters to 3 760 m above sea level. Accordingly, the climate varies from hot at lower elevations to cool at the highest altitudes. The western and southern slopes are the steepest and enjoy moderate to rather high rainfall, on average 300-500 mm/year, but in some places even more than 1000 mm/year. The eastern slopes show a comparatively smoother topography and average rainfall decreases rapidly from west to east.

Main Geographical region in Yemen

- **The Eastern Plateau Region:**
- This region covers the eastern half of the country. Elevations decrease from 1 200 - 1 800 m at the major watershed lines to 900 m on the northern desert border and to sea level on the coast. The climate in general is hot and dry, with average annual rainfall below 100 mm, except in the higher parts. Nevertheless, floods following rare rainfall may be devastating.

Main Geographical region in Yemen

- **The Desert:**
- Between the Yemen Mountain Massif and the Eastern Plateau lies the Ramlat As Sabatayn, a sand desert. Rainfall and vegetation are nearly absent, except along its margins where rivers bring water from adjacent mountain and upland zones. In the north lies the Rub Al Khali desert, which extends far into Saudi Arabia and is approximately 500 000 km² in area. This sand desert is one of the most desolate parts of the world.

Main Geographical region in Yemen

- **The Islands:**

The most important of all the islands is Soqatra, where more exuberant flora and fauna can be found than in any other region in Yemen.

Main Geographical region in Yemen



Natural hazards

- *Land degradation*
- *Flooding*
- *Firewood*

Natural hazards

- ***Land degradation***
- Due to the physiographic characteristics of the country, most of the arable lands are located within watershed entities. The accelerating degradation of watershed basins of Yemen has serious economic, ecological, environmental and social implications
- Erosion from the steep basins has resulted in talus fans with coarse gravel and silt along the foothills and gently sloping areas of fine silt along the alluvial plains below the outfalls of wadis in the coastal and interior plains.

Natural hazards

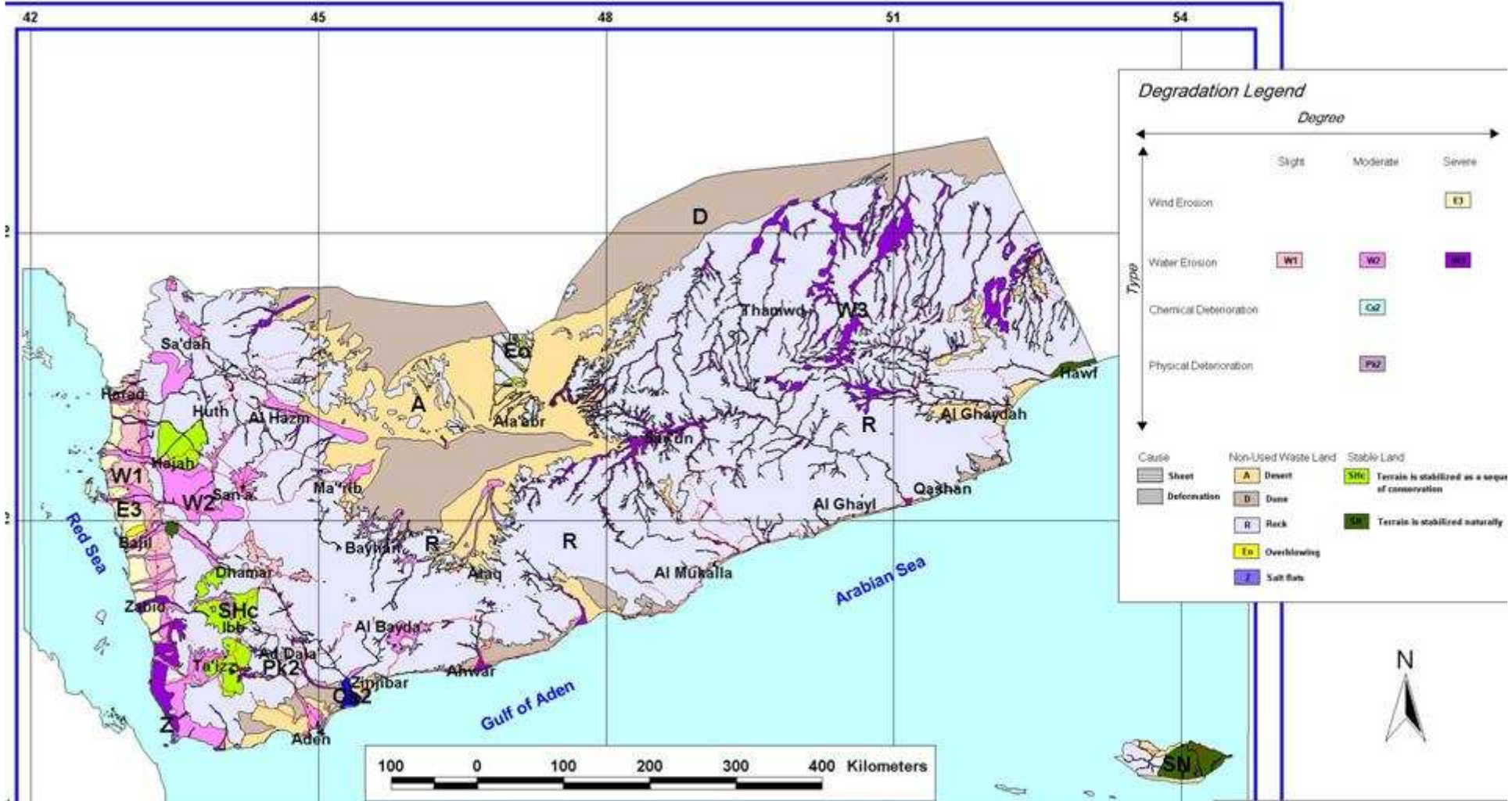
- ***Flooding***
- Flooding occurs during monsoon season leading to loss of productive agricultural lands along the wadis, increasing sedimentation and significant widening of down stream wadi bed.

Natural hazards

- ***Firewood***
- The natural vegetation of acacia scrub in the foothills has been degraded by the search for firewood. Natural forests have almost disappeared due to overcutting for construction, fuelwood, and fodder.
- Currently, there is no inventory of national forest resources. In addition, there is no detailed data on desertification (e. g. location and extension of sand dunes, movement, and patterns) trends in the degradation of terraces (e.g. ownership, size, impact and magnitude of soil erosion).

Human - Induced Land Degradation Map Of Yemen

خريطة تدهور الأراضي في الجمهورية اليمنية



Degradation Legend

Type	Degree		
	Slight	Moderate	Severe
Wind Erosion			E1
Water Erosion	W1	W2	W3
Chemical Deterioration			C2
Physical Deterioration			P2

Cause	Non-Used Waste Land	Stable Land
Sheet	A Desert	SHC Terrain is stabilized as a source of conservation
Deformation	D Dune	SLN Terrain is stabilized naturally
	R Rock	
	Lo Overblowing	
	S Salt Flats	

Agricultural Research And Extension Authority (AREA)
 Renewable Natural Resources Research Center (RNRRC)
 GIS and Remote Sensing Section

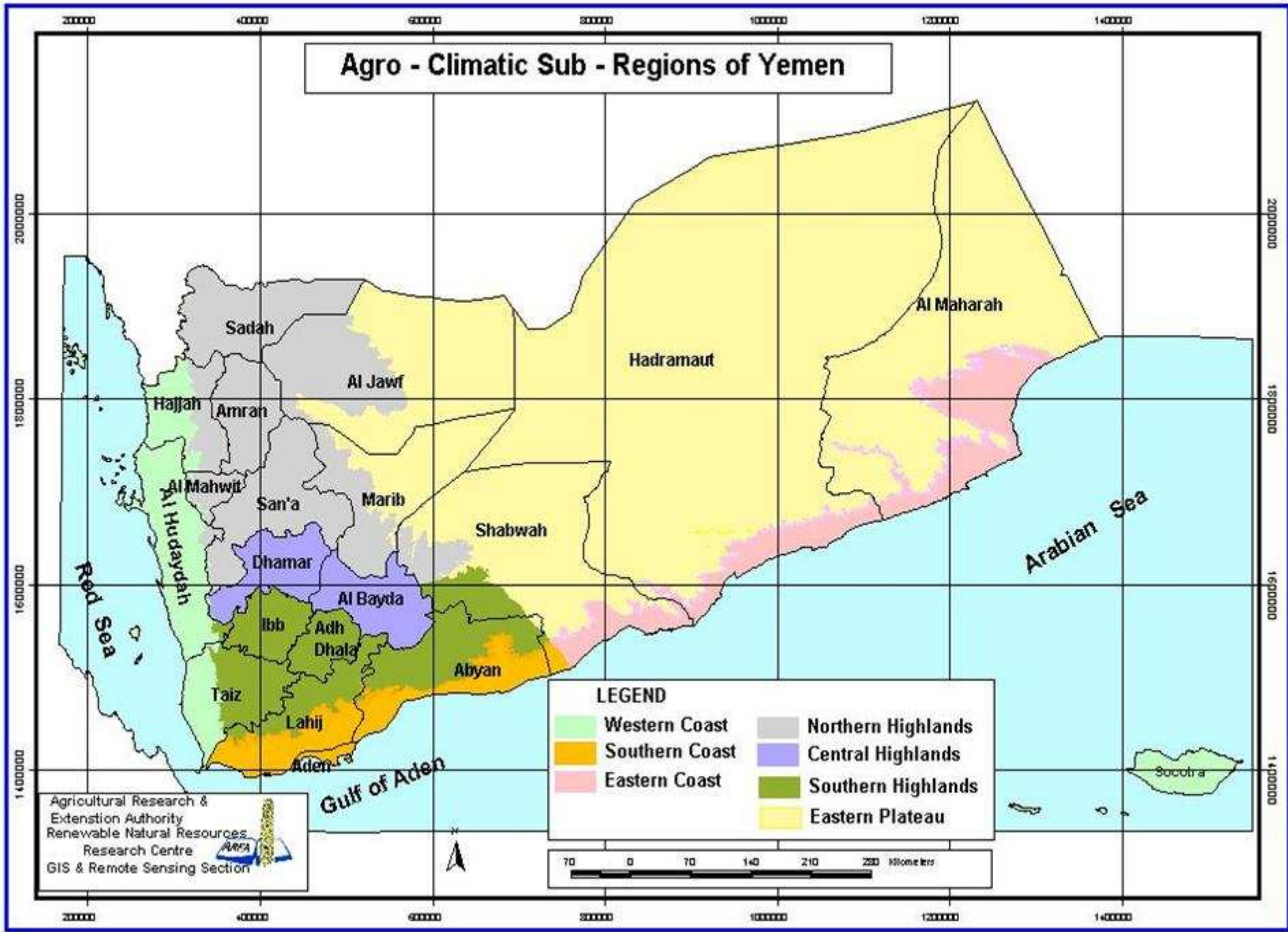
Arab Center for the Studies of Arid Zone and Dry Land (ACSAD)

United Nations Development Programme

Topographic Legend

	Settlement
	Main Roads
	Gravel Roads

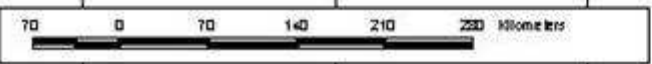
Agro - Climatic Sub - Regions of Yemen



LEGEND

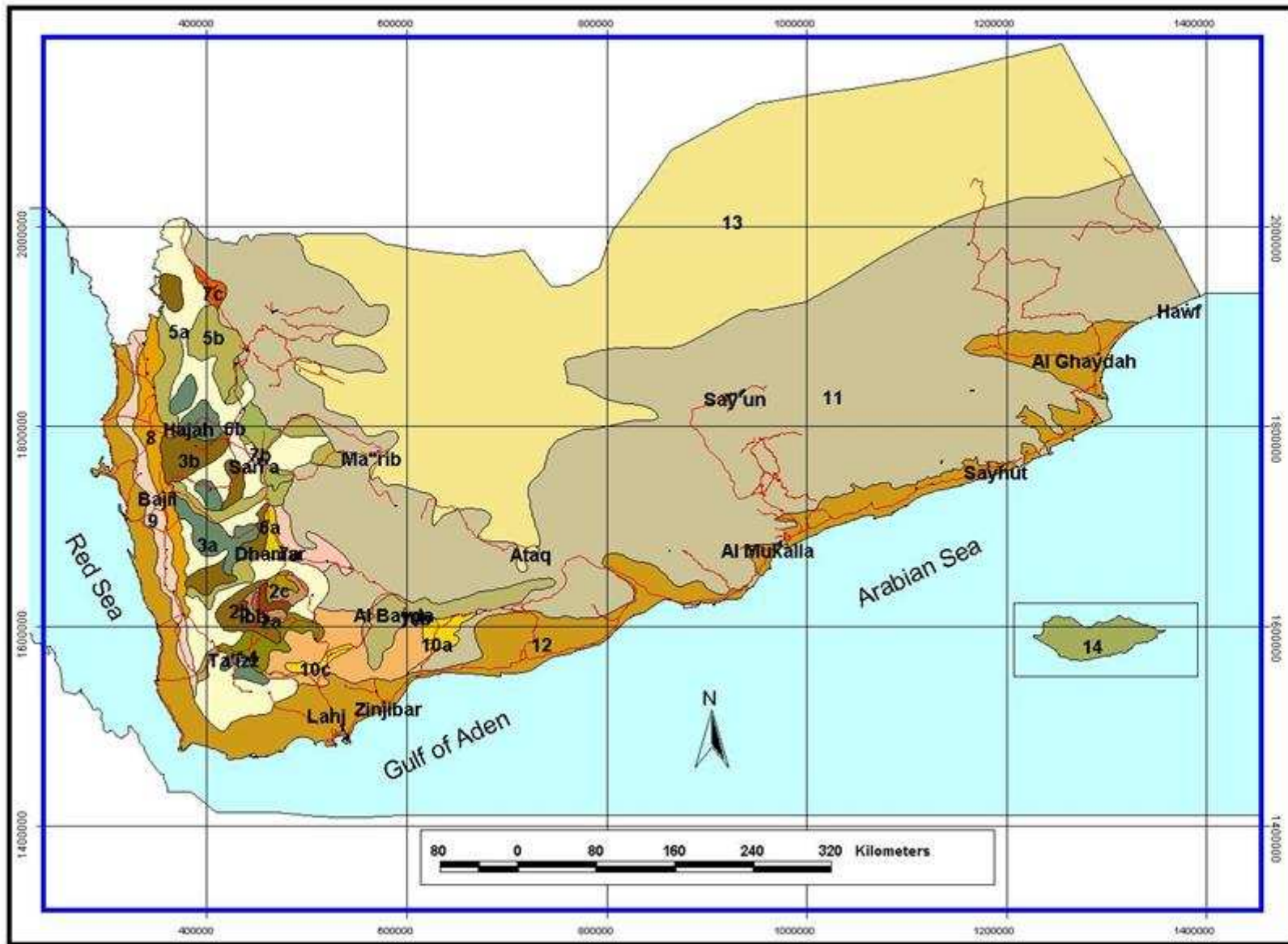
■ Western Coast	■ Northern Highlands
■ Southern Coast	■ Central Highlands
■ Eastern Coast	■ Southern Highlands
	■ Eastern Plateau

Agricultural Research & Extension Authority
 Renewable Natural Resources
 Research Centre
 GIS & Remote Sensing Section



Agro-climatic zones of yemen

النطاقات المناخية الزراعية في اليمن

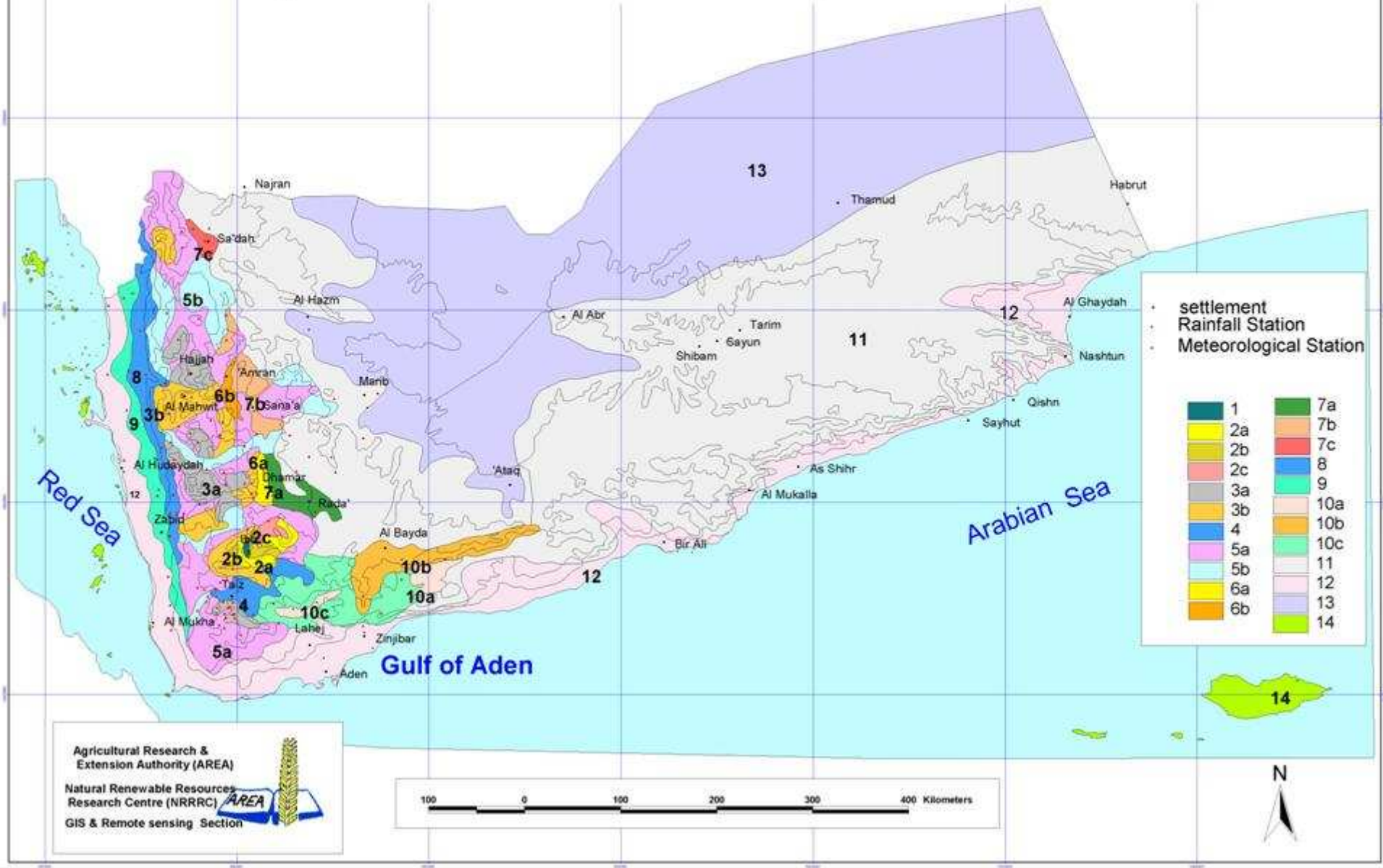


Legend

1	4
10a	5a
10b	5b
10c	6a
11	6b
12	7a
13	7b
14	7c
2a	8
2b	9
2c	
3a	
3b	

Agricultural Research Authority
 Renewable Natural Resources
 Research Center
 GIS and Remote Sensing Section

الطاقات المناخية الزراعية والمحطات الأرصادية في الجمهورية اليمنية
 Agro - Climatic Zones and Location of Meteorological Stations in Yemen

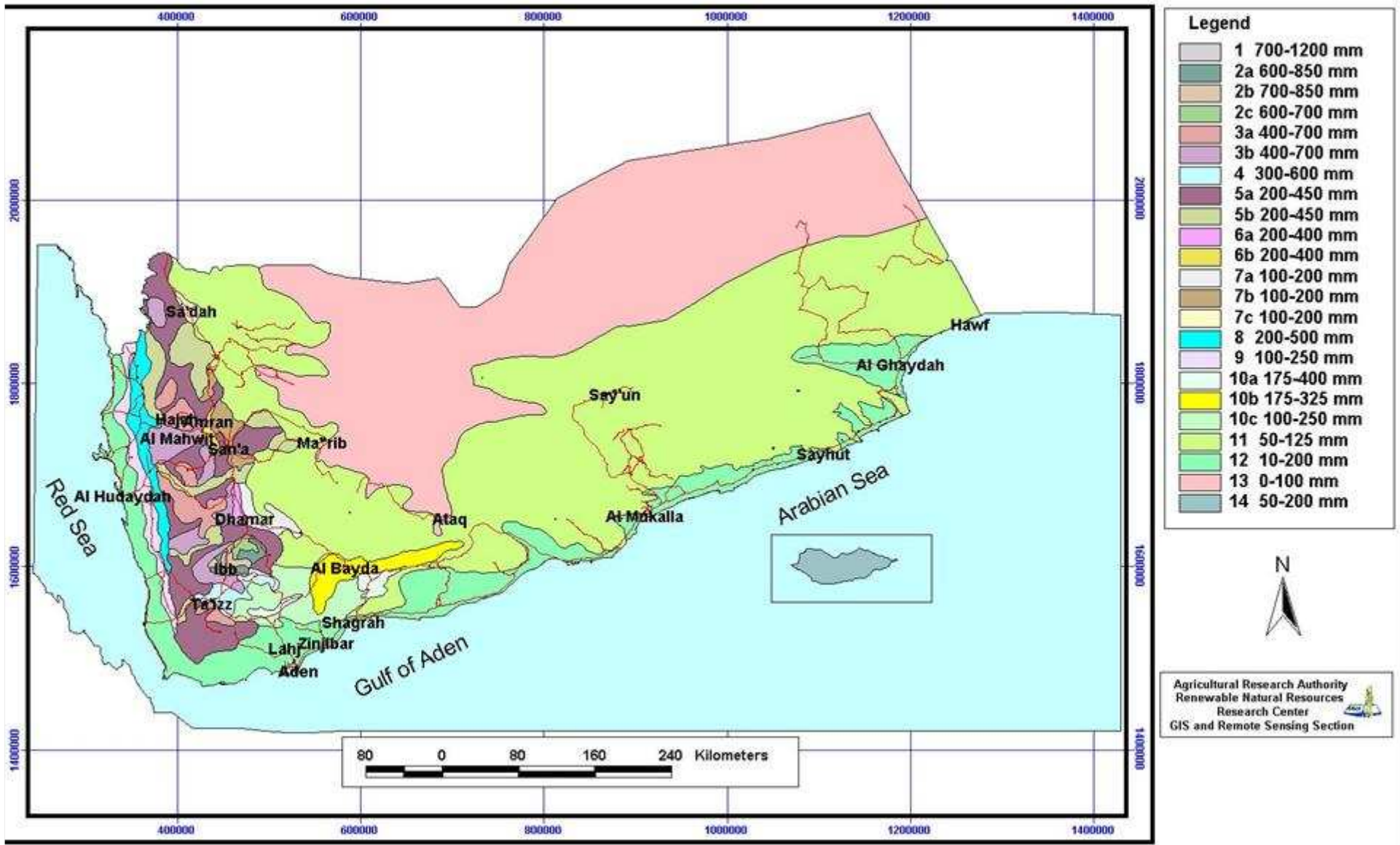


Agricultural Research & Extension Authority (AREA)
 Natural Renewable Resources Research Centre (NRRRC)
 GIS & Remote sensing Section



Precipitation over the Agro-climatic zones in Yemen

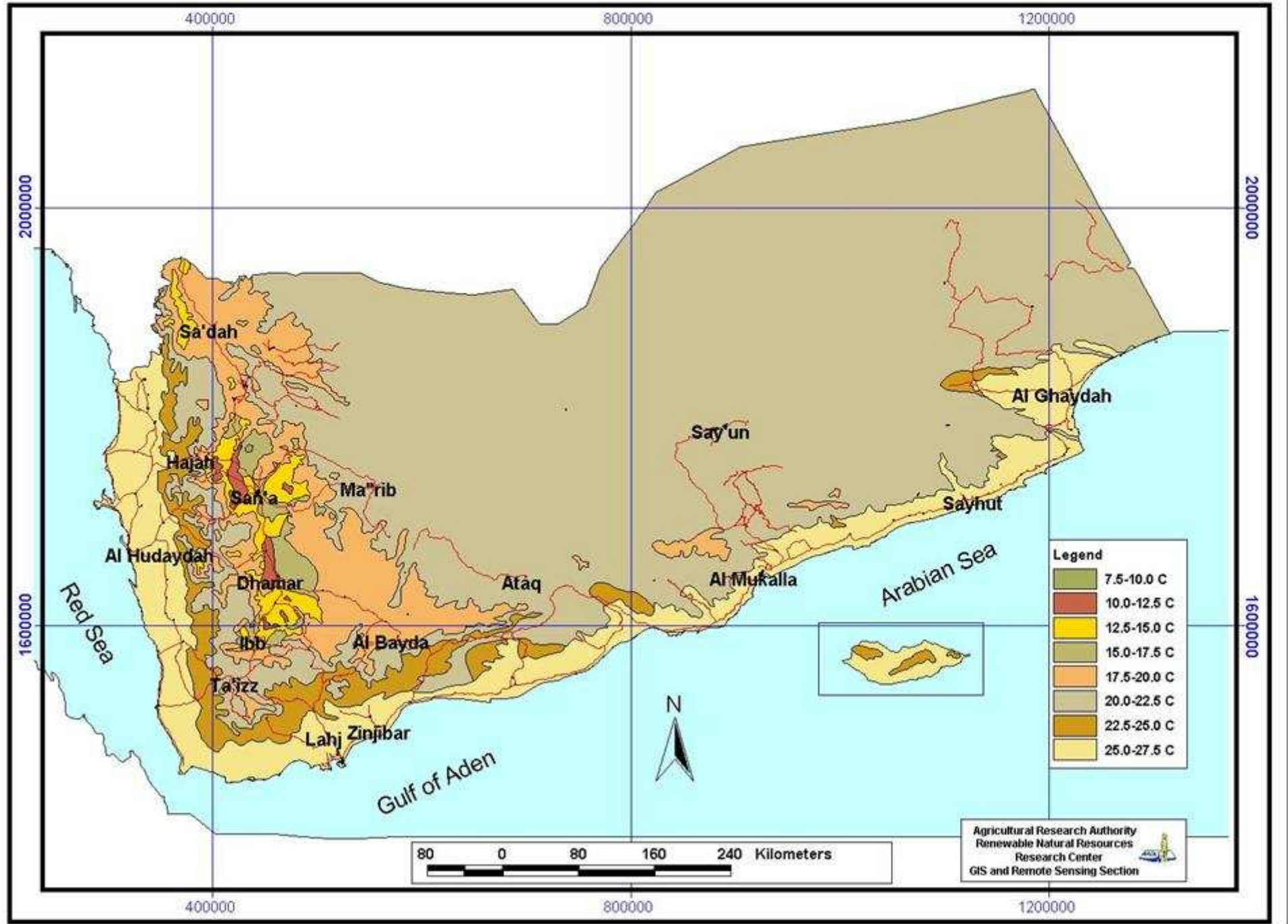
الهطول المطري في النطاقات المناخية المختلفة للجمهورية اليمنية



Agricultural Research Authority
 Renewable Natural Resources
 Research Center
 GIS and Remote Sensing Section

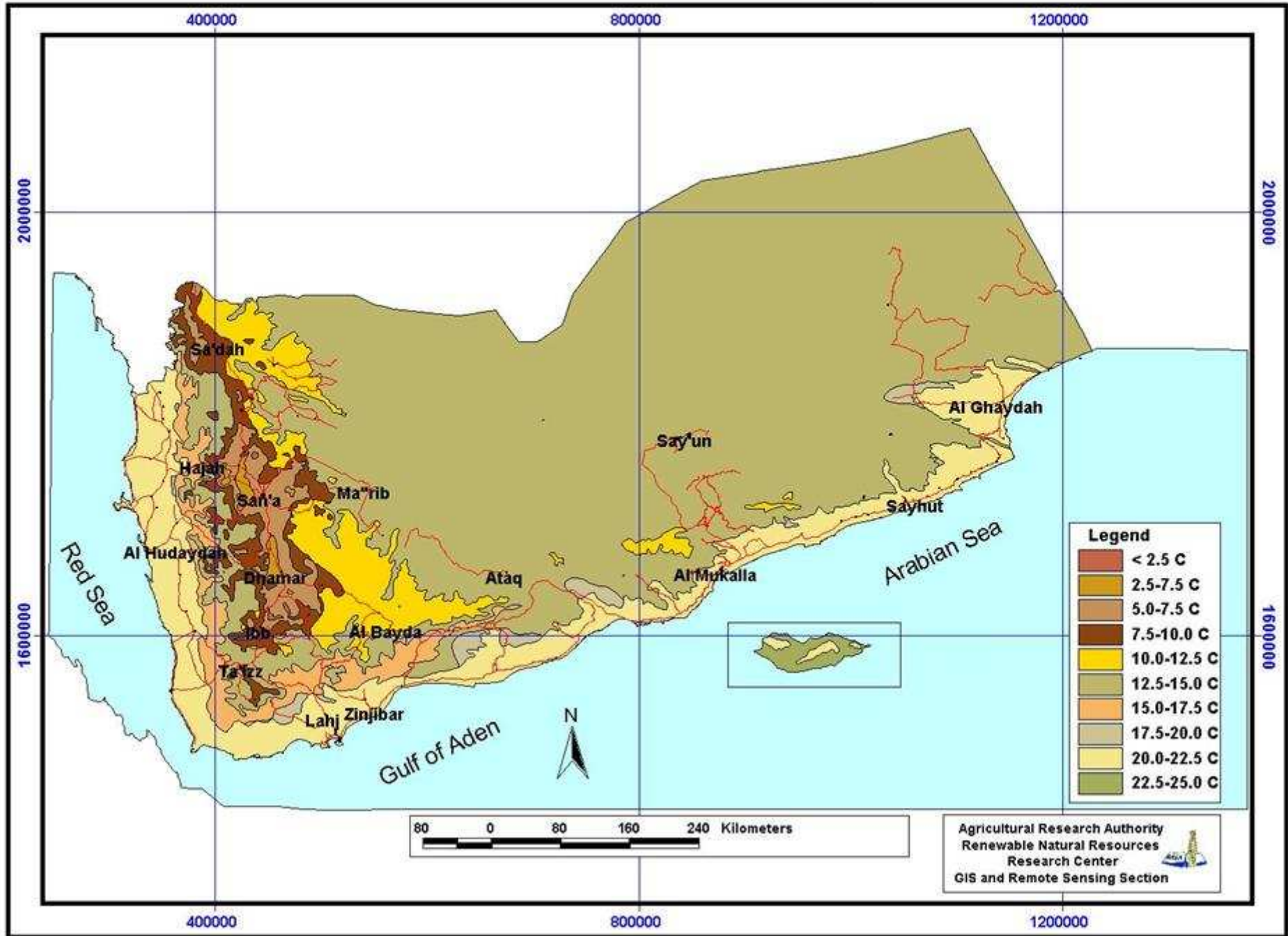
Mean daily temperature during cold season

المتوسط اليومي لدرجة الحرارة خلال الموسم الشتوي في اليمن



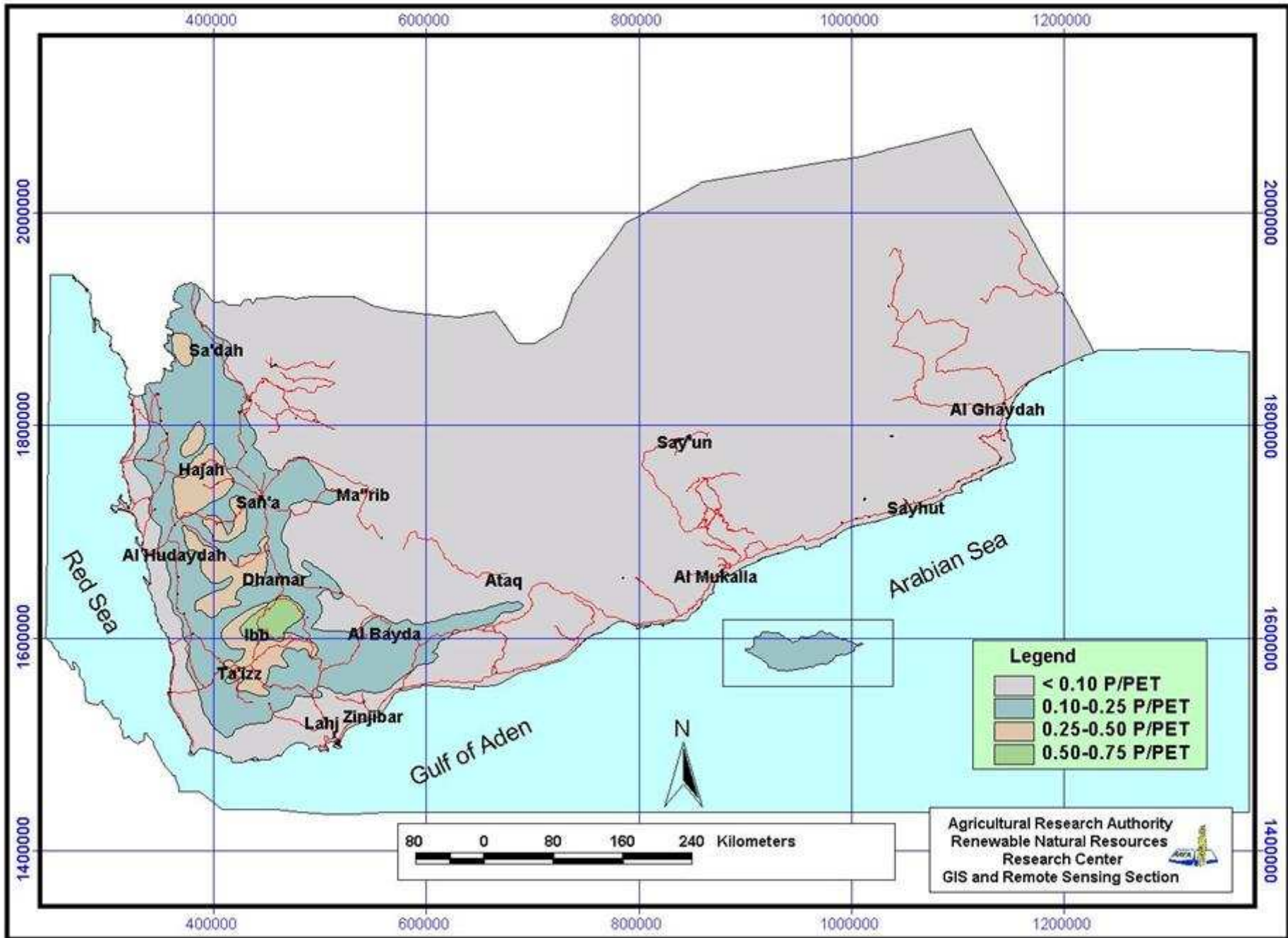
Mean minimum temperature during cold season

متوسط درجة الحرارة الصغرى خلال الموسم الشتوى



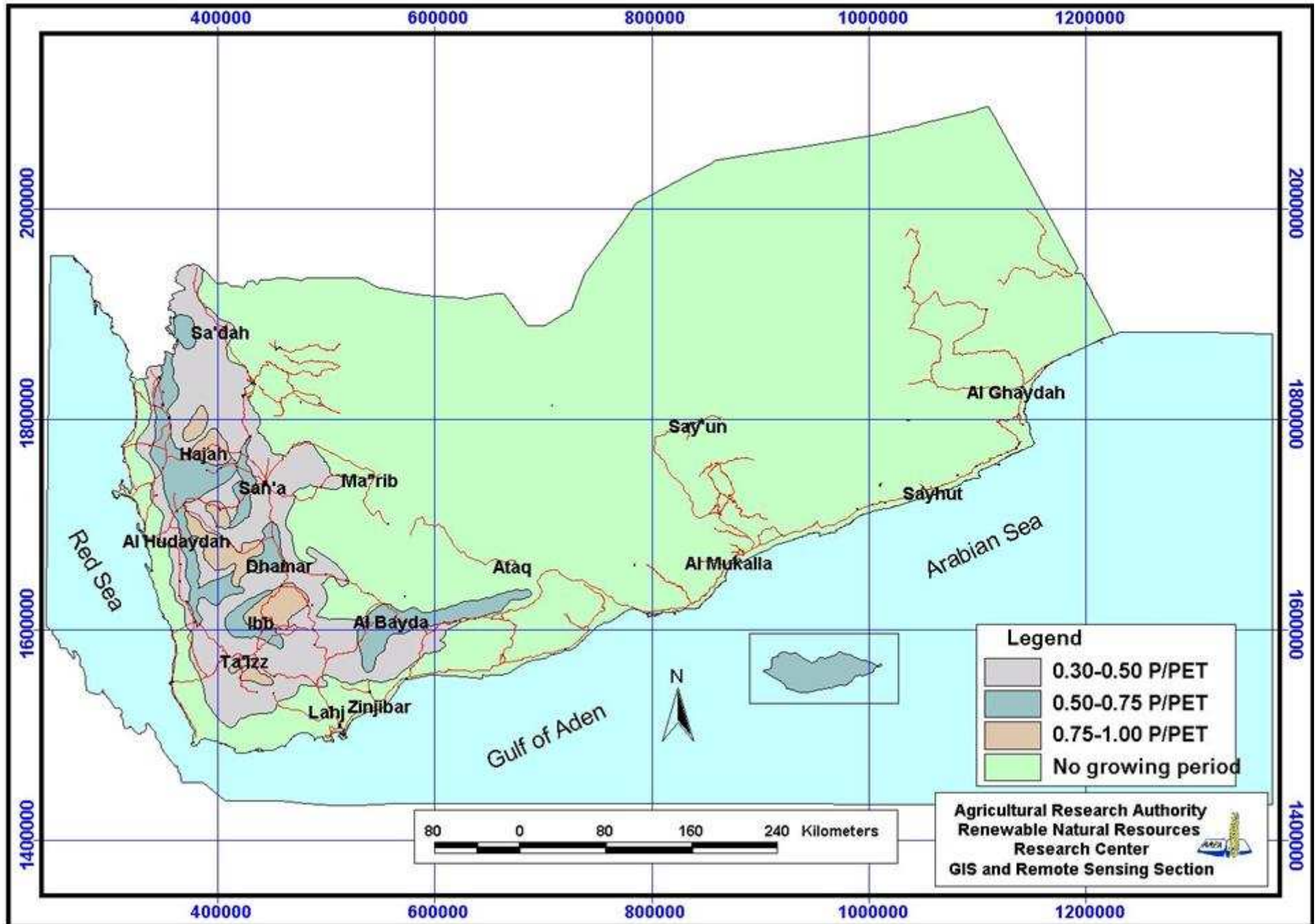
Potential evapotranspiration

كمية البخر - نتح الكامنة



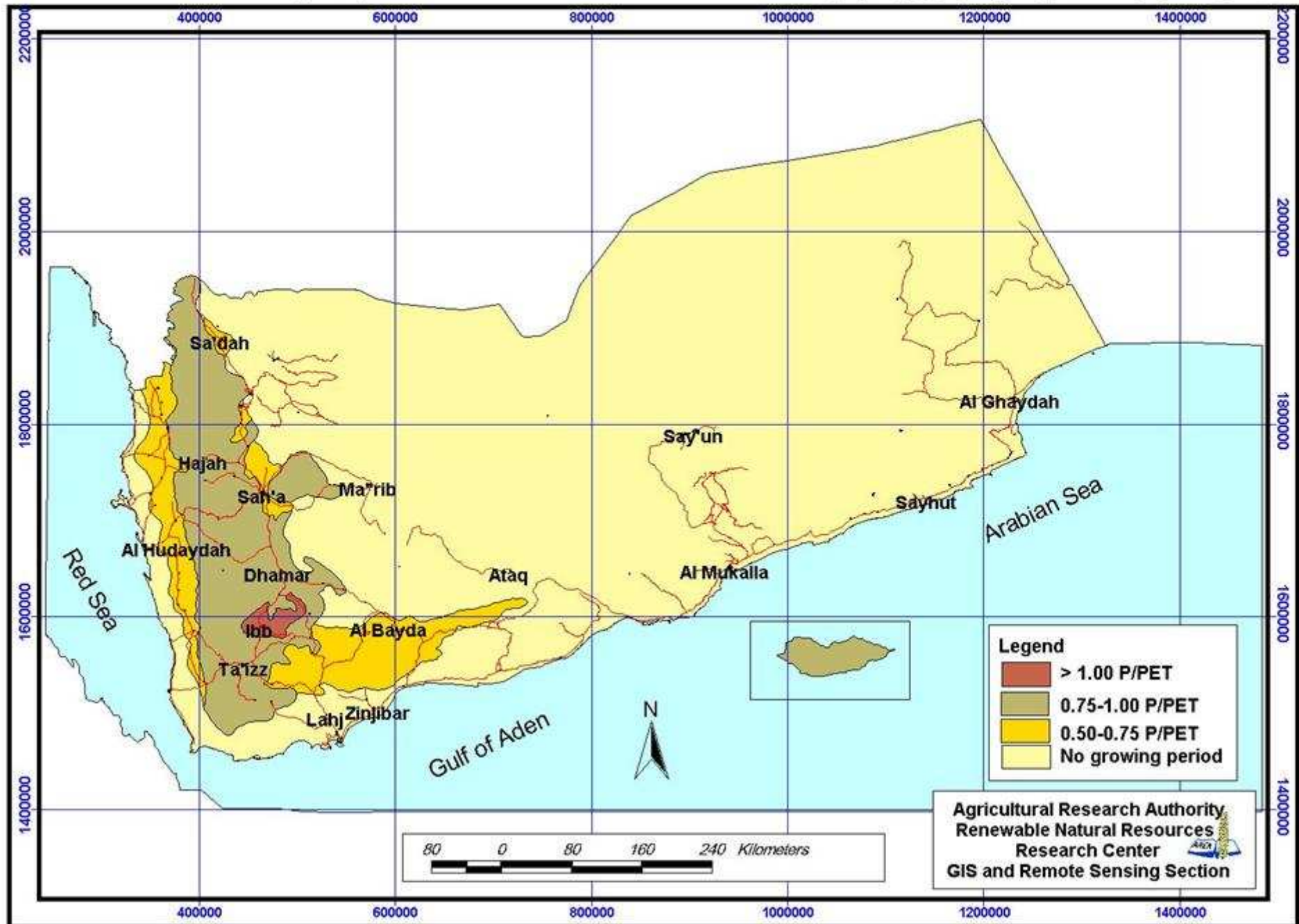
P/PET during growing period

نسبة كمية التساقط الى كمية البخر -نتج الكامنة خلال فترة النمو



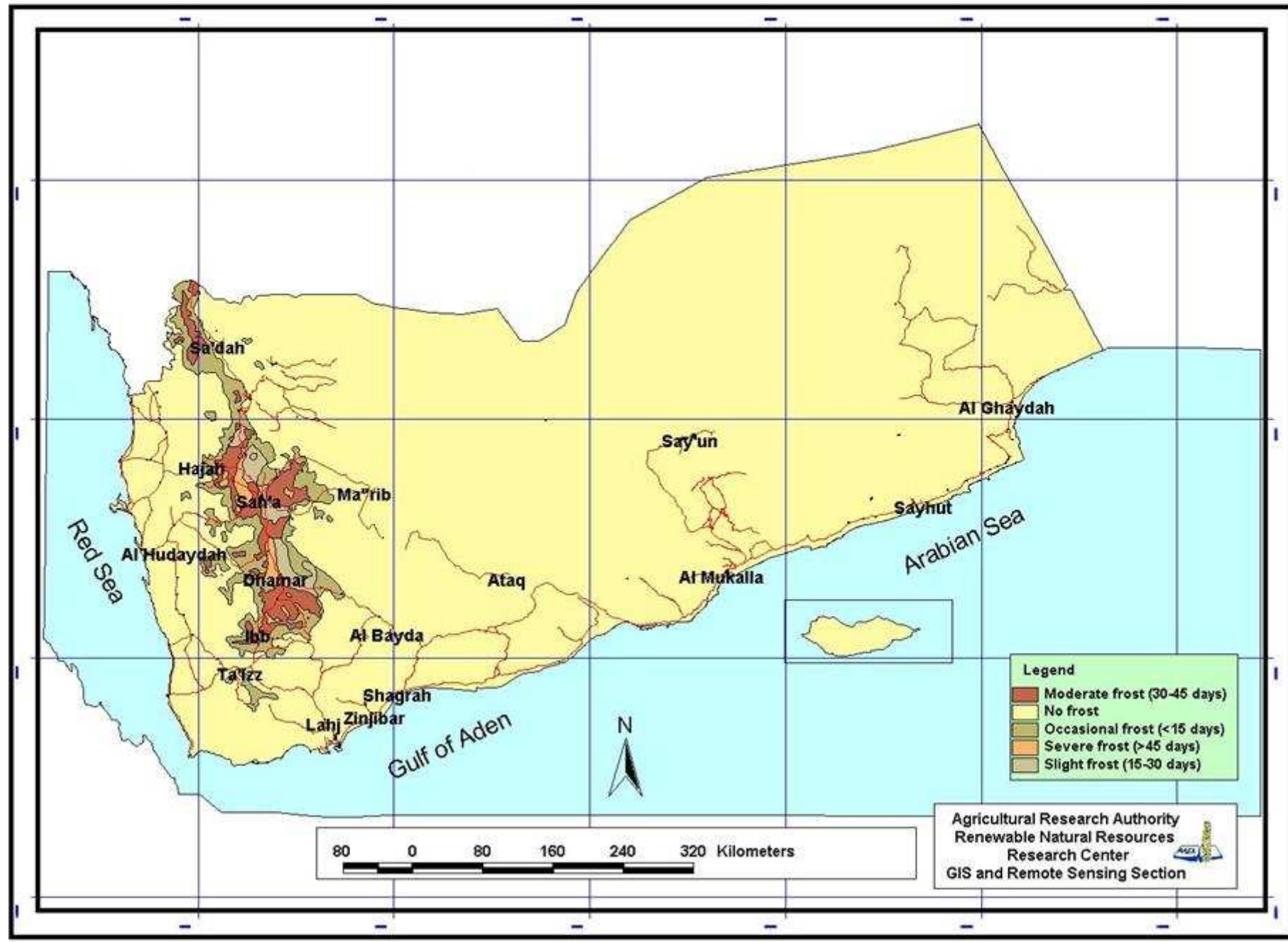
P/PET during growing period with water harvesting in yemen

نسبة كمية التساقط الى كمية البحر - نتح
 خلال فترة النمو بحصاد المياه فى الجمهورية اليمنية



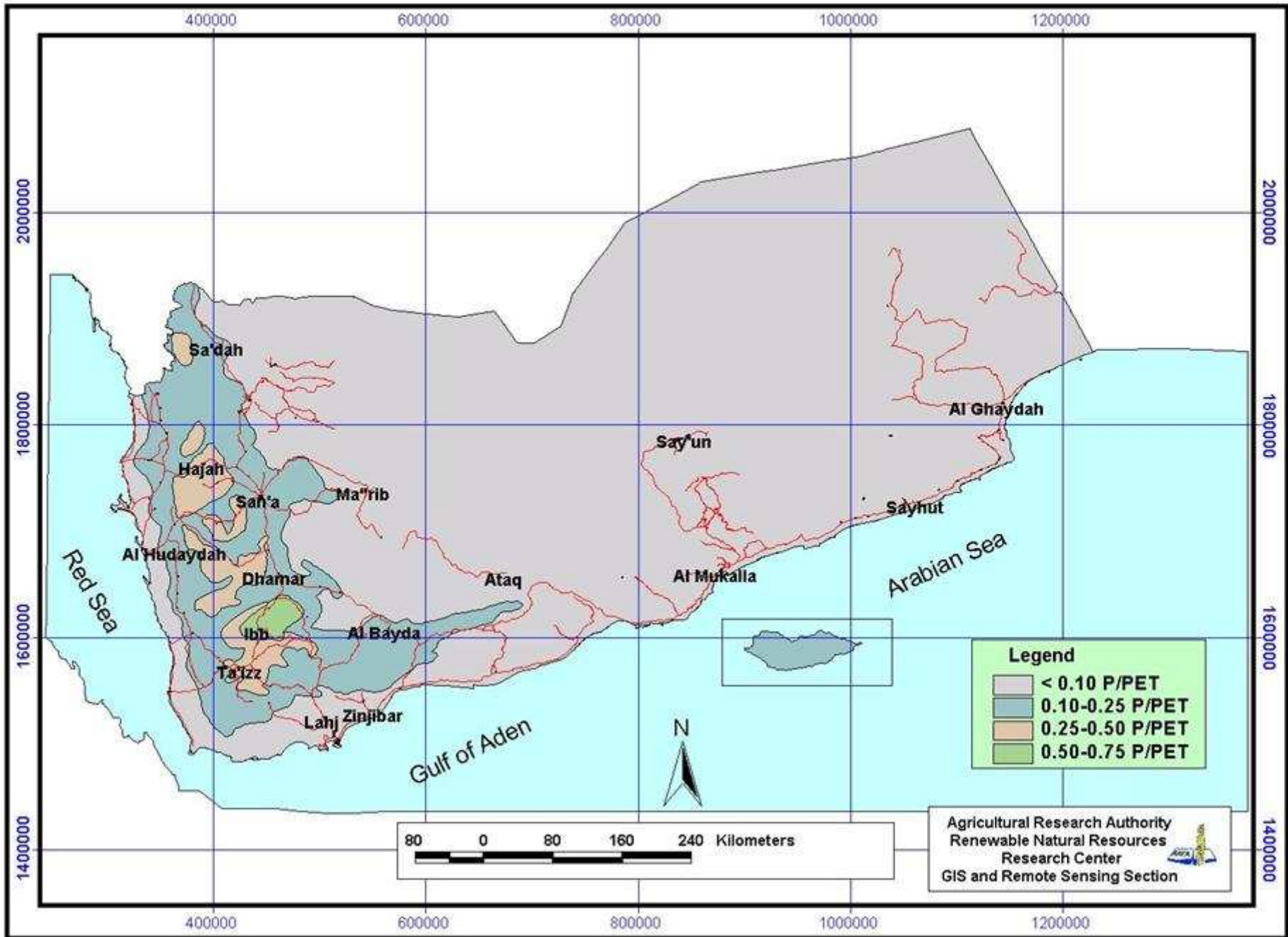
Frost occurrence in Yemen

مناطق تواجد الصقيع في الجمهورية اليمنية



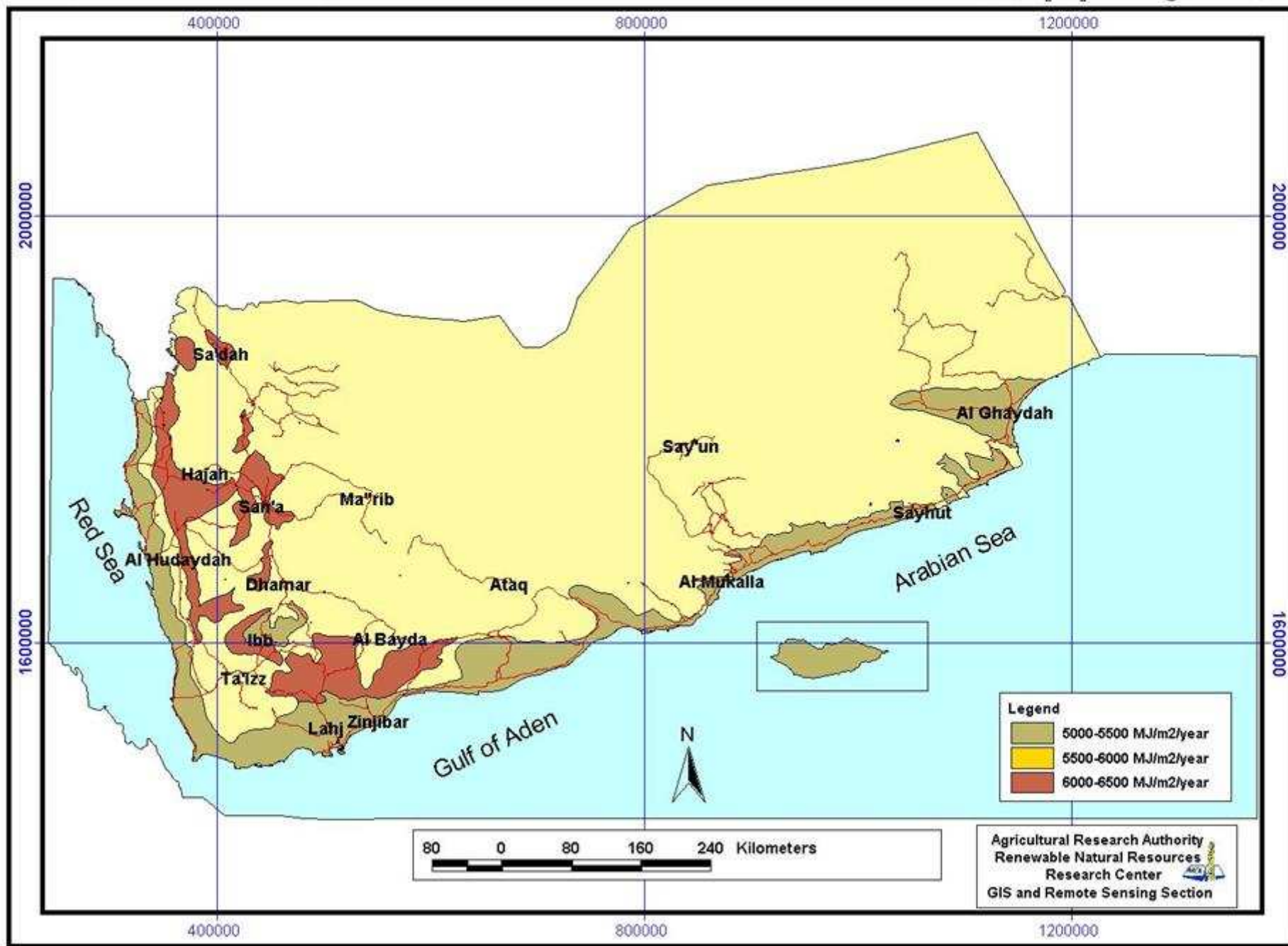
Potential evapotranspiration

كمية البخر - نتح الكامنة



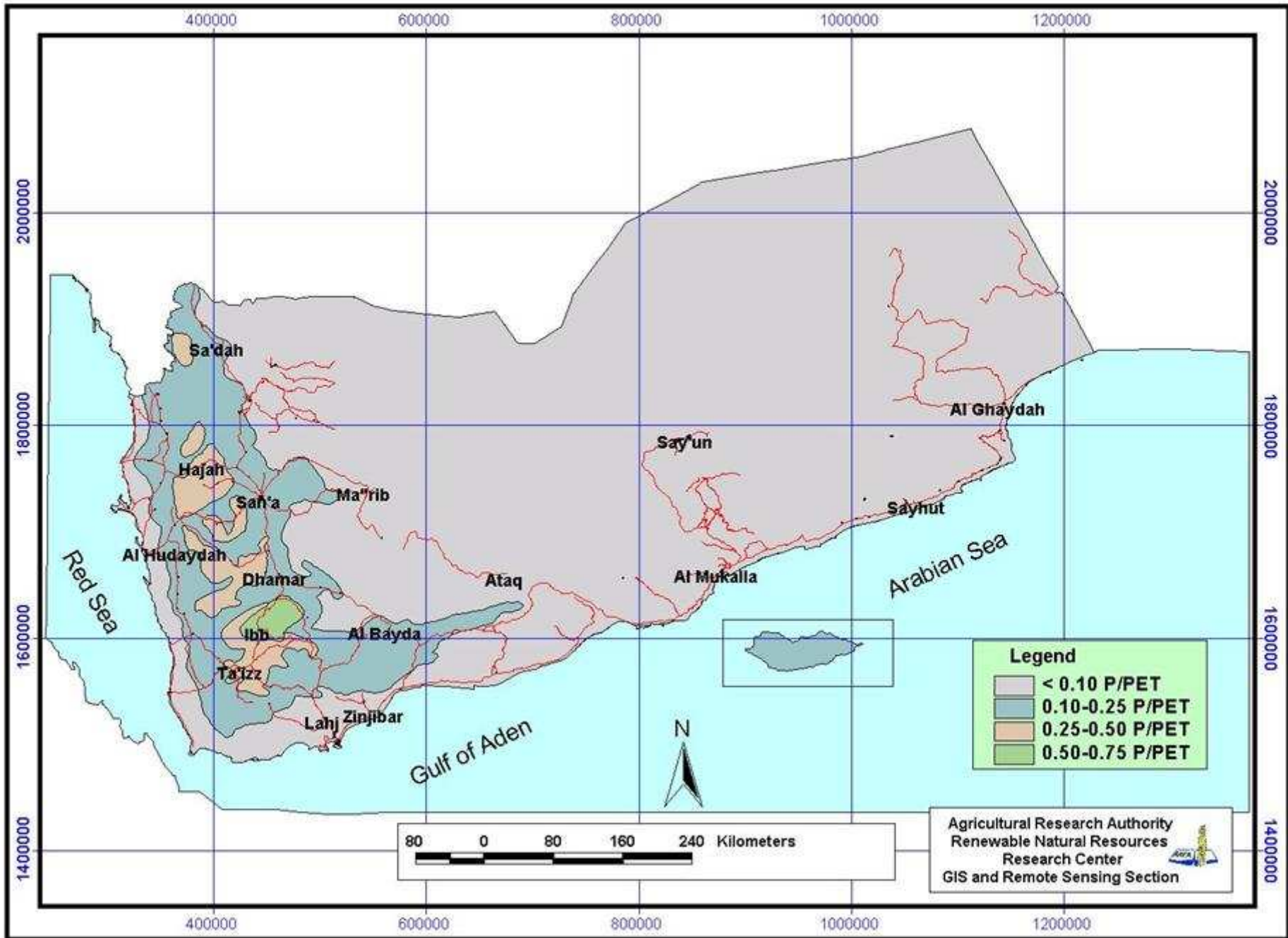
Solar Radiation in yemen

كمية الاشعاع الشمسي في اليمن



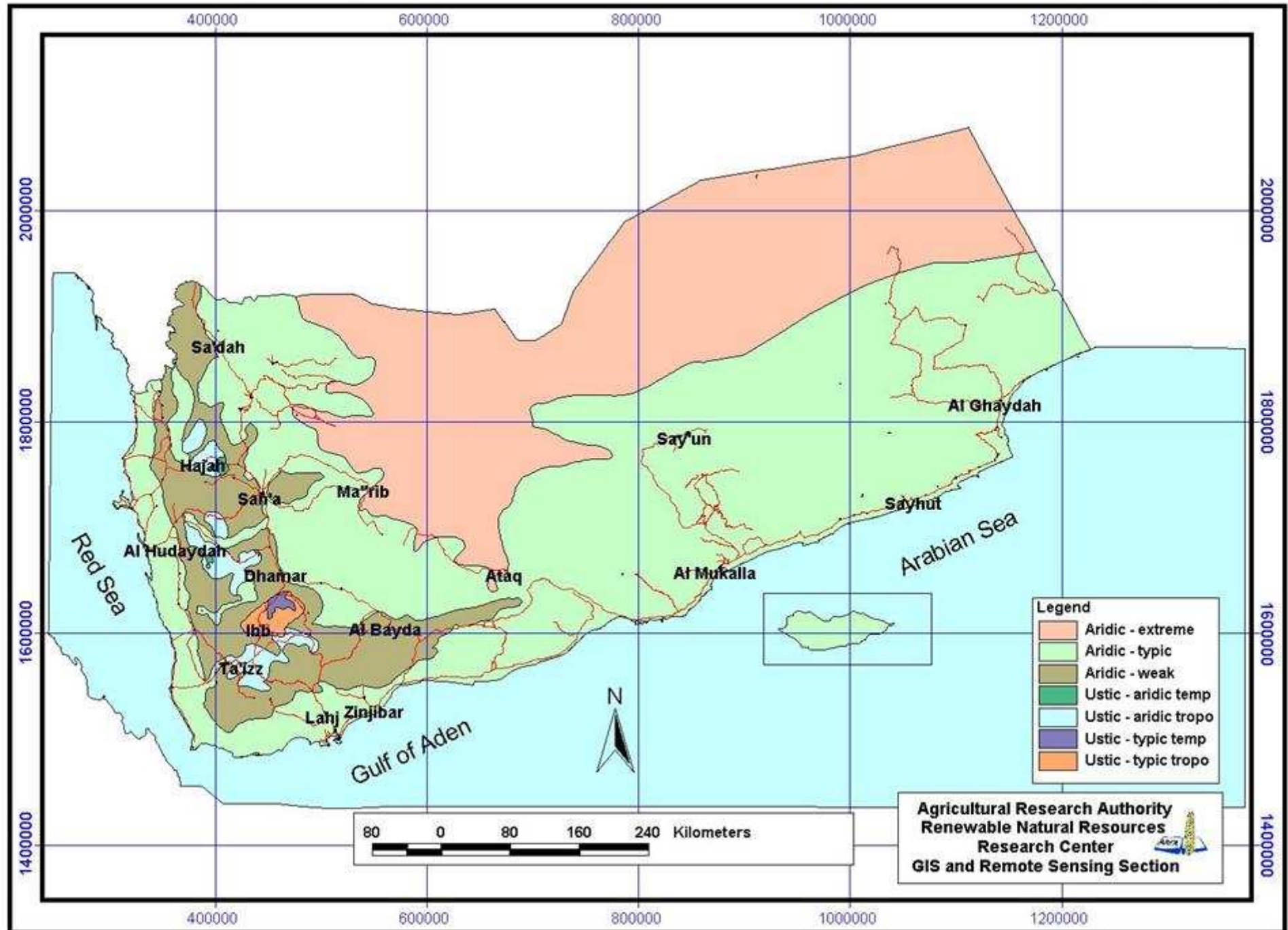
Potential evapotranspiration

كمية البخر - نتح الكامنة



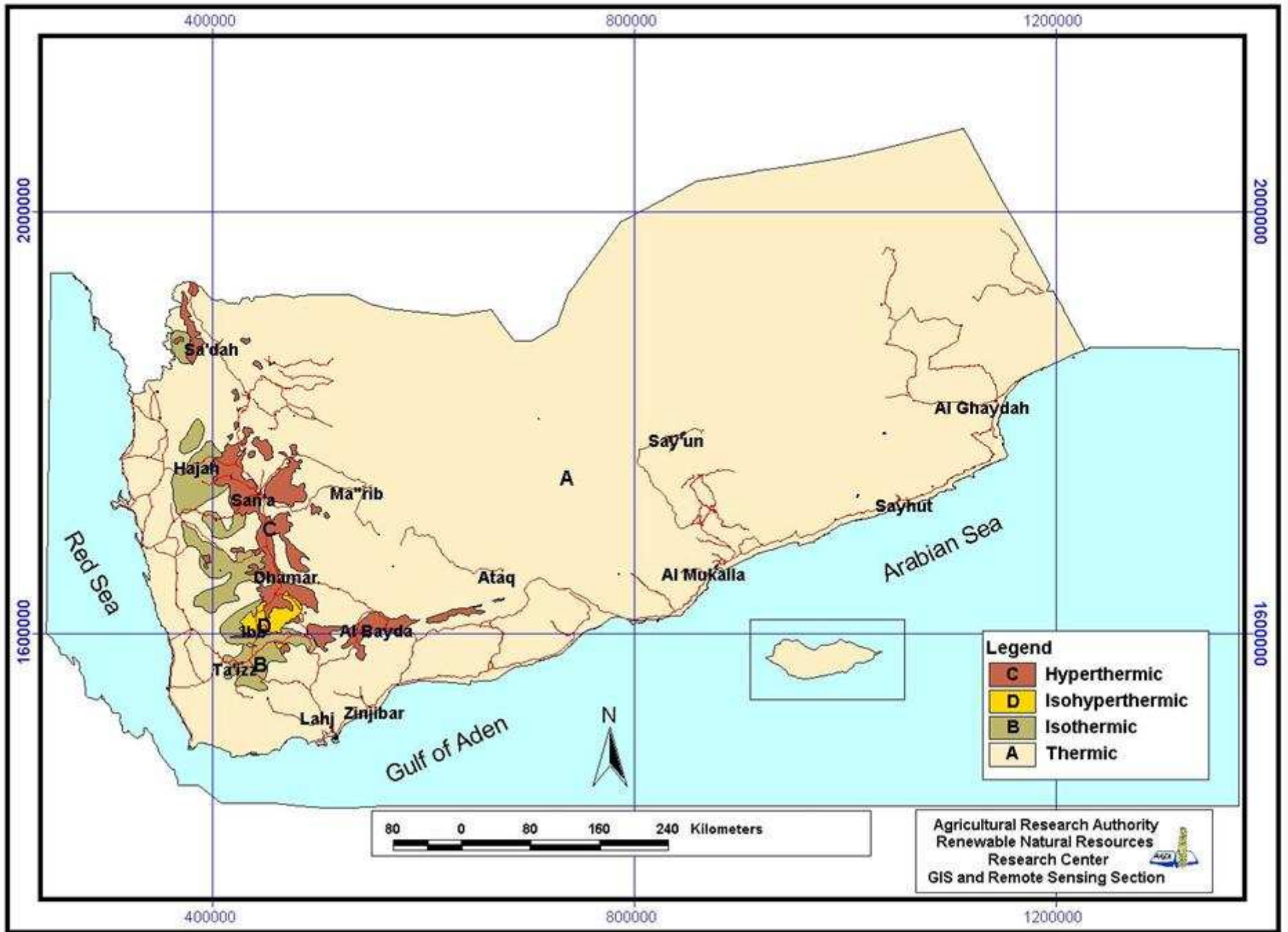
Soil moisture regime in yemen

النظام الرطوبي للتربة في الجمهورية اليمنية



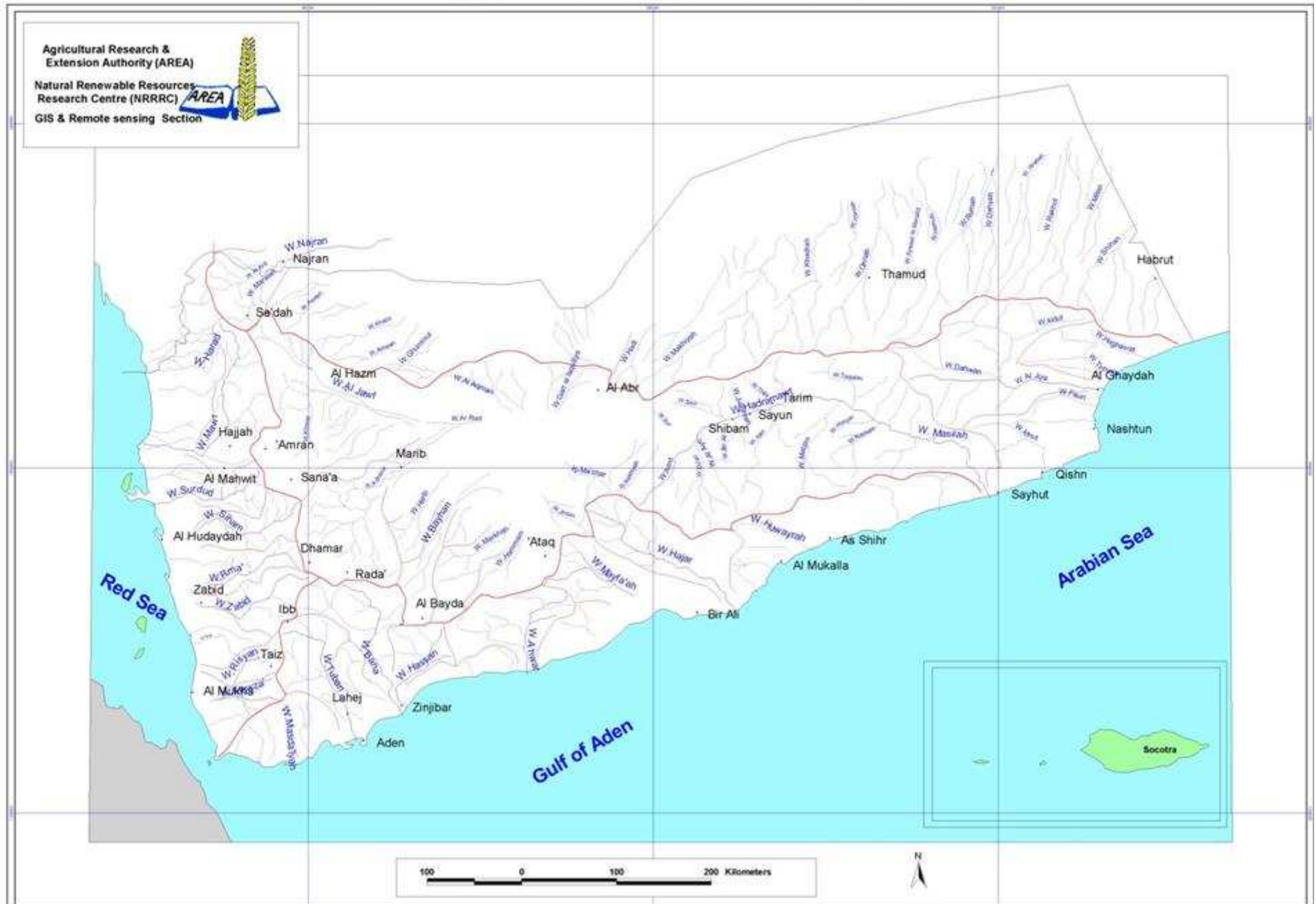
Soil temperature regime

درجة حرارة التربة في الجمهورية اليمنية



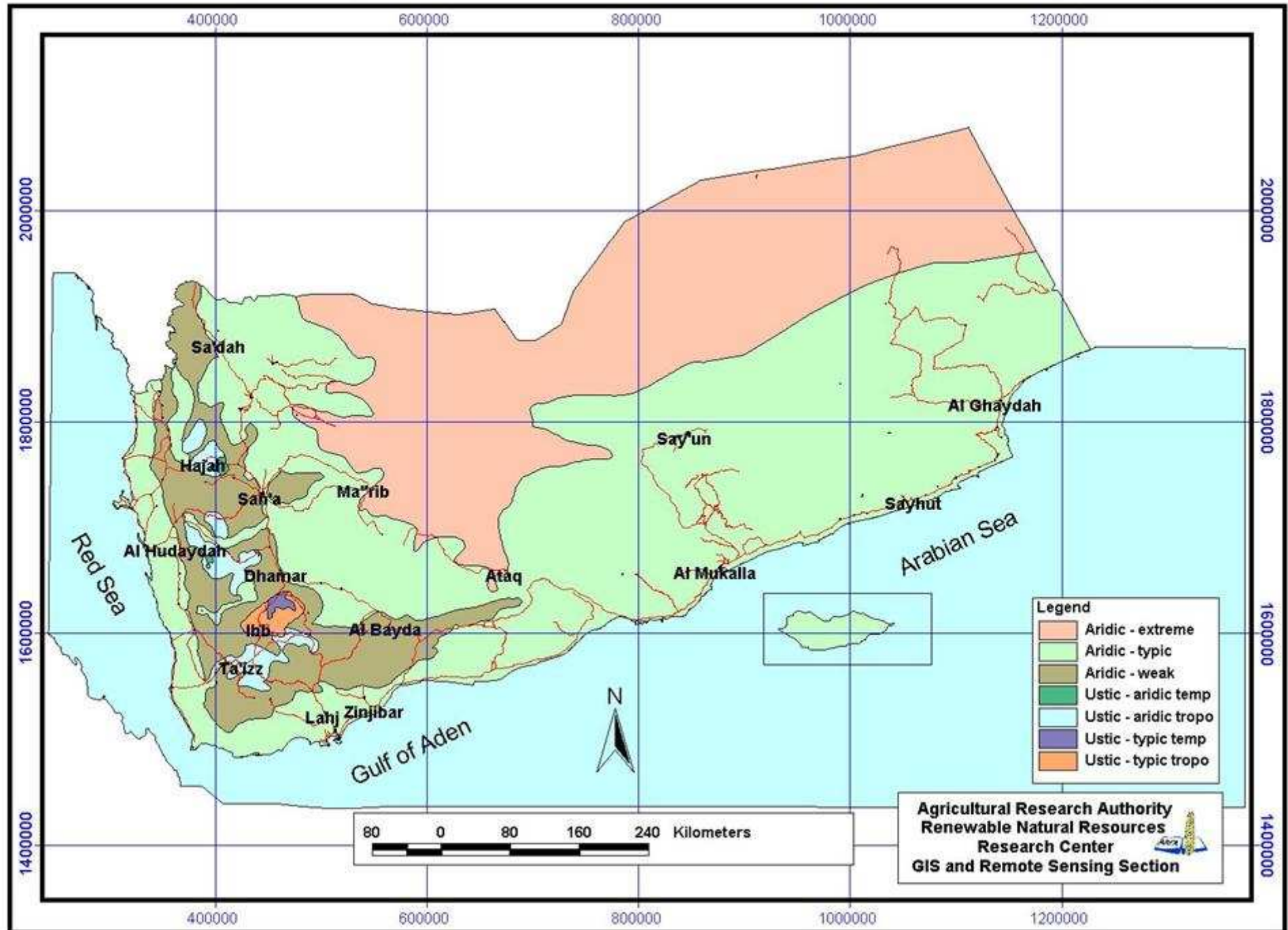
الأحواض والمساقط المائية في الجمهورية اليمنية

Drainage Basins & Watersheds of Yemen



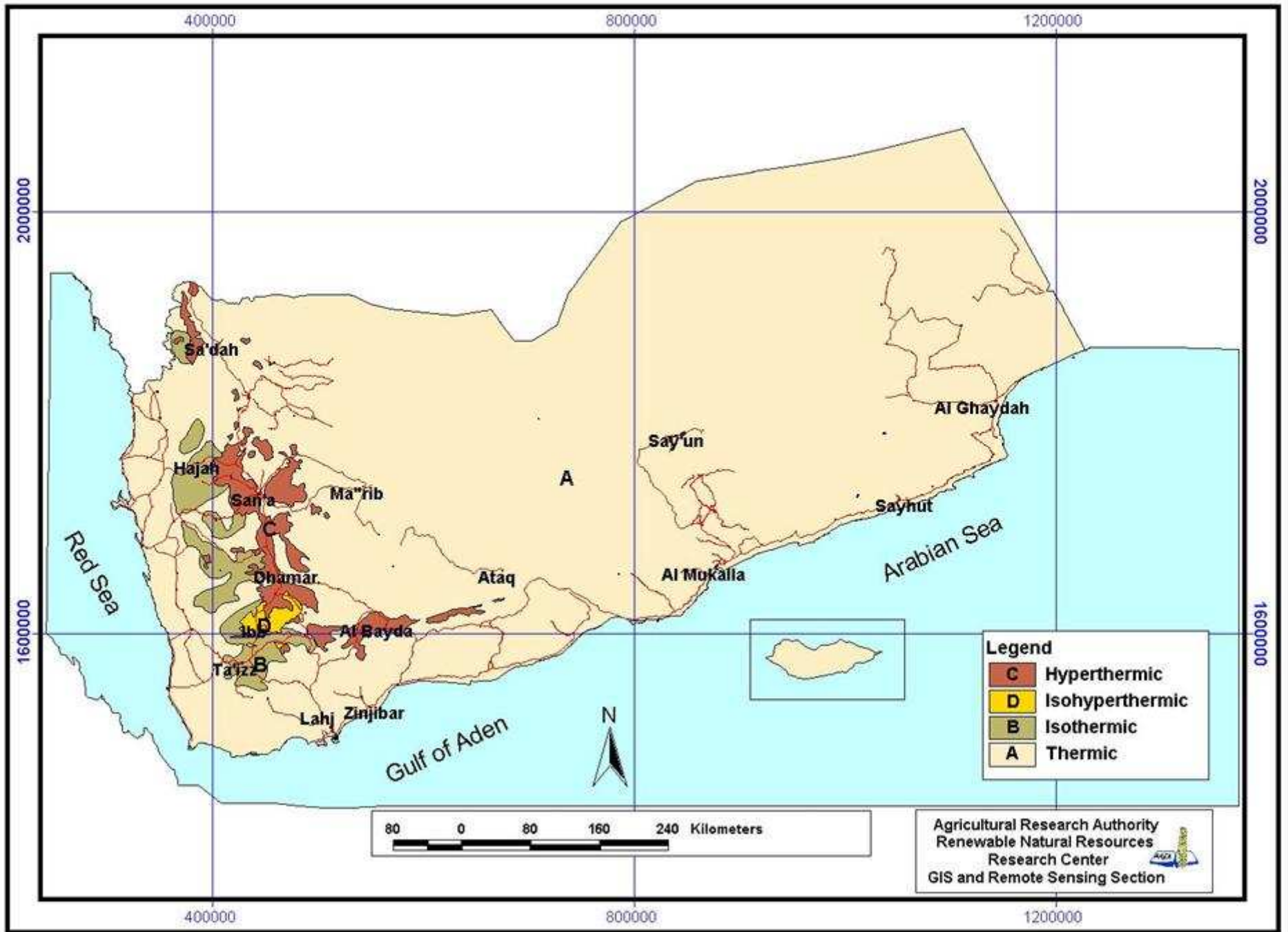
Soil moisture regime in yemen

النظام الرطوبي للتربة في الجمهورية اليمنية



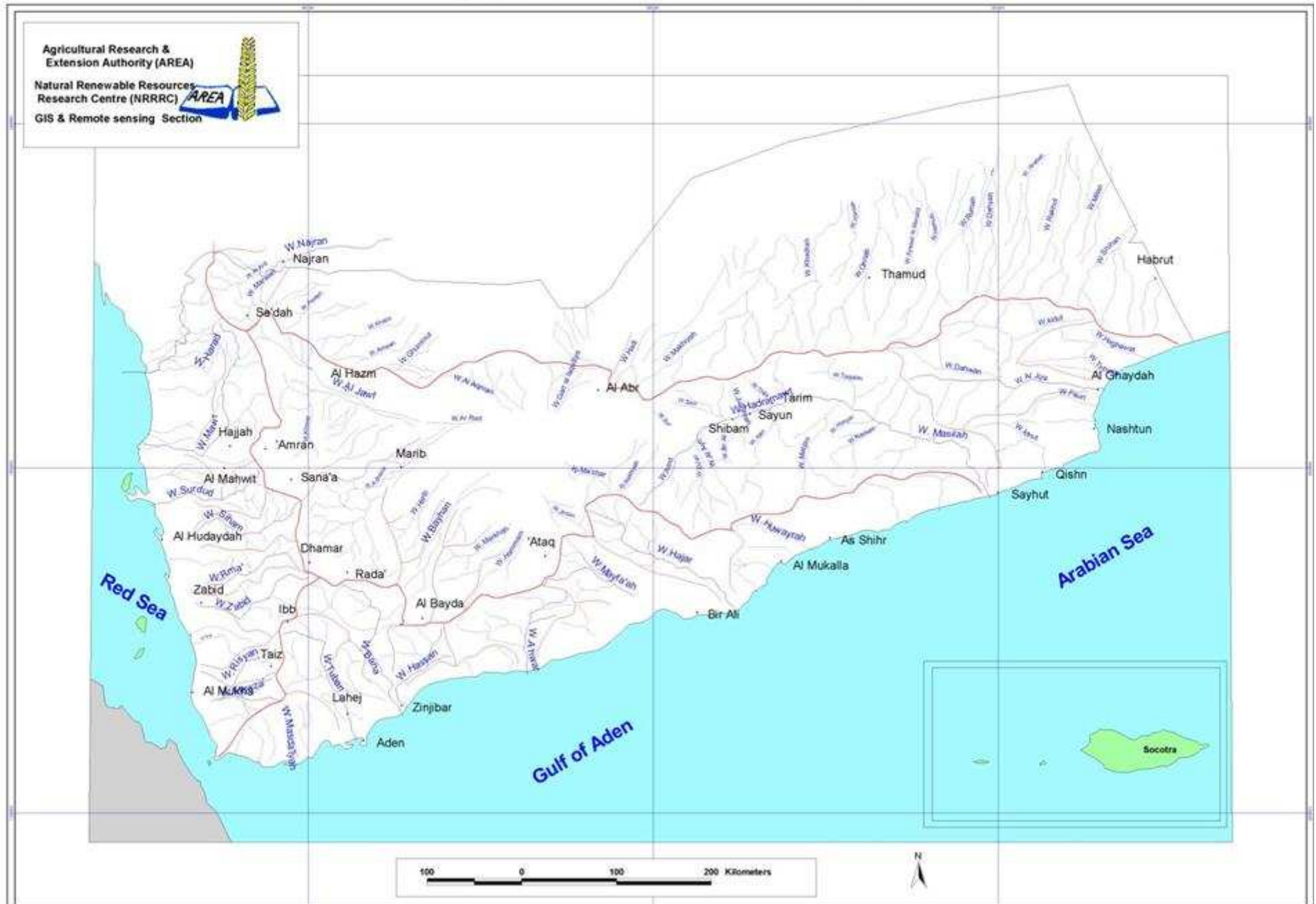
Soil temperature regime

درجة حرارة التربة في الجمهورية اليمنية



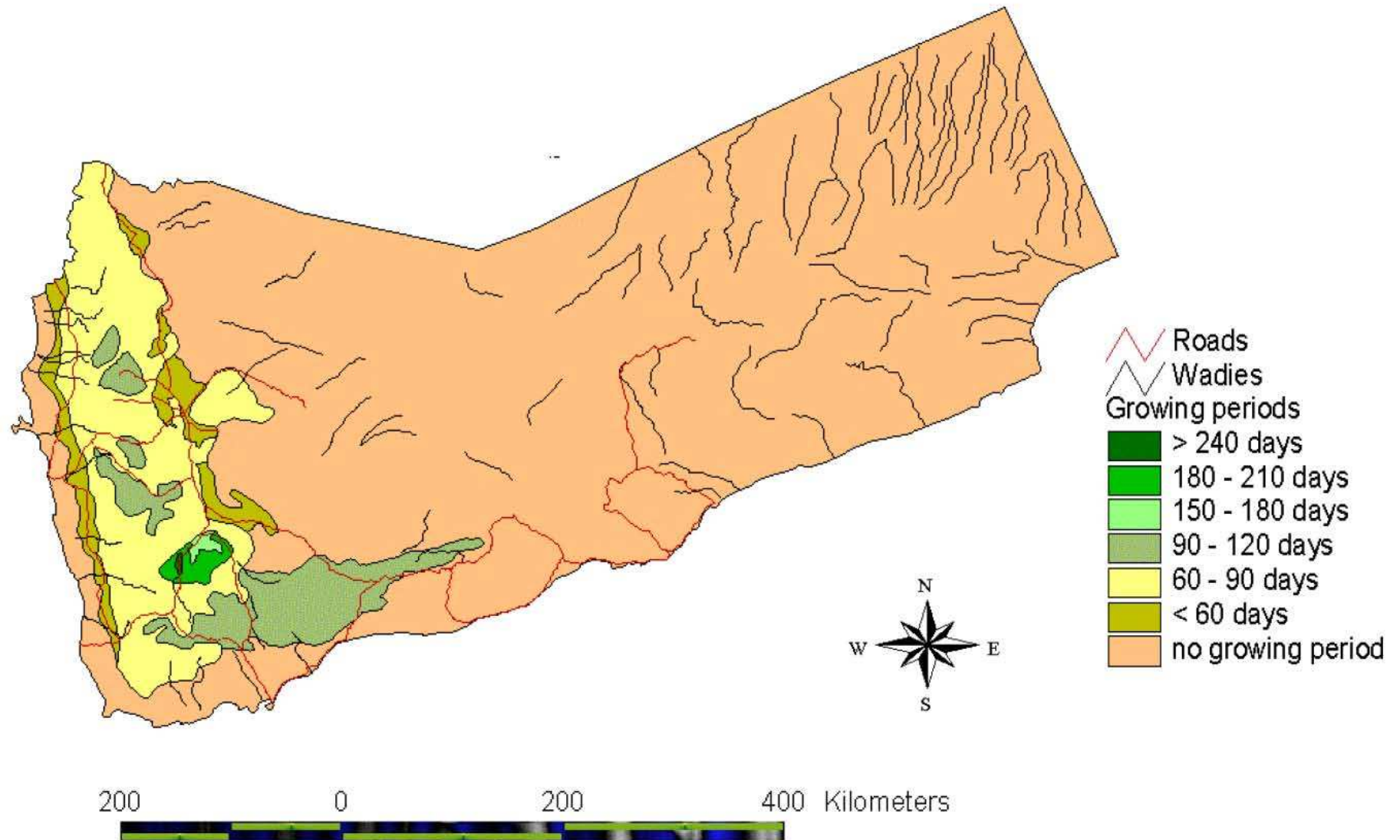
الأحواض والمساقط المائية في الجمهورية اليمنية

Drainage Basins & Watersheds of Yemen



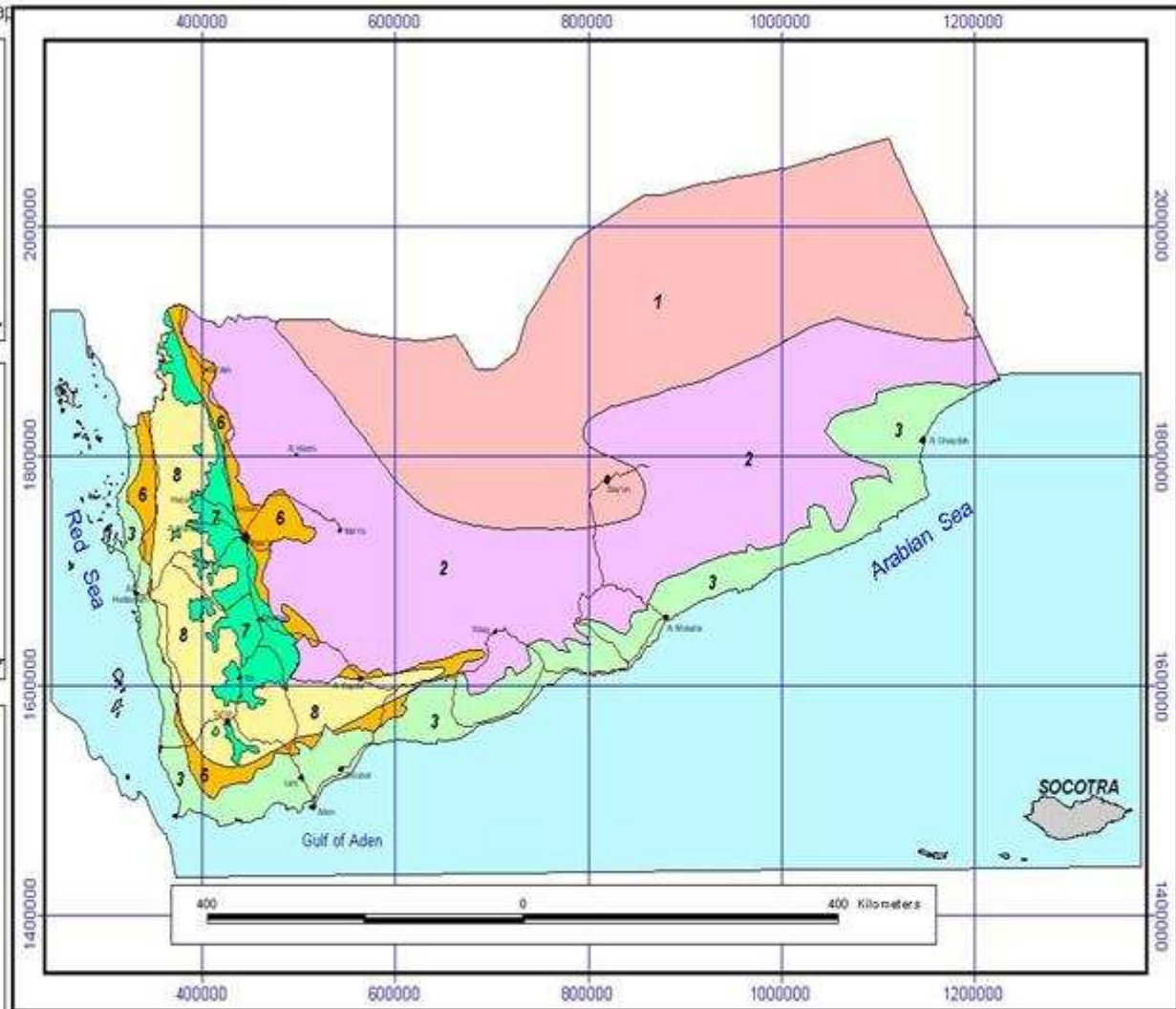
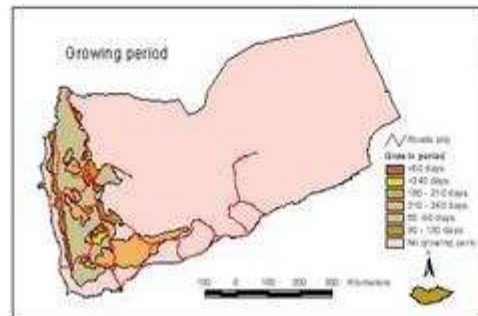
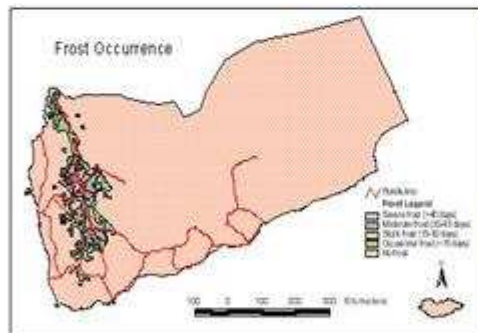
Agro climatic Resources of Yemen

Length of Growing period



Major Farming Systems Zones Map of Yemen

Layers used for producing Farming System Zones Map



Main Farming System Zones

<ul style="list-style-type: none"> System 1 = Spars (arid) farming system <i>Below 50mm rainfall on North - eastern plateau</i> System 2 = Pastoral farming system <i>Rainfall above 50 mm in average years, but no growing period (considering water harvesting)</i> System 3 = Coastal artisanal fishing system <i>500 meters altitude parallel to the coast</i> System 4 = Urban based farming system <i>No data available</i> 	<ul style="list-style-type: none"> System 5 = Irrigated farming system <i>No data available</i> System 6 = Dryland mixed farming system <i>Growing period (including water harvesting) > 90 days, but below 250mm annual rainfall</i> System 7 = Highland mixed farming system <i>Occasional or seasonal frost occurrences at altitude above 2000 meters</i> System 8 = Rainfed mixed farming system <i>Frost free areas with rainfall above 250 mm</i>
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

TOPOGRAPHIC LEGEND

- Main road
- Settlement
- Sea
- Islands

Prepared by:
 Agricultural Research & Extension Authority (AREA),
 Natural Resources Research & Extension Center (NREC),
 Environmental Protection & Rehabilitation Unit,
 Land Use Planning & Development Section



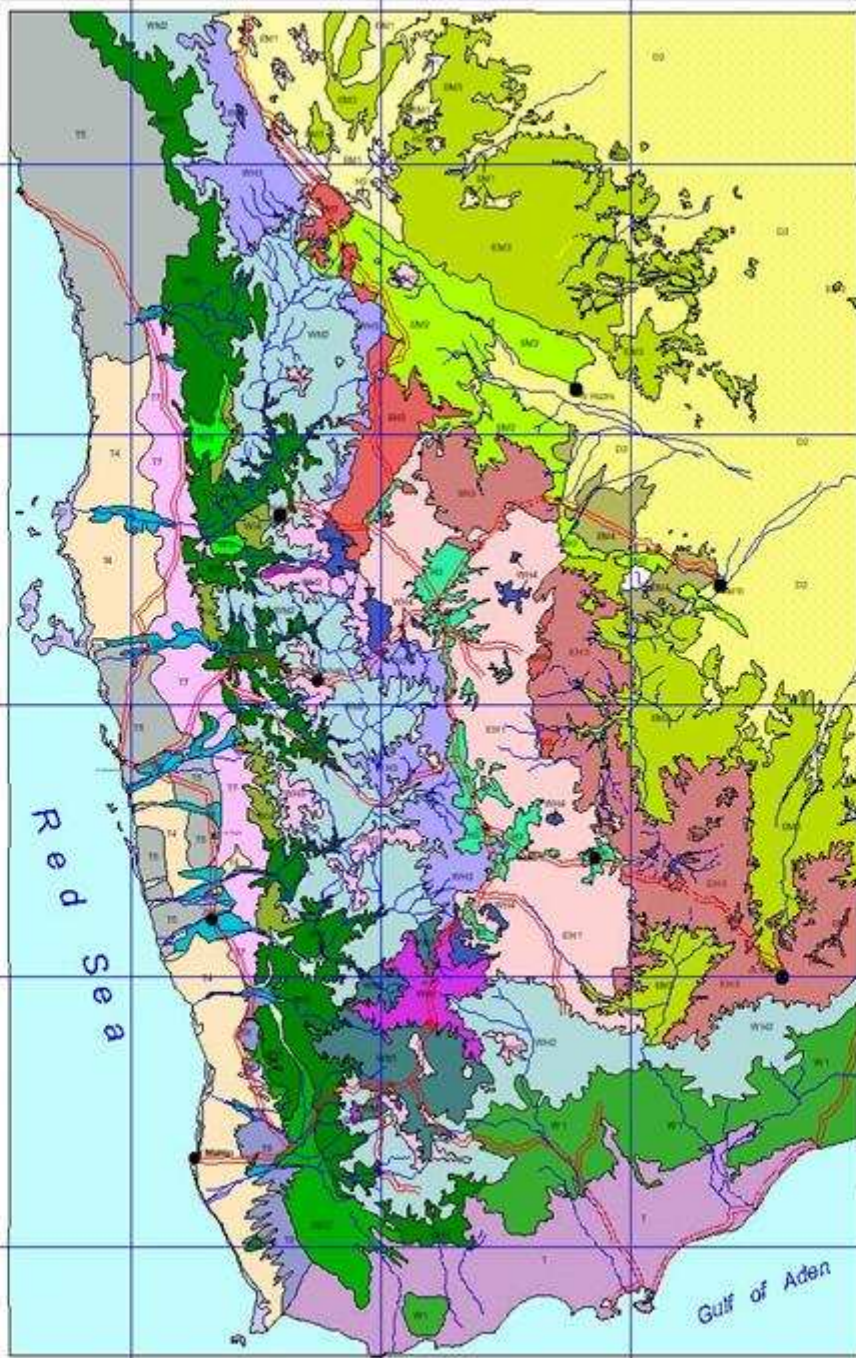
VEGETATION OF YEMEN

LOCATION DIAGRAM



Data derived from :
Vegetation Map of Yemen Republic
(Western part)
prepared by DHV - AREA, August 1990.

GIS by :
Ahmad R. An Nasiri
Ahmad N. Shakhab



LEGEND

- THAMAM COASTAL PLAIN (400m)**
 - T1 Mangrove / Acacia Woodland
 - T2 Savanna Scrub / Sparse Dwarf / Shrub Land And Bare Land
 - T3 Park Grass / Phoenix / Salvator Woodland
 - T4 Salt / Sun lands, Sparse / Openland Dwarf / Shrub Land
 - T5 Papyrus / Bamboo Grassland And Bare Land
 - T6 Dryland / Openland / Coastal Land / Shrubland
 - T7 Papyrus / Bamboo / Coastal Land / Openland / Coastal Land
 - T8 Acacia / Openland / Open Woodland And Bare Land
- THAMAM FOOTHILLS AND LOWER ALTITUDE WESTERN MOUNTAINS (1000m)**
 - W11 Acacia / Sparse / Shrubland
 - W12 Dryland / Sparse / Shrubland
 - W13 Acacia / Tall / Sparse / Shrubland
 - W14 Convolvulus / Sparse / Shrubland
 - W15 Acacia / Sparse / Shrubland
- MEDIUM ALTITUDE WESTERN MOUNTAINS (1000-1800m)**
 - W16 Acacia / Sparse / Shrubland
 - W17 Acacia / Sparse / Shrubland
 - W18 Acacia / Sparse / Shrubland
 - W19 Acacia / Sparse / Shrubland
 - W20 Acacia / Sparse / Shrubland
 - W21 Acacia / Sparse / Shrubland
- HIGHLAND PLAINS**
 - H1 Acacia / Sparse / Shrubland (1000-1800m)
 - H2 Acacia / Sparse / Shrubland (2000-3000m)
 - H3 Acacia / Sparse / Shrubland (3000m)
- HIGH ALTITUDE EASTERN MOUNTAINS AND HIGHLANDS (1800m)**
 - E11 Acacia / Sparse / Shrubland
 - E12 Acacia / Sparse / Shrubland
 - E13 Acacia / Sparse / Shrubland
 - E14 Acacia / Sparse / Shrubland
- MEDIUM ALTITUDE EASTERN MOUNTAINS (1200-1800m)**
 - E15 Acacia / Sparse / Shrubland
 - E16 Acacia / Sparse / Shrubland
 - E17 Acacia / Sparse / Shrubland
 - E18 Acacia / Sparse / Shrubland
- EASTERN DESERT PLAIN (1000)**
 - D1 Acacia / Sparse / Shrubland
 - D2 Acacia / Sparse / Shrubland
 - D3 Acacia / Sparse / Shrubland
 - D4 Acacia / Sparse / Shrubland

Prepared by :
Agricultural Research & Extension Authority

Renewable Natural Resources
Research Centre

