Agriculture Drought In AFRICA AND MEDITERANEAN

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SPECIAL REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

MANAGING THE RISKS OF EXTREME EVENTS AND DISASTERS TO ADVANCE CLIMATE CHANGE ADAPTATION

KEY MASSAGE

There is *medium confidence that droughts will intensify in the 21st century in some seasons and areas, due* to reduced precipitation and/or increased evapotranspiration.

This applies to regions including southern Europe and the Mediterranean region, central Europe, central North America, Central America and Mexico, northeast Brazil, and southern Africa. Elsewhere there is overall *low confidence because of inconsistent projections of drought changes* (dependent both on model and dryness index). Definitional issues, lack of observational data, and the inability of models to include all the factors that influence droughts preclude stronger confidence than *medium in drought projections.*

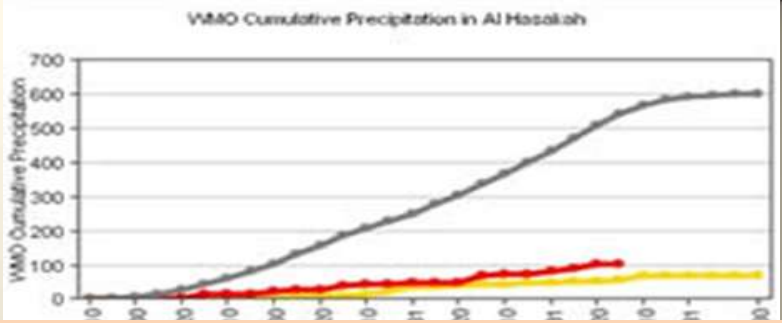
IPCC 2012, See Figure SPM.5. [3.5.1, Table 3-3, Box 3-3]

A period of abnormally dry weather long enough to cause a serious hydrological imbalance.

Drought is a relative term
shortage of precipitation
related to particular activity

Storage changes in soil moisture and groundwater are also affected by increases in actual evapotranspiration in addition to reductions in precipitation.

A MEGADROUGHT
is drought, lasting much longer than normal, usually a decade or more.



Precipitation deficit is defined as a METEOROLOGICAL DROUGHT.

during the growing season affects yield - SOIL MOISTURE DROUGHT, or AGRICULTURAL DROUGHT,

during the runoff season affects water supplies – HYDROLOGICAL DROUGHT.

Building Blocks of Drought Risk Analysis

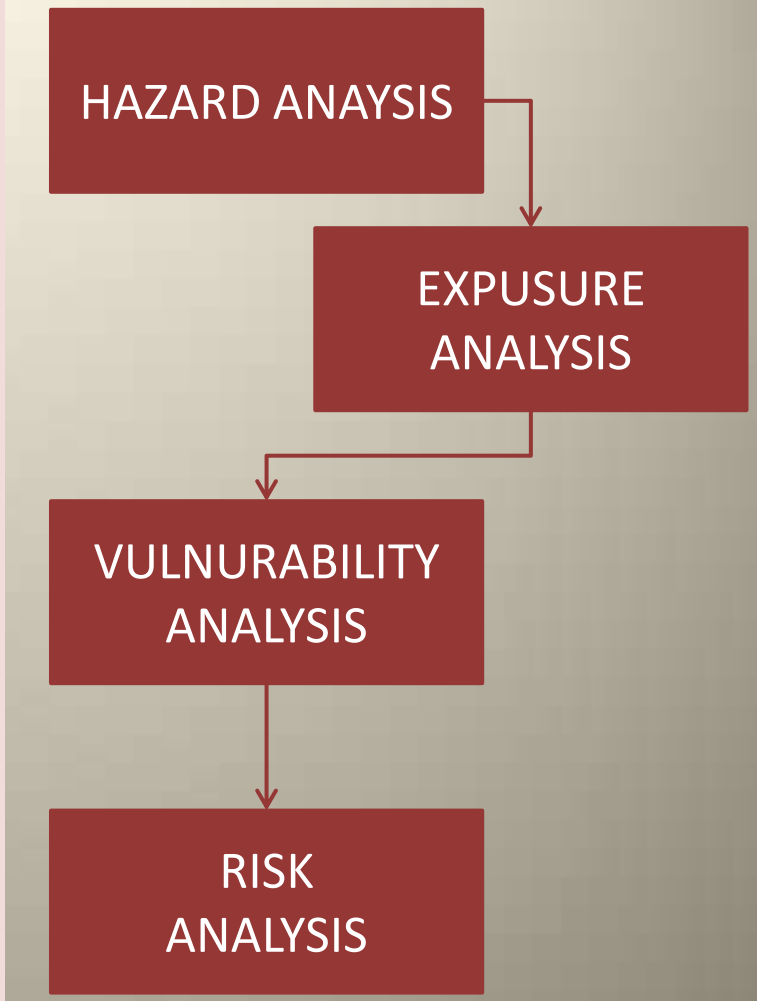
•***Hazard analysis***: Hazard analysis consists of using indices to describe the intensity, frequency and duration spatial and temporal characteristics of drought. The selection of hazard index depends on the purpose of the study, the degree of availability of exposure data.

•***Exposure analysis***: Exposure analysis essentially consists of building up of data base regarding the asset-at-risk. In the case of agricultural droughts, the elements of exposure include long term records of rainfall, crop area, crop production and yields, population affected, and such

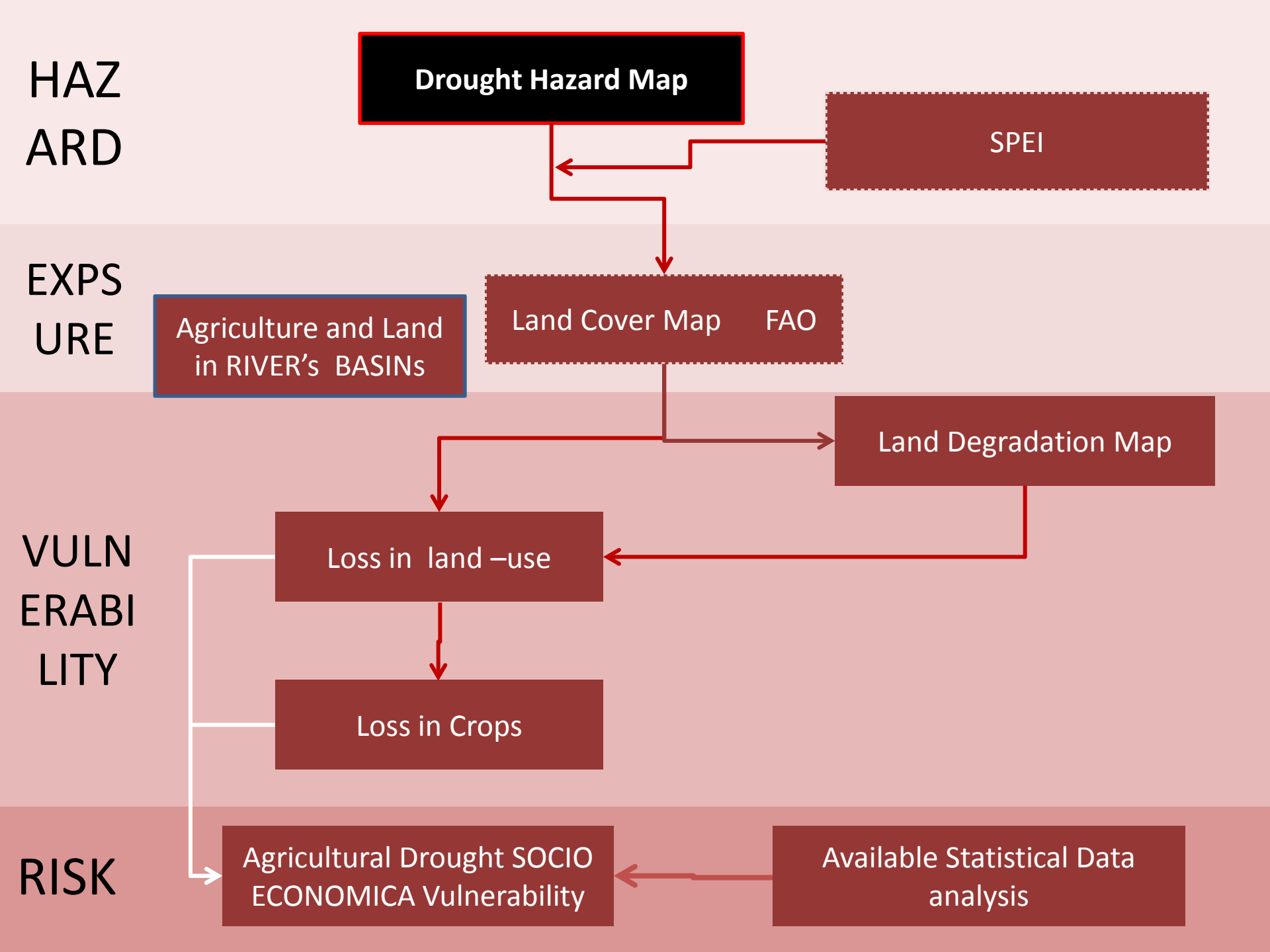
.

•***Vulnerability analysis*:** Vulnerability describes the functional relationship between hazard and the corresponding impact on the assets-at-risk (reduction in crop area, reduction in yield, reduction in total production, affected population, and shortfall per unit population).

•***Risk analysis***: Risk analysis helps in ascertaining the metrics that quantify losses (in physical and financial terms) and attribute probabilities of their occurrence.



Elements of drought risk reduction


HAZ
ARD
Drought Hazard Map
SPEI
EXPS
URE
Agriculture and Land in RIVER's BASINs
Land Cover Map FAO
Land Degradation Map
VULN
ERABI
LITY
Loss in land –use
Loss in Crops
RISK
Agricultural Drought SOCIO ECONOMICA Vulnerability
Available Statistical Data analysis

Using **MODIS** The Moderate Resolution Imaging Spectroradiometer 1999-2011

STEP 1

Monthly during 12 years But as Africa and Mediterranean countries have different climatic zones all agriculture seasons will be analyzed as follows

1. (12 months) for all Africa and mainly tropical region),
2. (Winter Months -8 from Oct-May),
3. (Summer Months -8 from March - Oct)
4. (Monsoon Months – 6 May – Oct)

Monthly VCI
Vegetation Condition Index

+

Monthly TCI
Temperature Condition Index

=

Monthly VHI
Vegetation Healthy Index

Drought Intensity Map

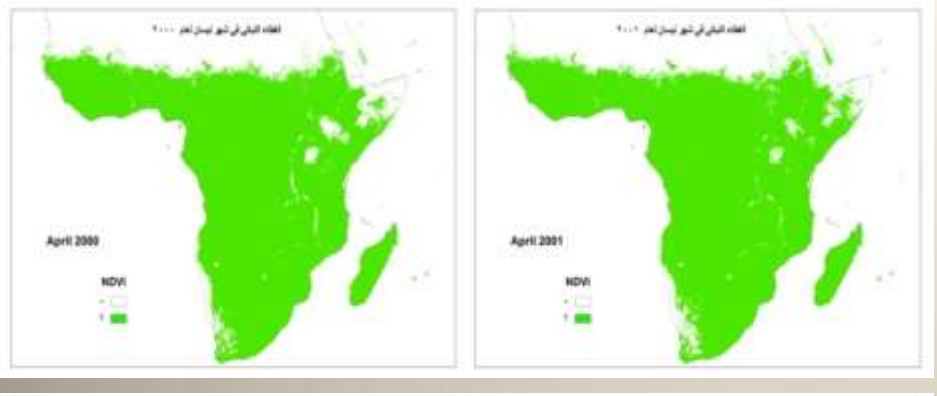
Drought Variability Map

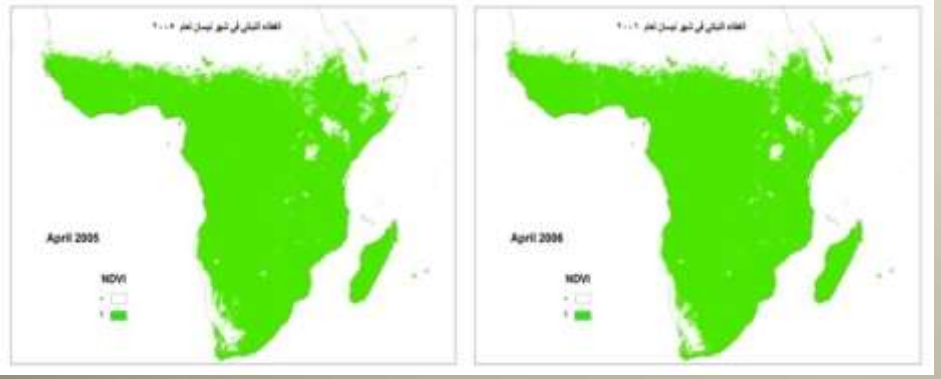
Drought Frequency Map

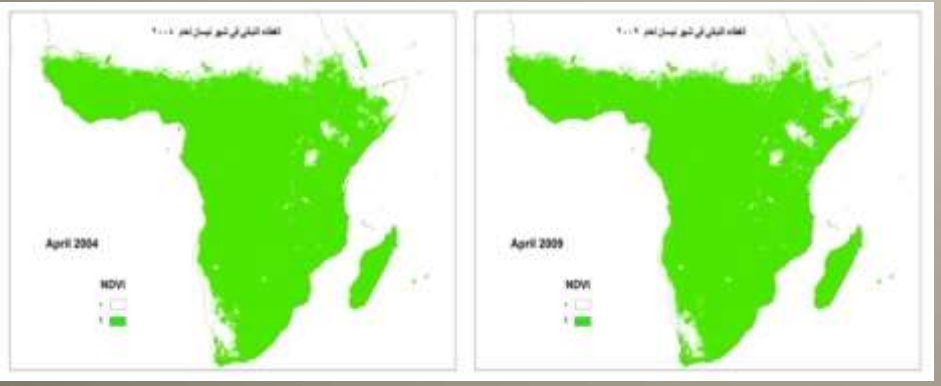
Drought Consecutive Map

Agriculture Drought Hazard Map

NDVI APRIL (2010 - 2000)

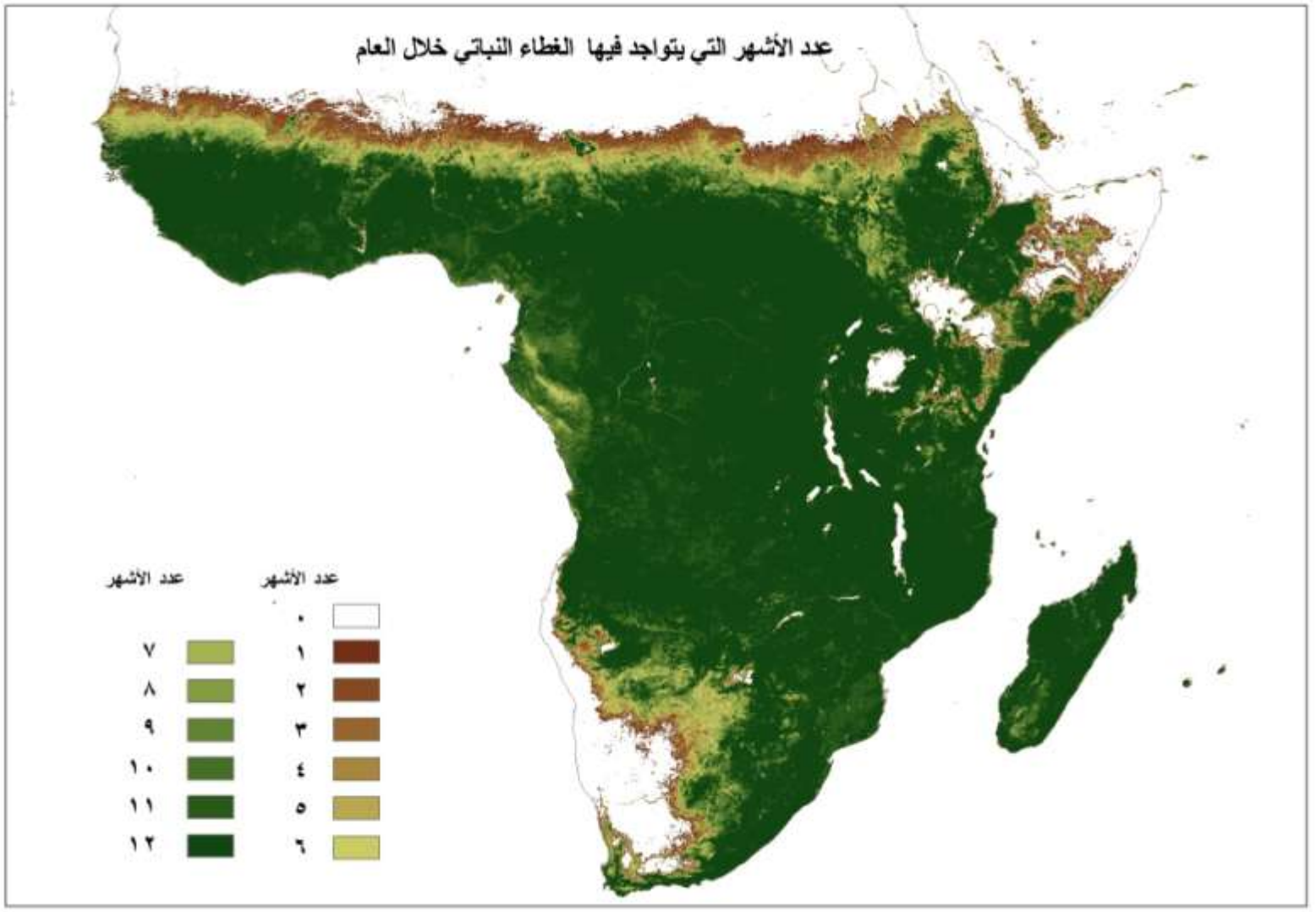




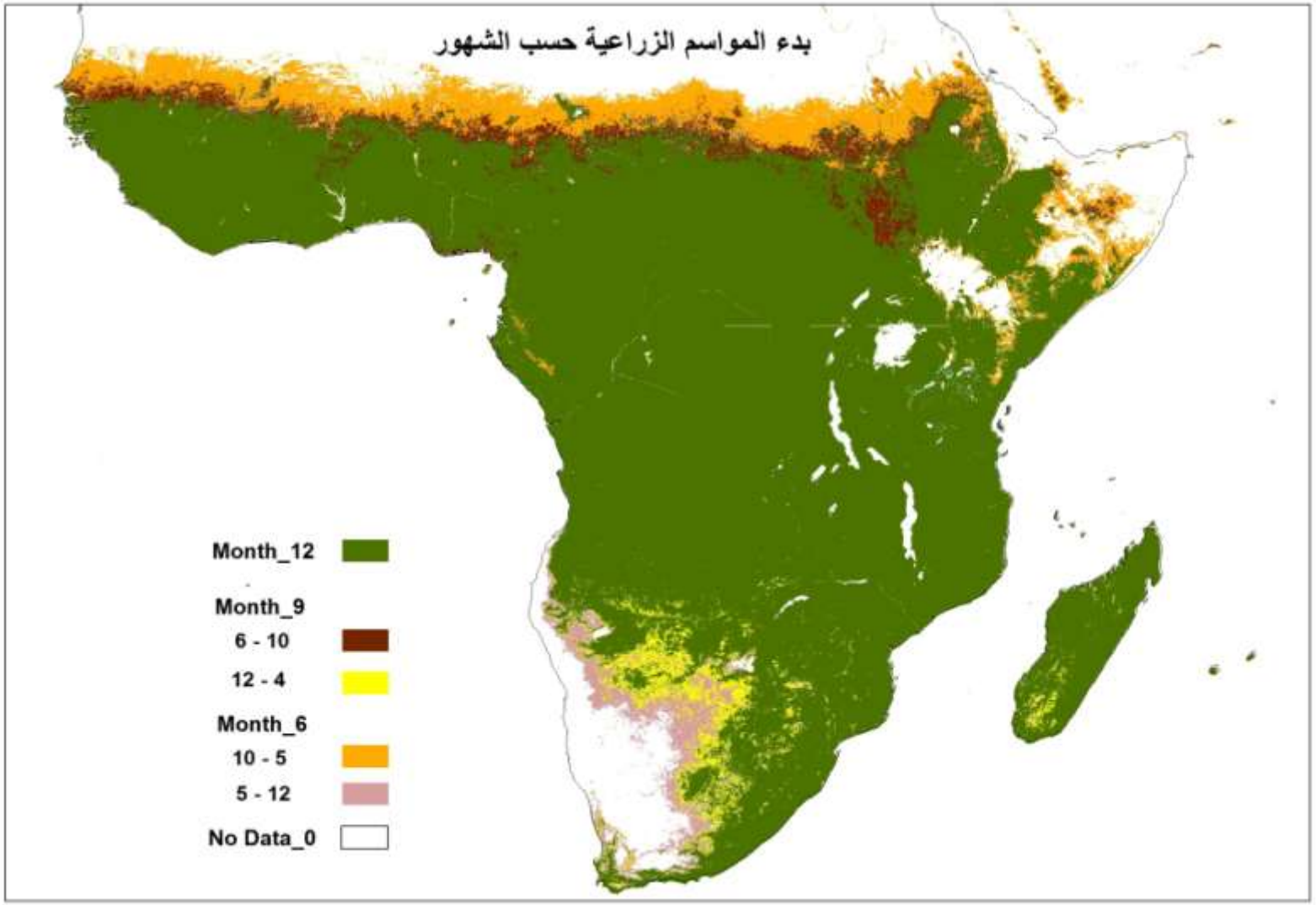


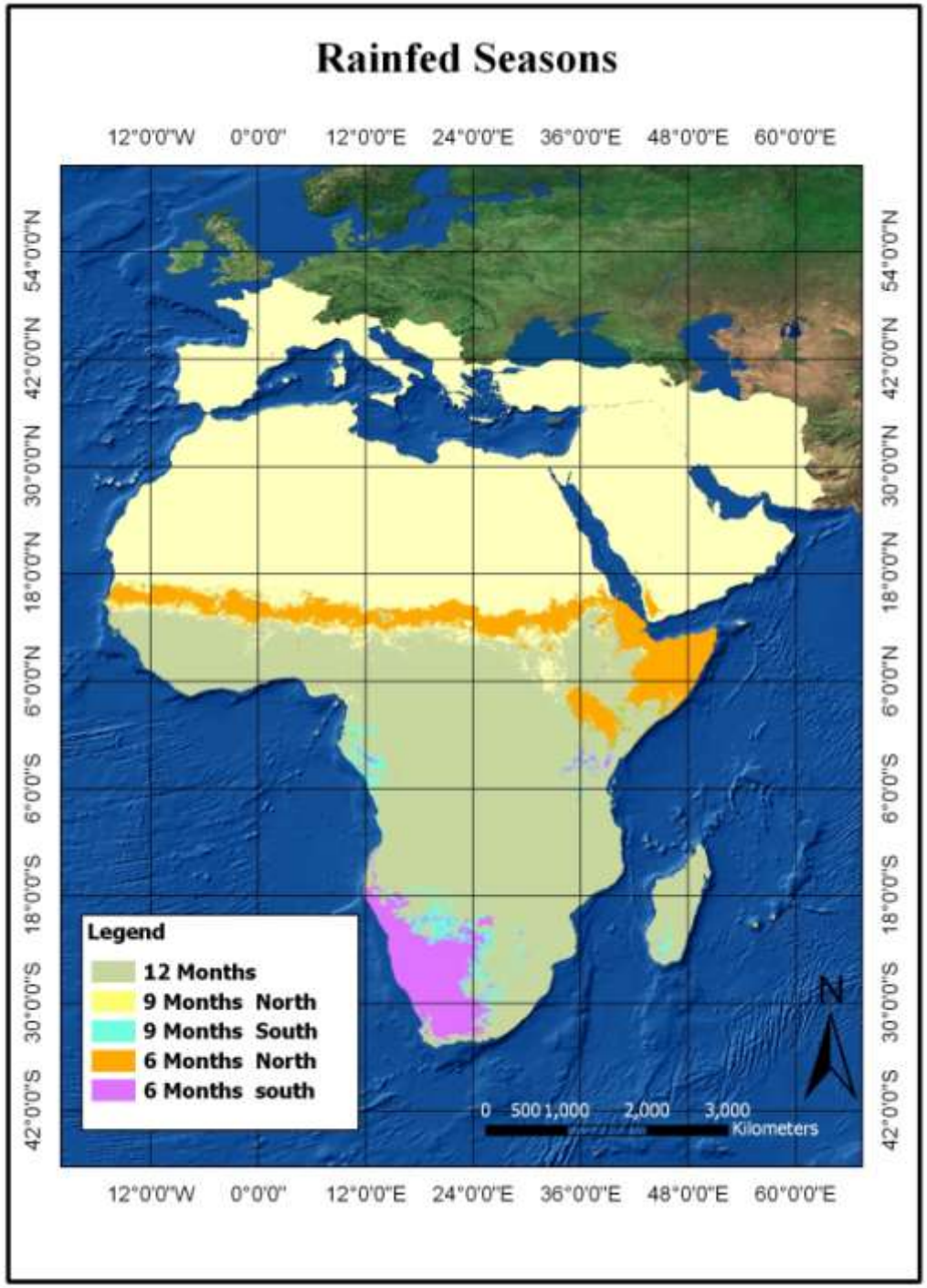
حساب متوسط قرينة الغطاء النباتي للشهور خلال أعوام (2000 - 2010)

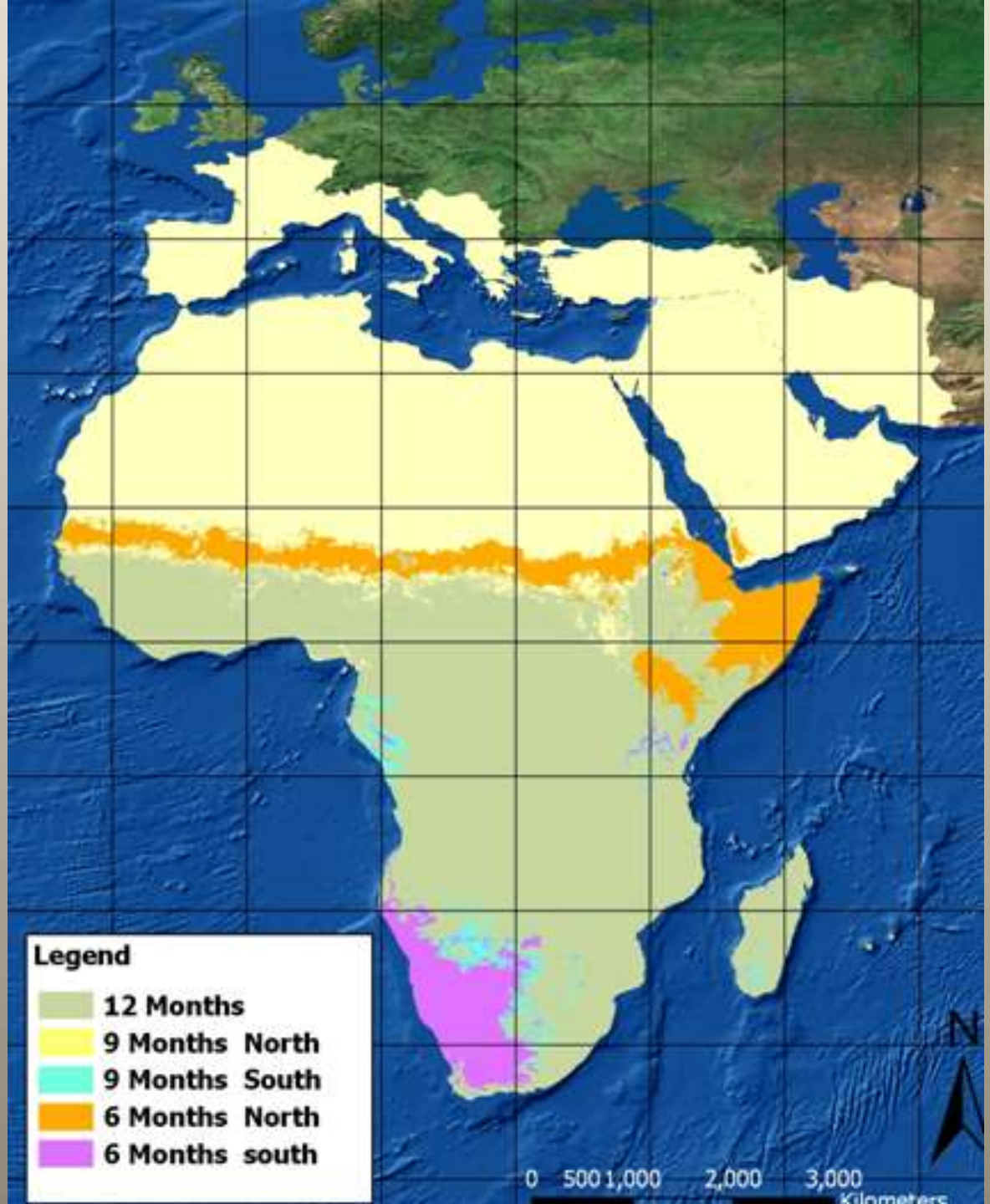
مجموع متوسط قرينة الغطاء النباتي للشهور خلال أعوام (2000 - 2010)
(المجموع الأفقي لمتوسط الشهور)



توزع المواسم الزراعية بحسب قرينة الغطاء النباتي




Rainfed Seasons
12°0'0"W
0°0'0"
12°0'0"E
24°0'0"E
36°0'0"E
48°0'0"E
60°0'0"E
54°0'0"N
42°0'0"N
30°0'0"N
18°0'0"N
6°0'0"N
6°0'0"S
18°0'0"S
30°0'0"S
42°0'0"S
Legend
12 Months
9 Months North
9 Months South
6 Months North
6 Months south
N
0 500 1,000 2,000 3,000
Kilometers


Legend
12 Months
9 Months North
9 Months South
6 Months North
6 Months south
N
0 500 1,000 2,000 3,000
Kilometers

Thenkabail et al (2004) and European Commission (2006),

- The Normalized Difference Vegetation Index

$$NDVI = (\lambda NIR - \lambda red) / (\lambda NIR + \lambda red)$$

- The Normalized Difference Water Index

$$NDWI = (\rho_{NIR} - \rho_{SWIR})/(\rho_{NIR} + \rho_{SWIR})$$

- Standardize Precipitation Index SPI
- Vegetation Condition Index

$$VCI = (NDVI - NDVI_{min})/(NDVI_{max} - NDVI_{min})*100$$

- Temperature Condition Index

$$TCI = (BT_{max} - BT)/(BT_{max} - BT_{min})*100$$

Where, BT is the brightness temperature (MODIS LST)

- Vegetation Healthy Index

$$VHI = VCI * 0.5 + TCI * 0.5$$

- Soil Moisture SM

October – May Winter Season

2001 - 2000

2002 - 2001

2003 - 2002

2004 - 2003

2005 - 2004

2006 - 2005

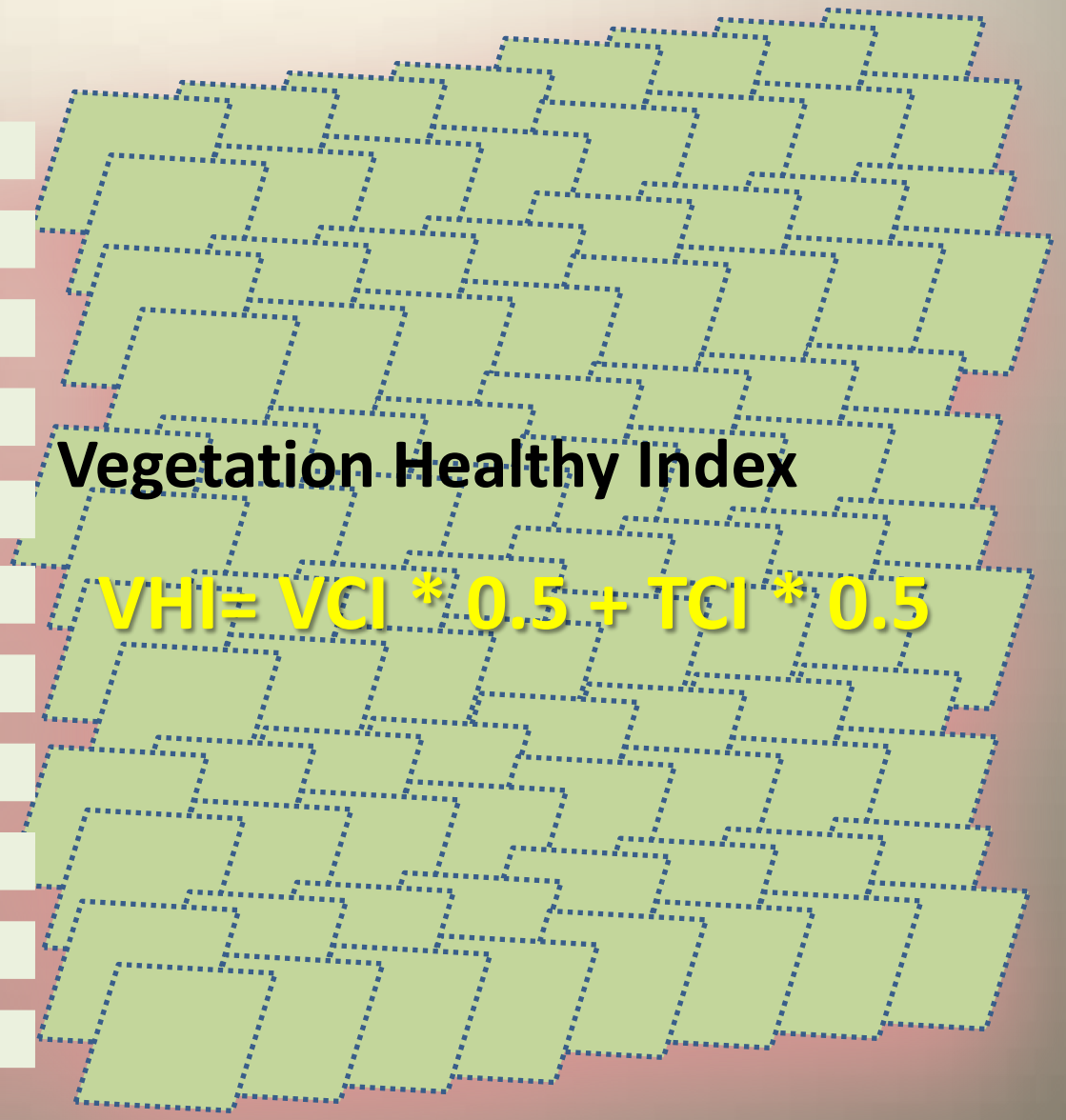
2007 - 2006

2008 - 2007

2009 - 2008

2010 - 2009

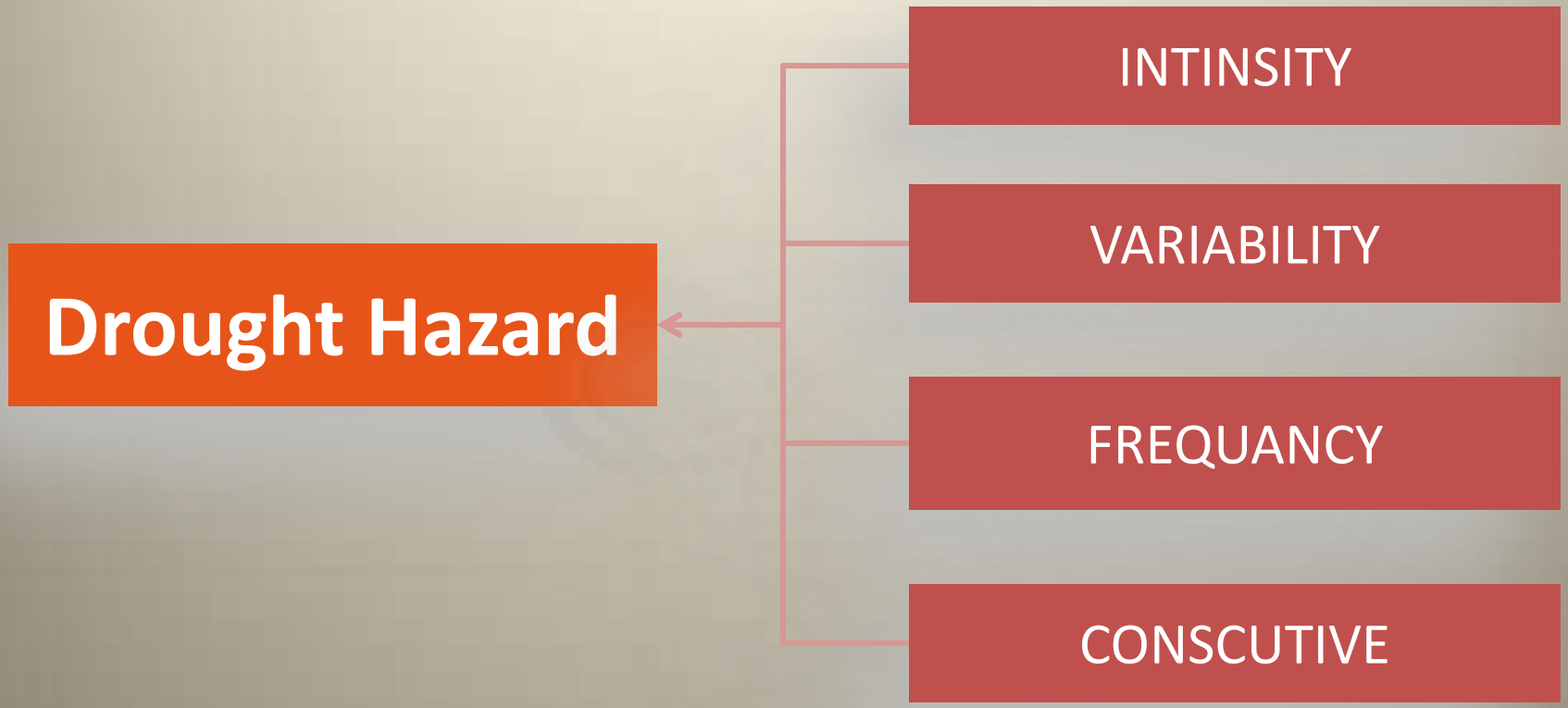
2011 - 2010

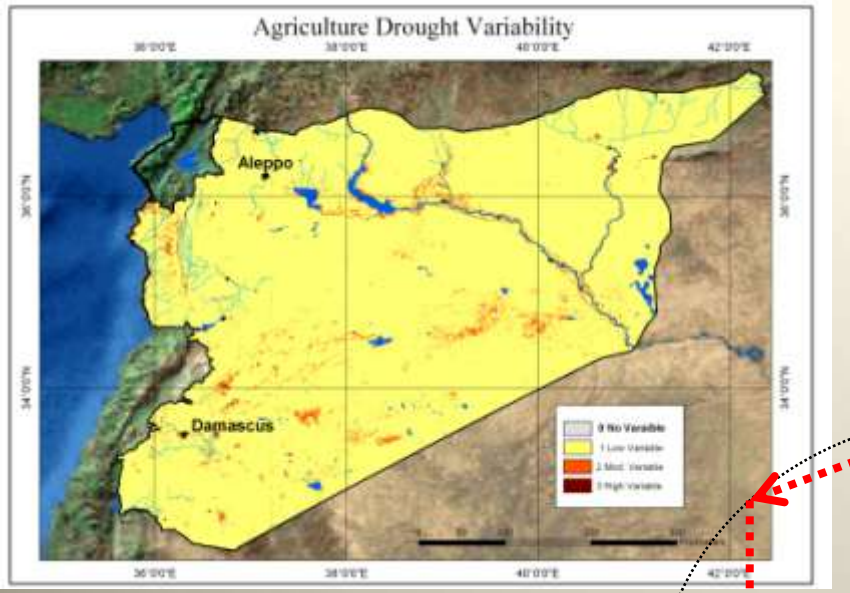


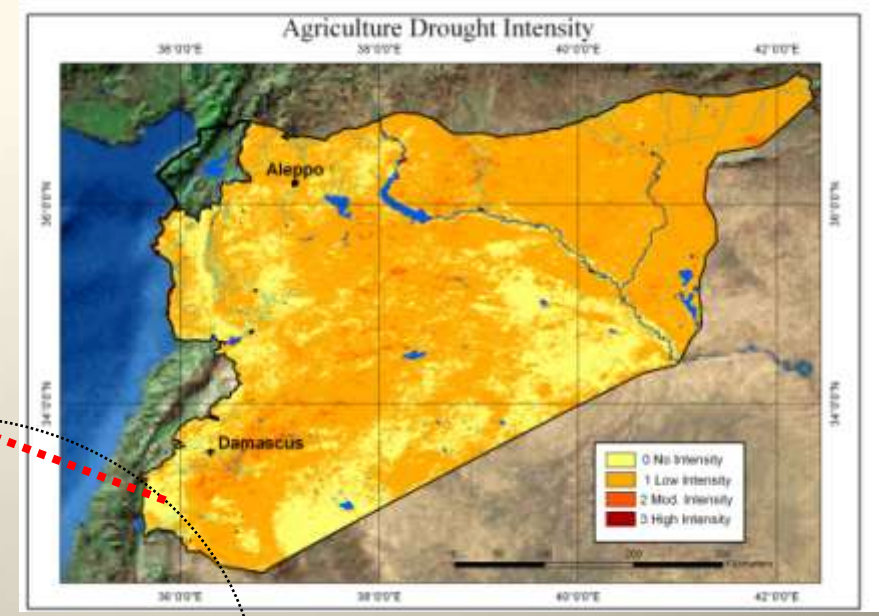
Vegetation Healthy Index

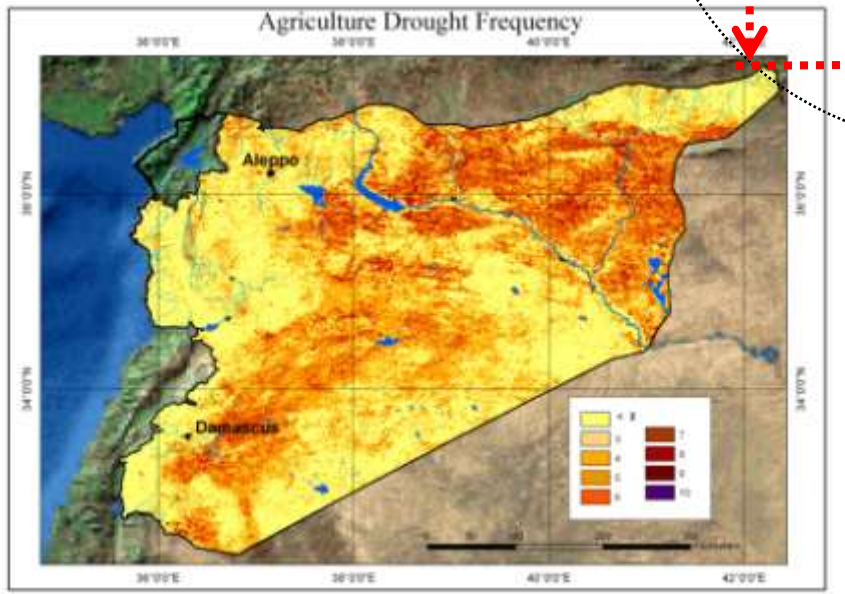
$$VHI = VCI * 0.5 + TCI * 0.5$$

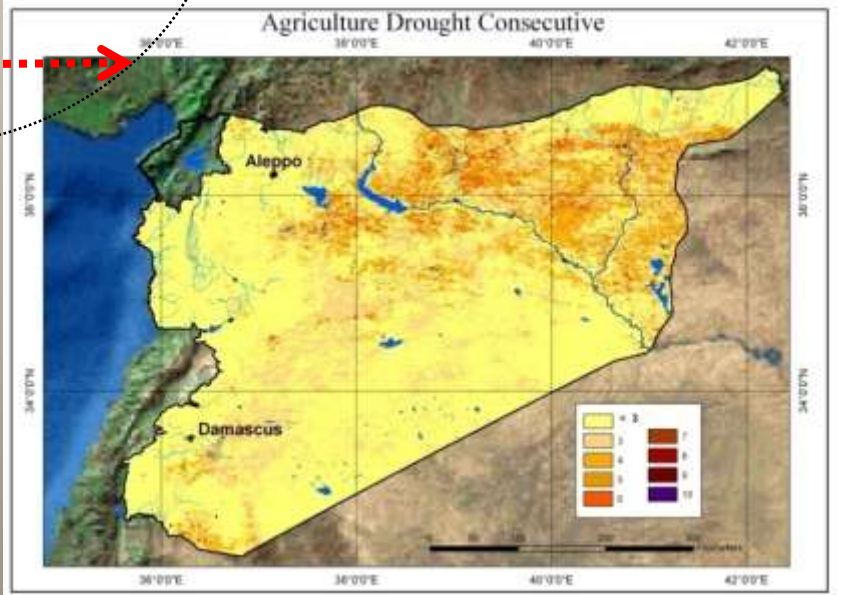
Agriculture Seasons

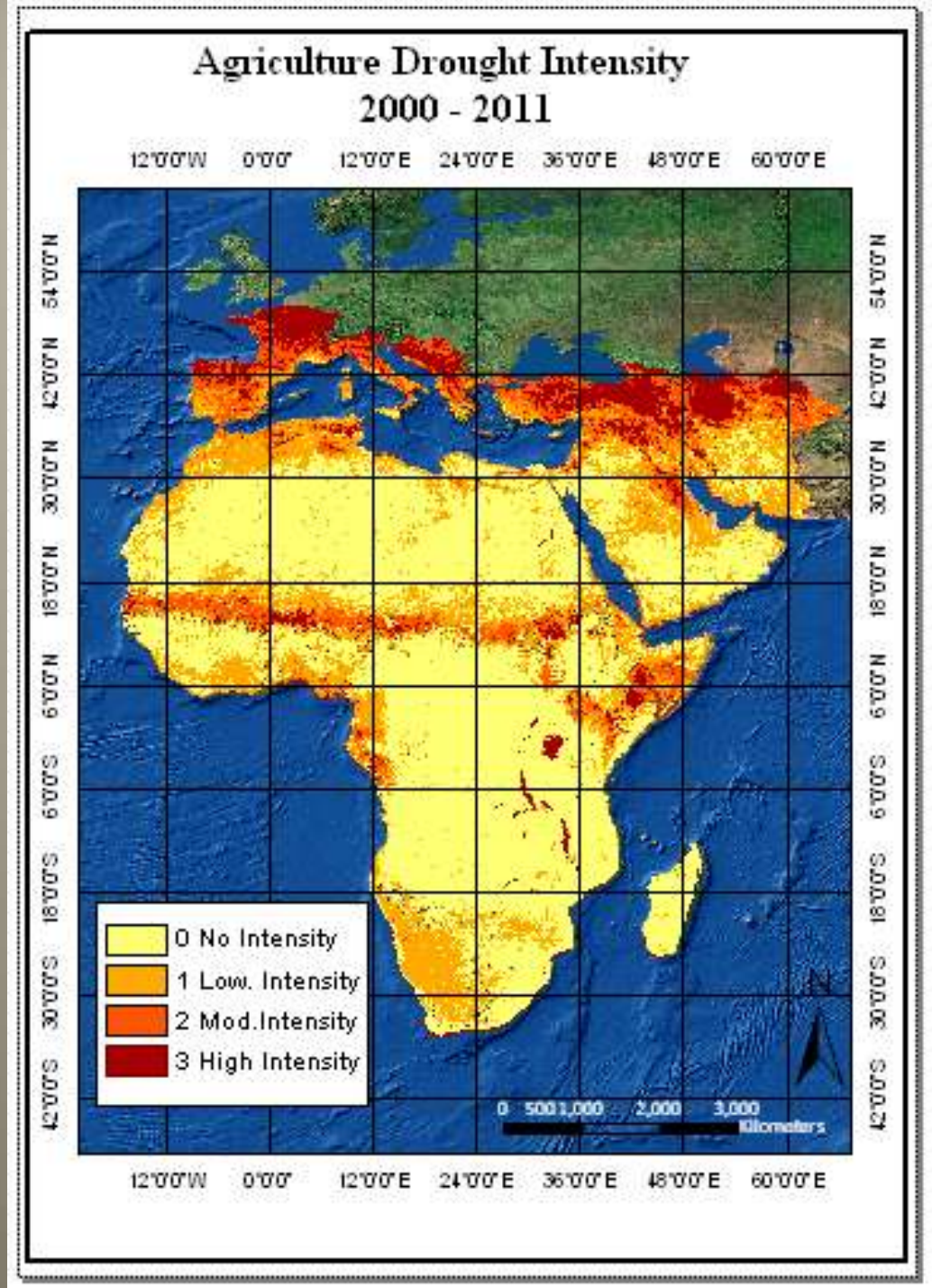

Drought Hazard
INTINSITY
VARIABILITY
FREQUANCY
CONSCUTIVE


Agriculture Drought Variability
Aleppo
Damascus
0 No Variable

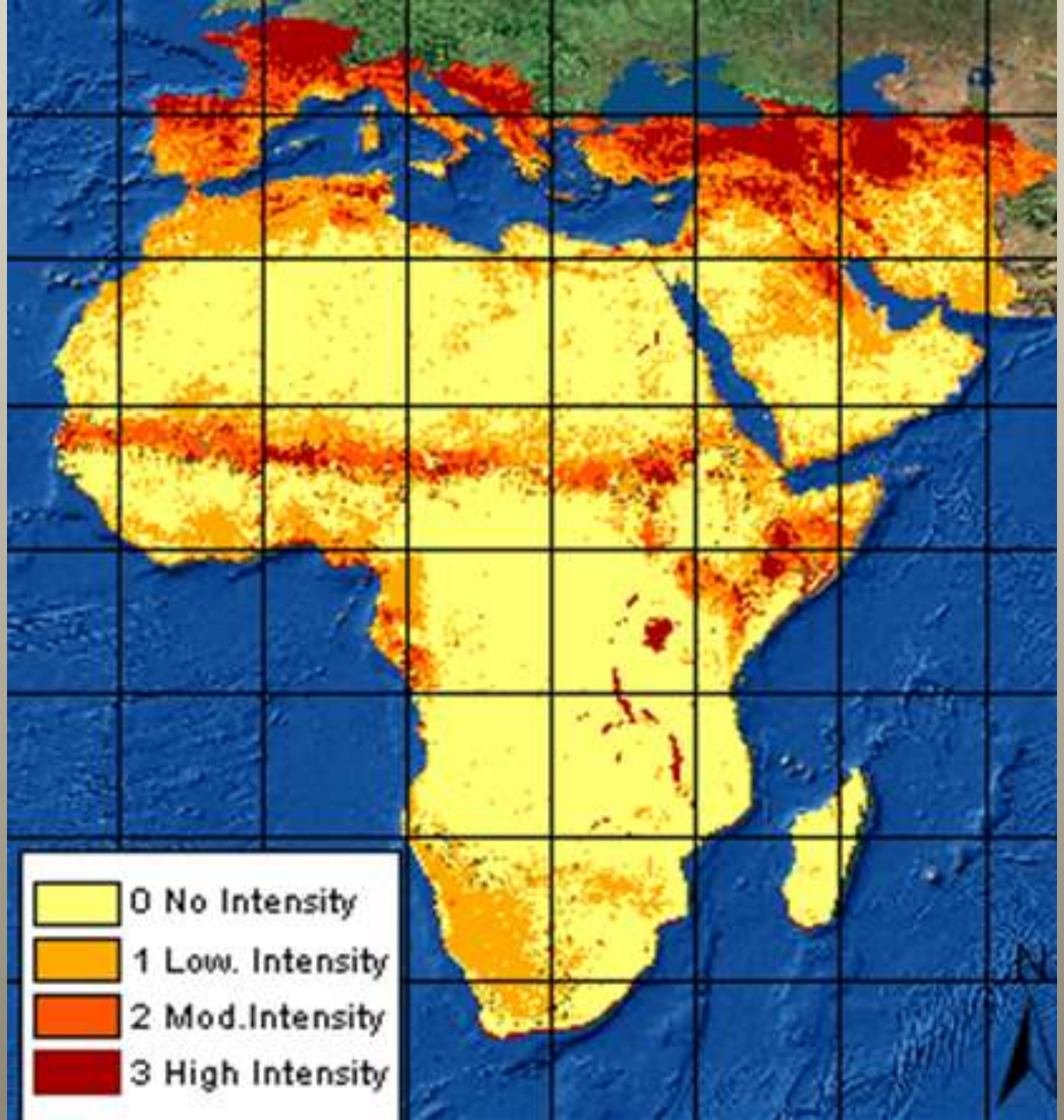

Agriculture Drought Intensity
Aleppo
Damascus
0 No Intensity
1 Low Intensity
2 Mod. Intensity
3 High Intensity

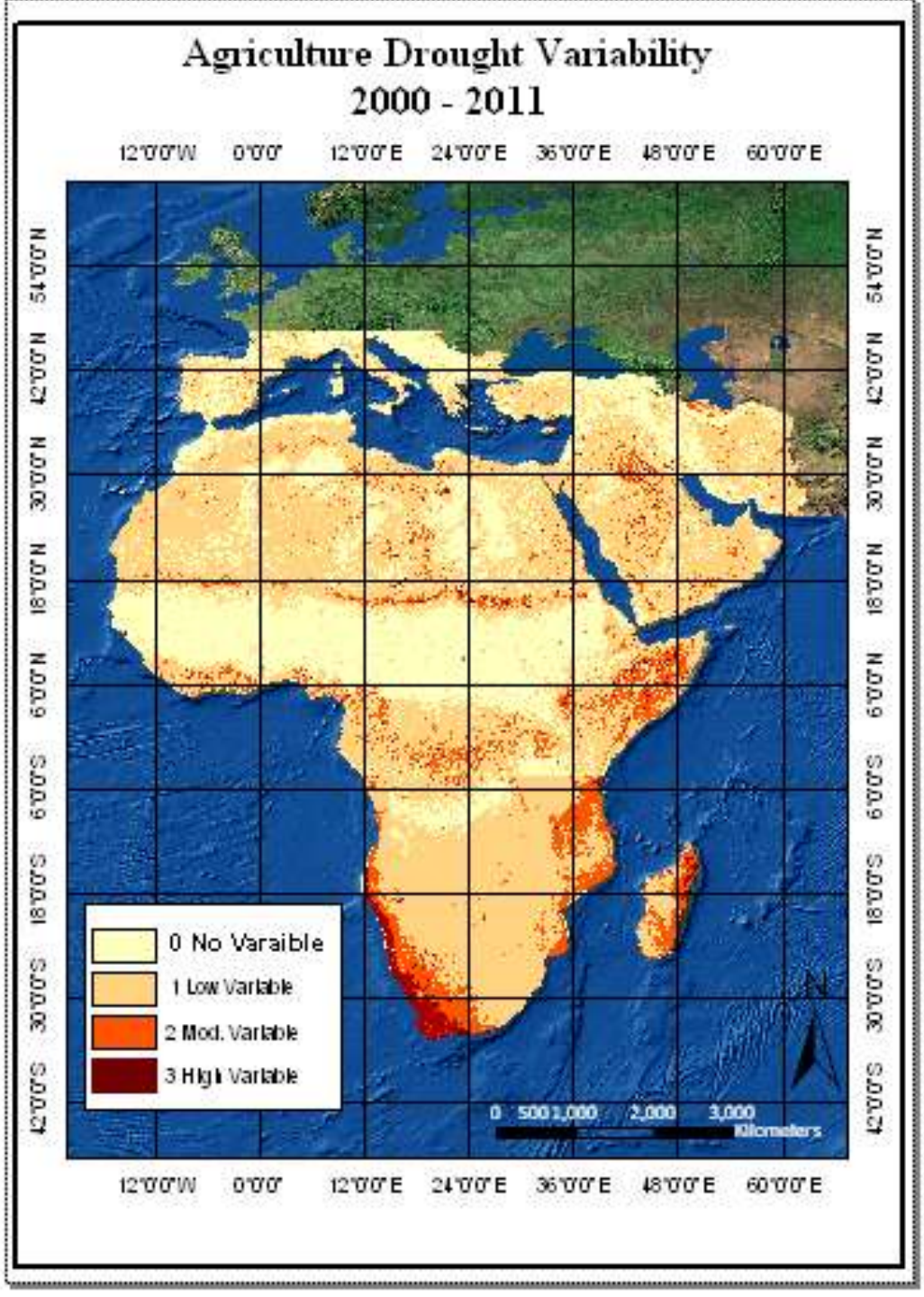

Agriculture Drought Frequency
Aleppo
Damascus


Agriculture Drought Consecutive
Aleppo
Damascus

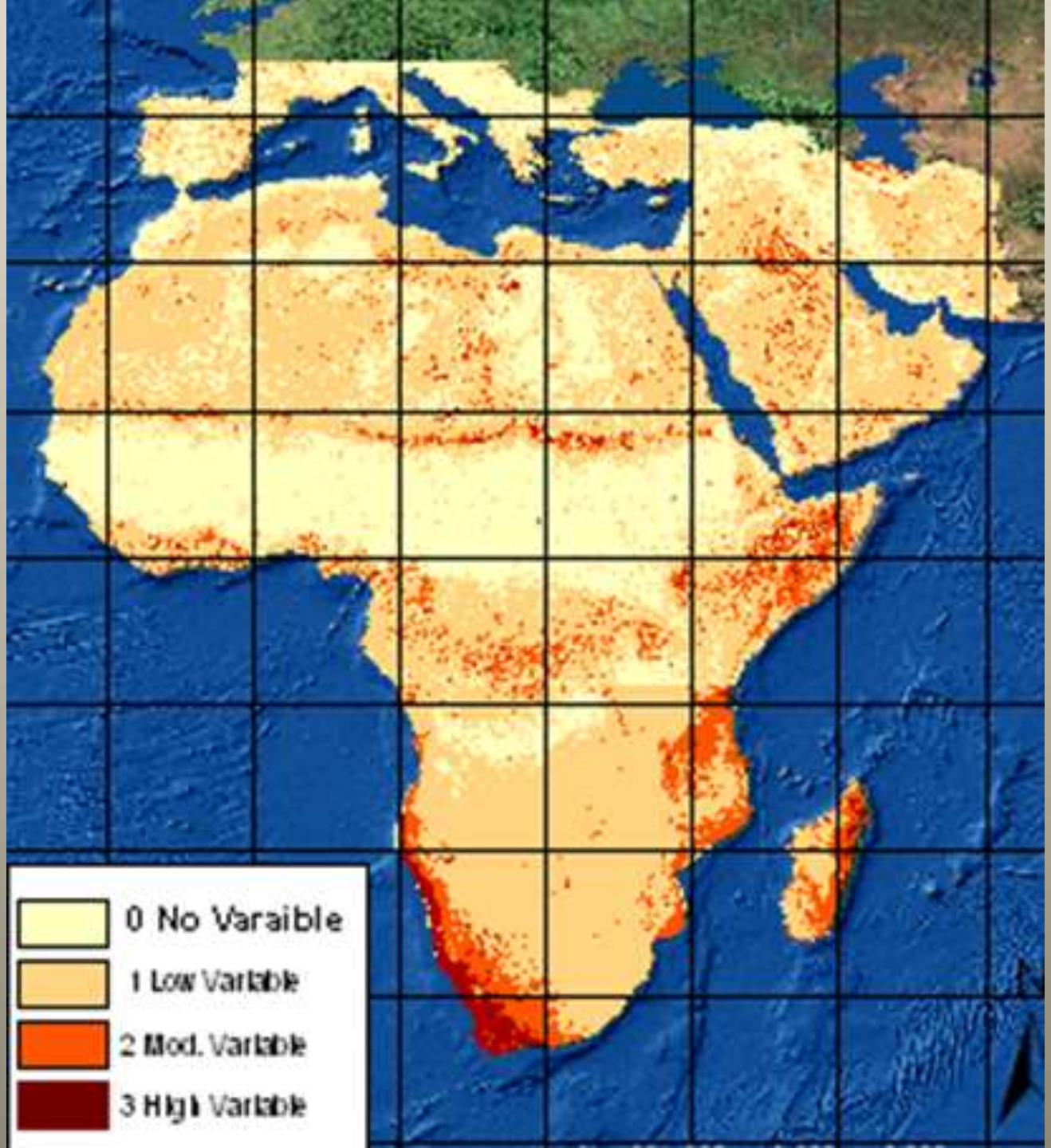


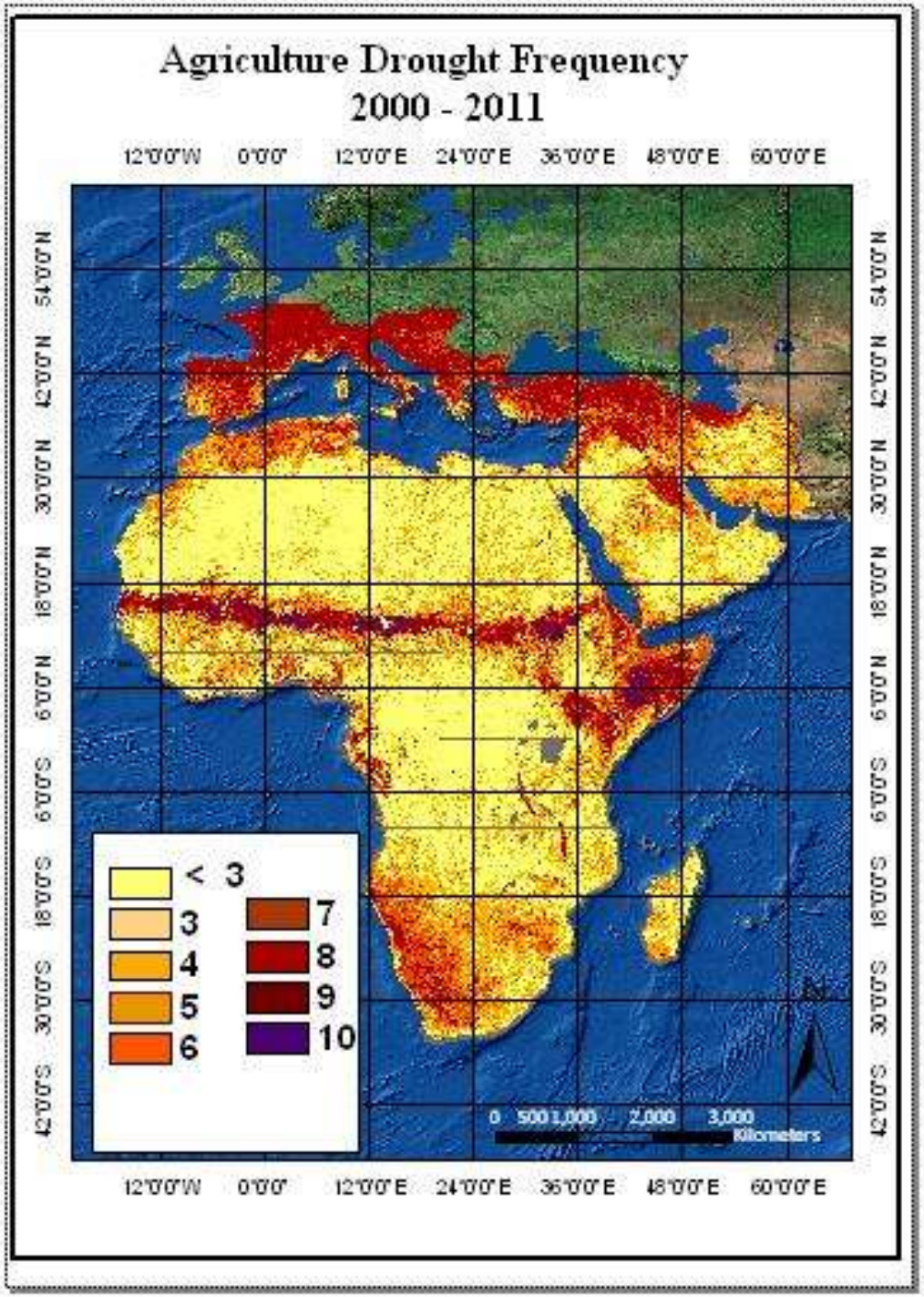
class	%
0	60.24%
1	23.58%
2	8.84%
3	7.34%


0 No Intensity
1 Low. Intensity
2 Mod.Intensity
3 High Intensity

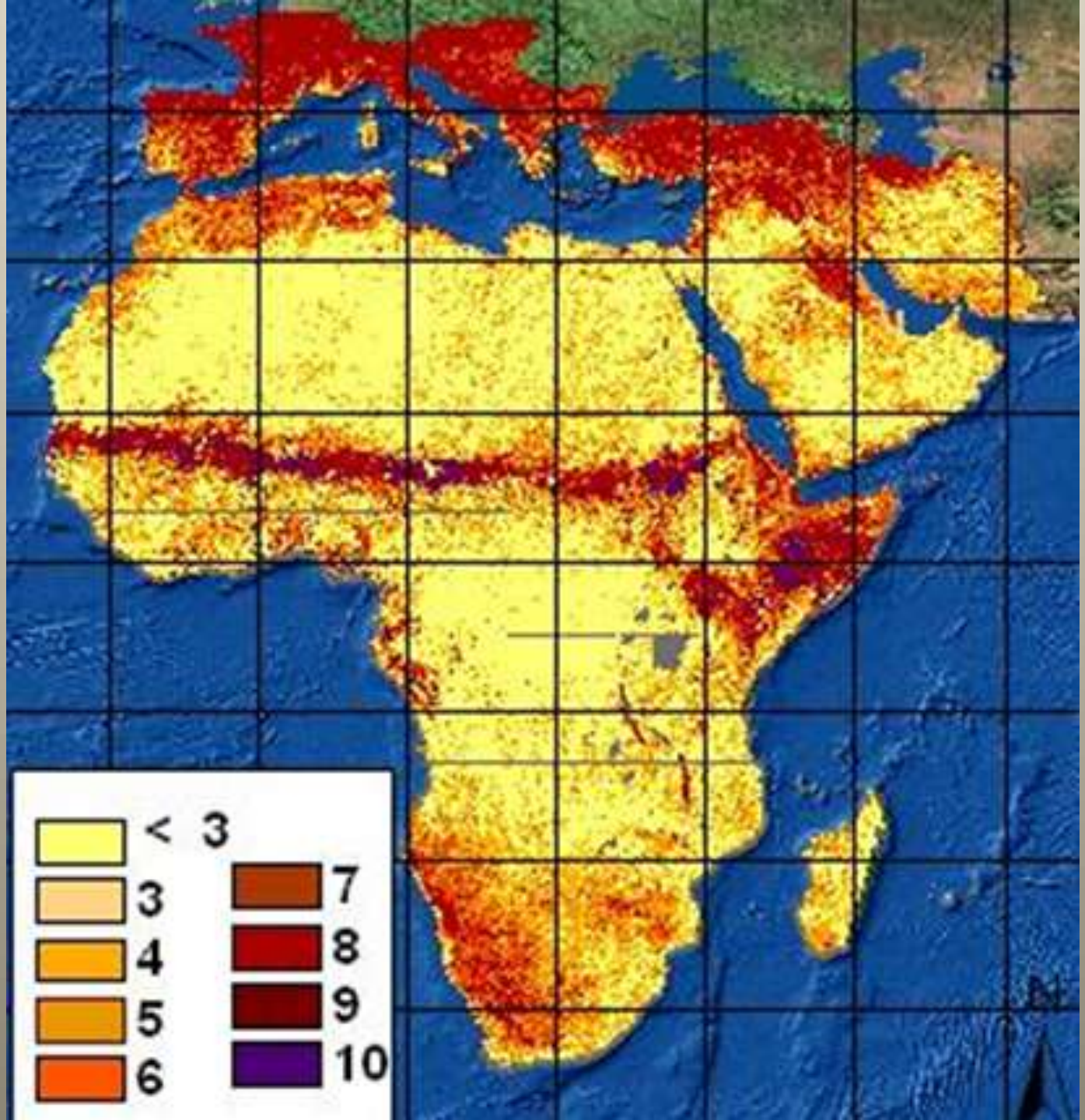


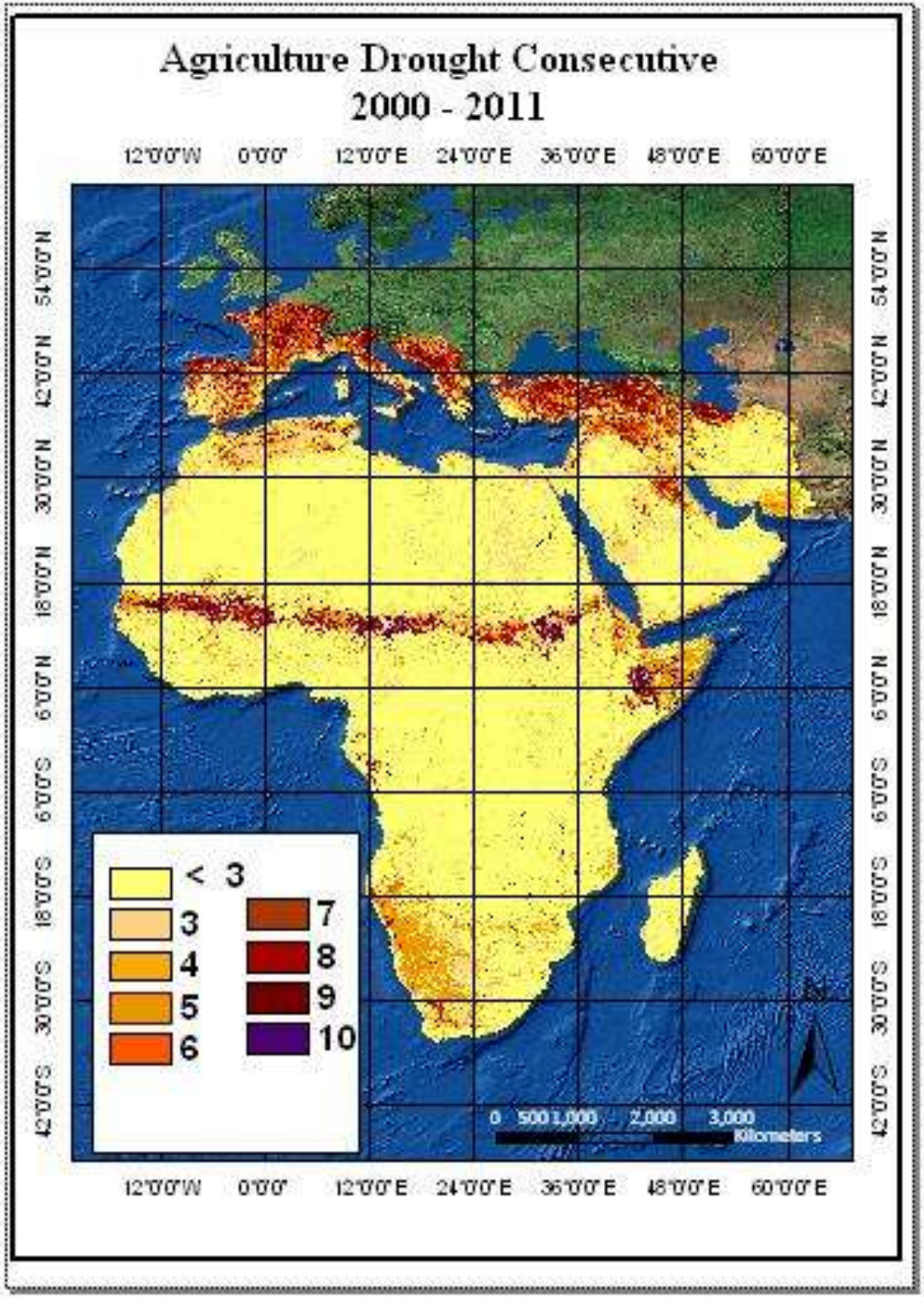
class	%
0	33.66%
1	55.62%
2	9.12%
3	1.60%


0 No Varaible
1 Low Variable
2 Mod. Variable
3 High Variable

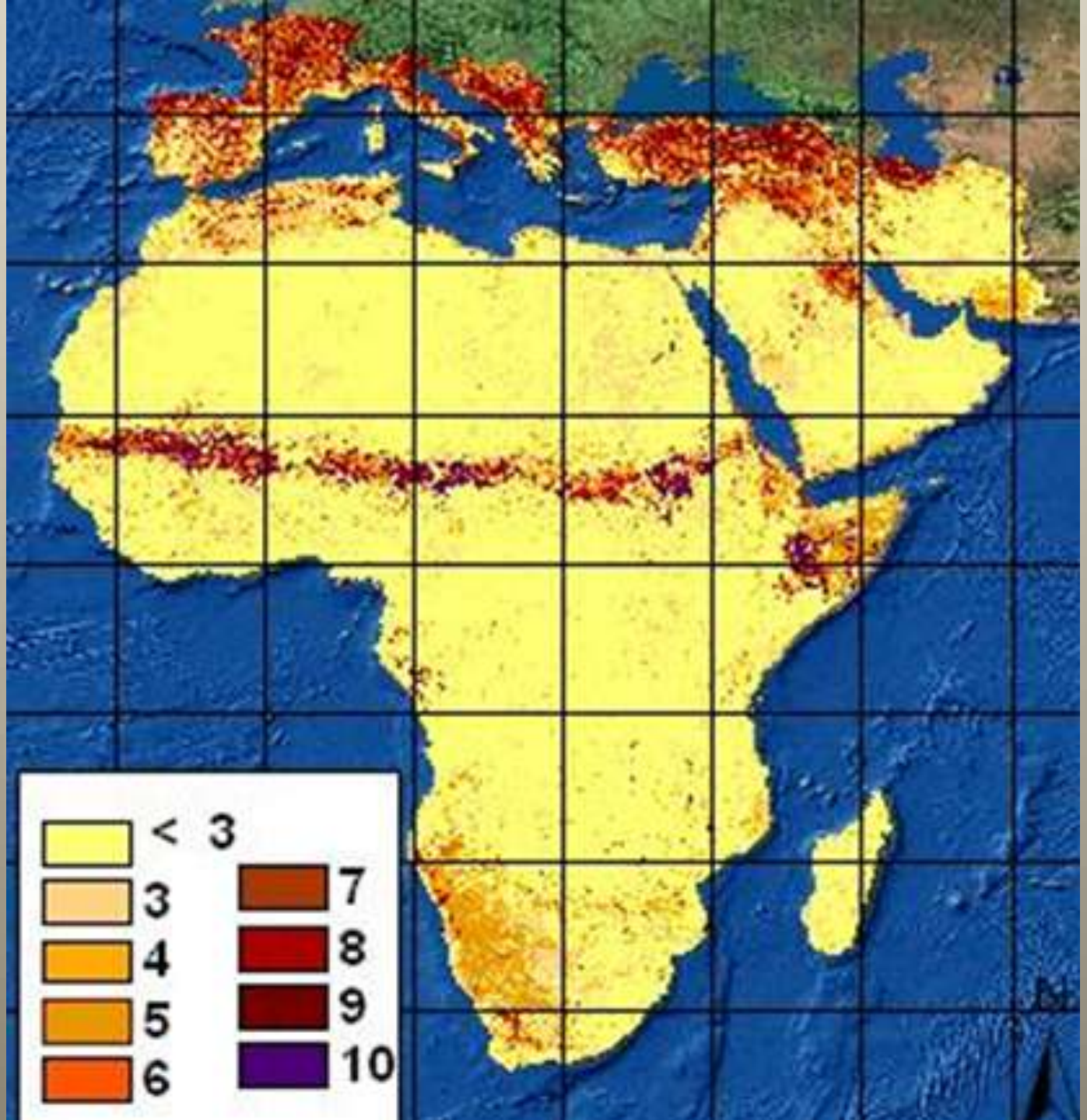


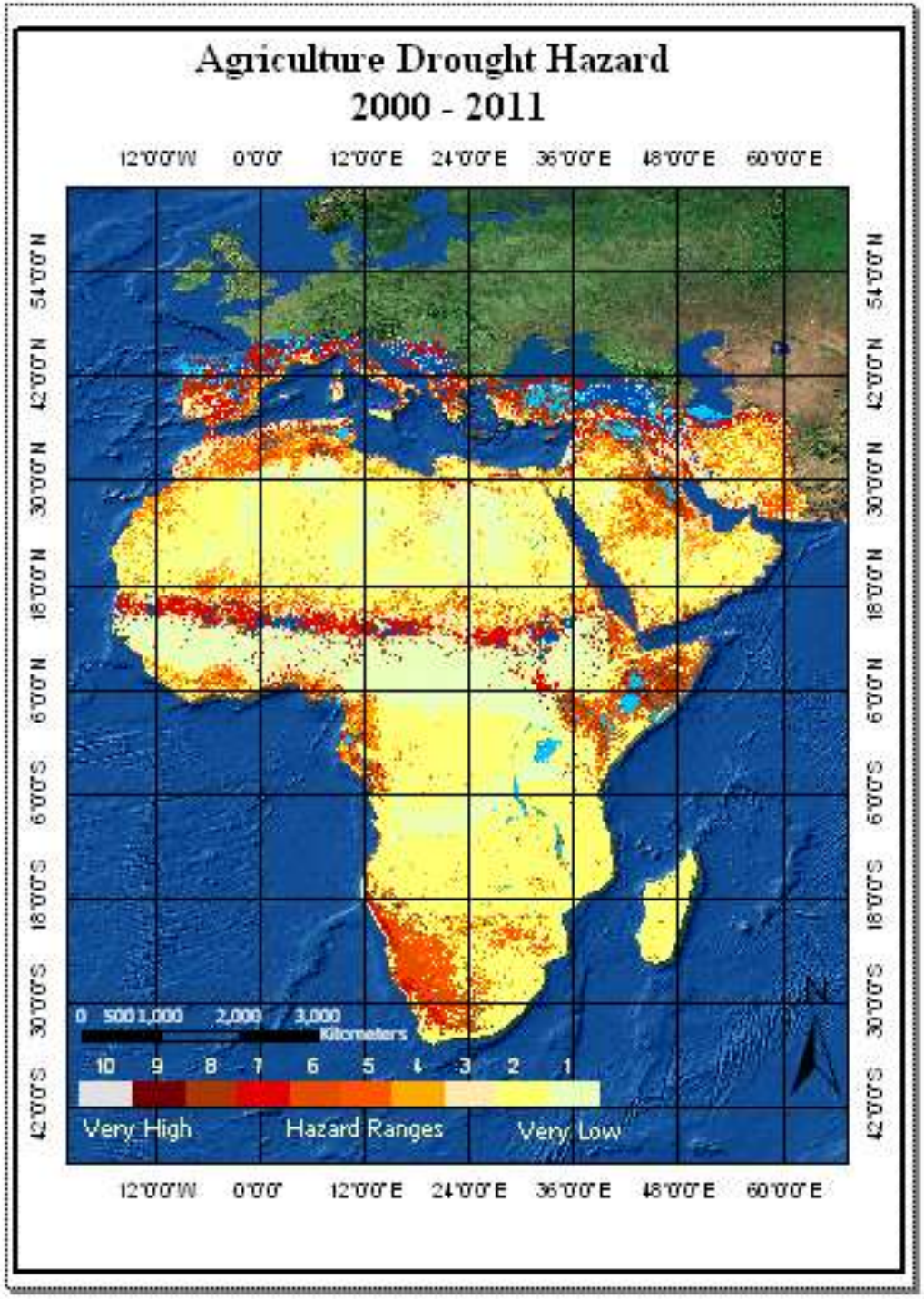
AD Frequency Classes Number of year	%
0	4.36%
1	7.13%
2	9.80%
3	13.95%
4	16.92%
5	14.86%
6	12.22%
7	9.41%
8	6.38%
9	2.82%
10	1.38%
11	0.54%
12	0.22%

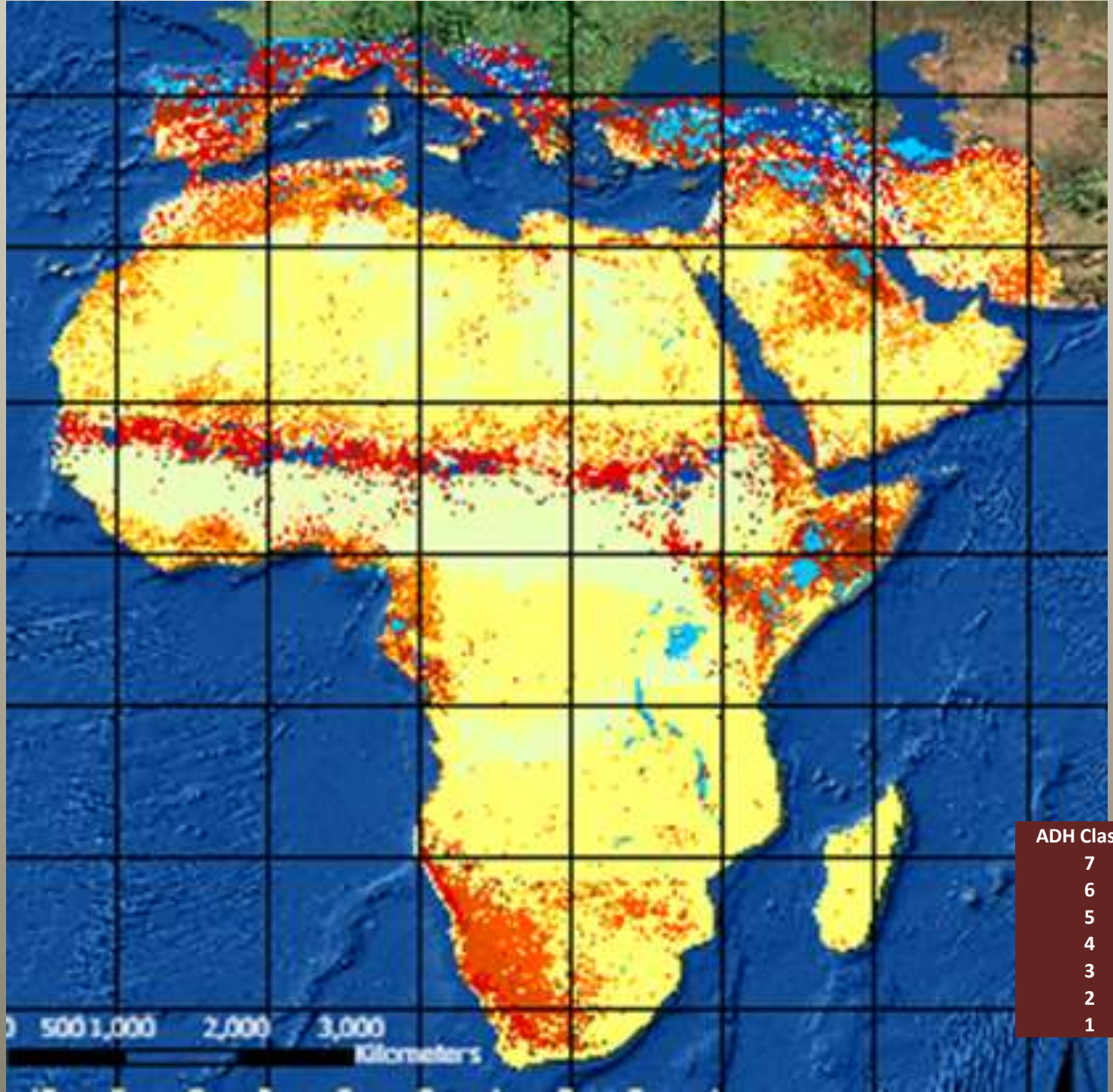

< 3
3
4
5
6
7
8
9
10



Consecutive Classes	%
0	8.37%
1	26.33%
2	23.79%
3	23.88%
4	4.63%
5	3.61%
6	2.73%
7	1.17%
8	1.04%
9	1.09%
10	2.61%
11	0.72%
12	0.02%


< 3
3
4
5
6
7
8
9
10


Agriculture Drought Hazard
2000 - 2011
12°0'0"W
0°0'0"
12°0'0"E
24°0'0"E
36°0'0"E
48°0'0"E
60°0'0"E
54°0'0"N
42°0'0"N
30°0'0"N
18°0'0"N
6°0'0"N
6°0'0"S
18°0'0"S
30°0'0"S
42°0'0"S
0 500 1,000 2,000 3,000
Kilometers
10 9 8 7 6 5 4 3 2 1
Very High
Hazard Ranges
Very Low
N

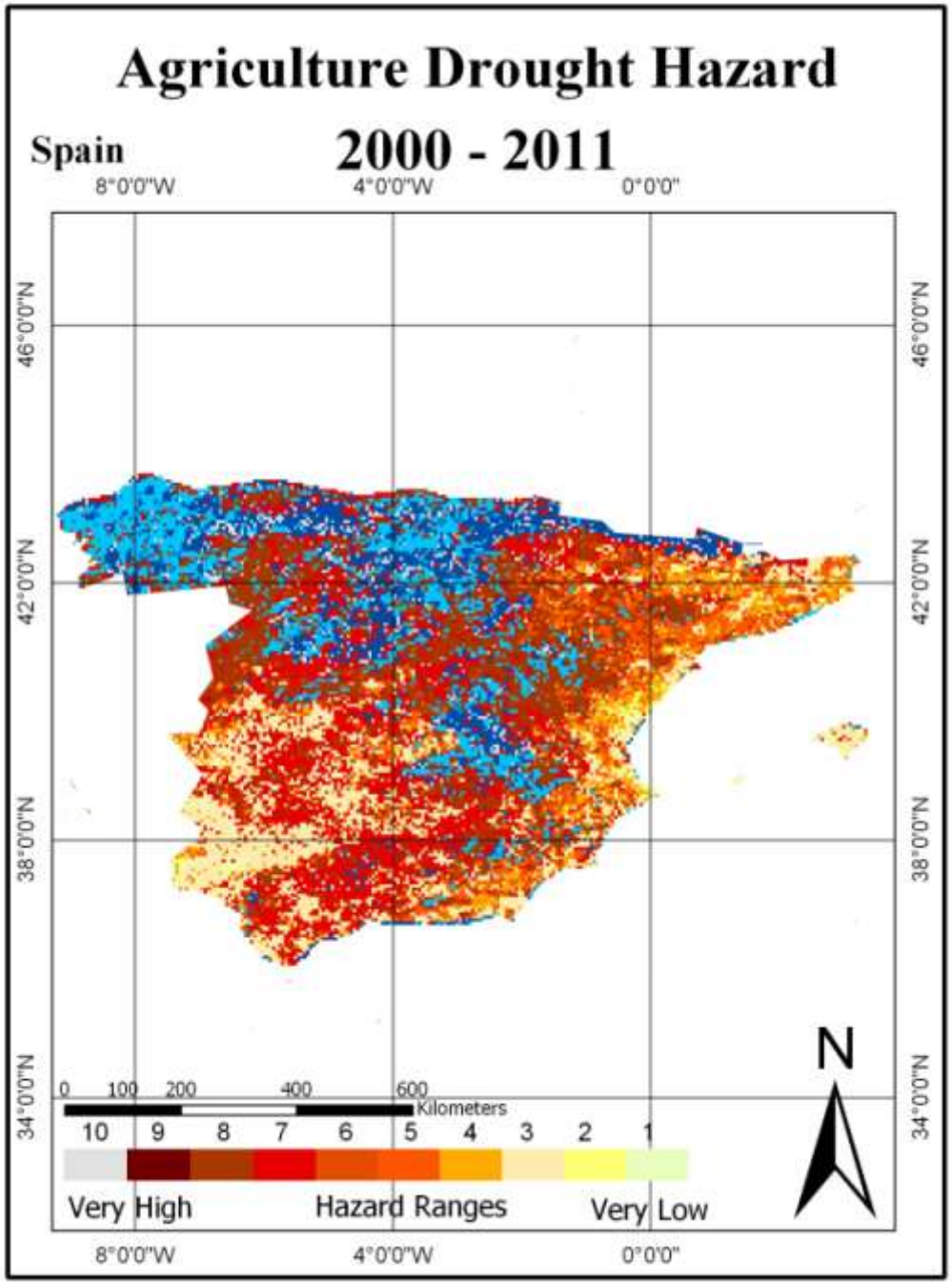


ADH Classes	%
7	>75
6	50- 75
5	30-50
4	15-30
3	10-15
2	5-10
1	<5

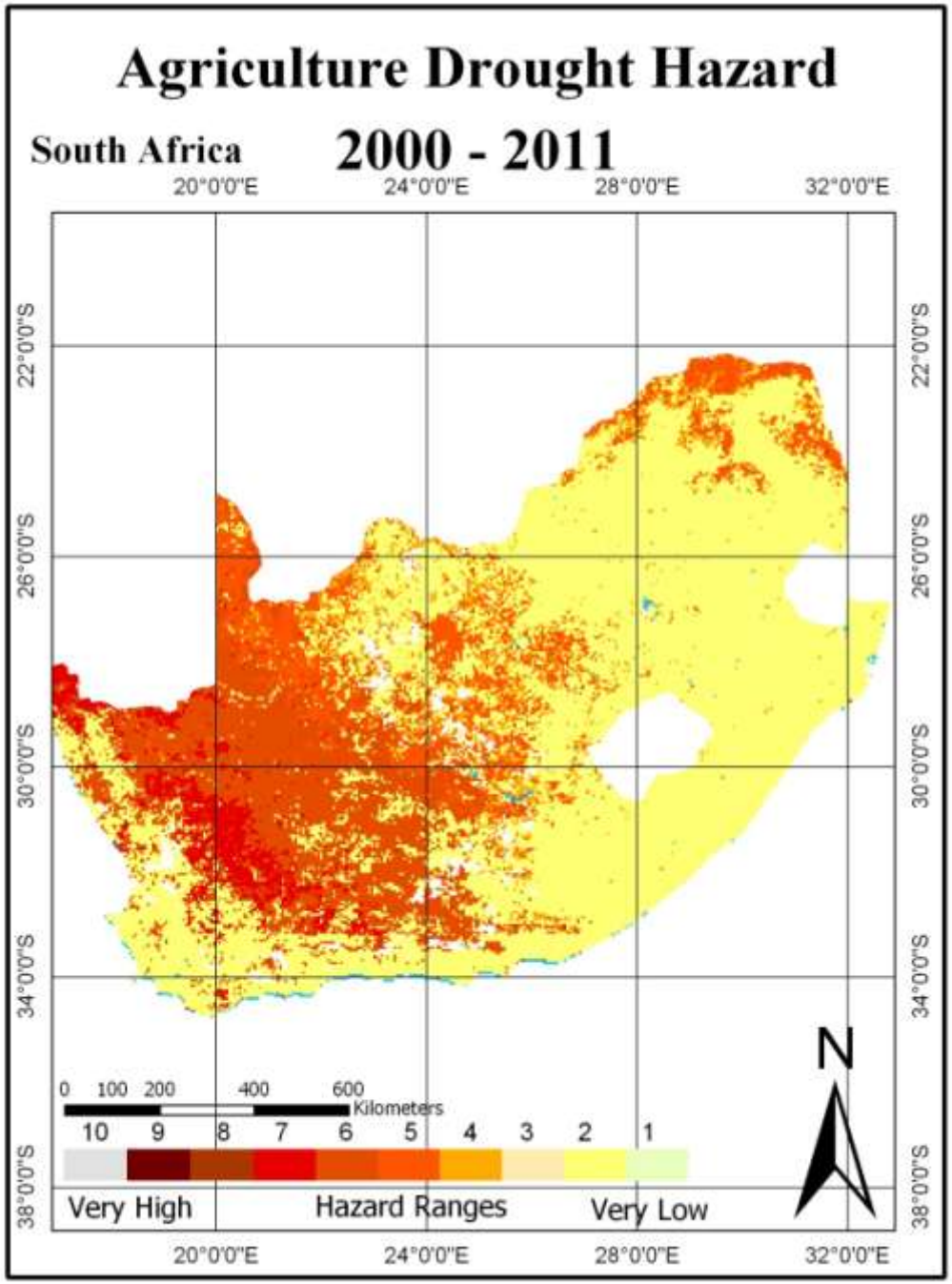
All	H/M	Country	High	Moderate	Slight	No Change	All Hazard	High/Moderate
7	5	Equatorial Guinea	4.96	30.86	41.35	22.83	77.17	35.82
7	5	Eritrea	6.43	32.01	40.98	20.58	79.42	38.44
7	5	Gaza Strip	9.69	35.09	44.82	10.39	89.6	44.78
7	6	Greece	25.16	35.77	24.96	14.11	85.89	60.93
7	6	Kuwait	47.12	26.71	9.29	16.88	83.12	73.83
7	5	Lebanon	15.16	24.67	49.79	10.38	89.62	39.83
7	5	Morocco	2.9	31.14	50.18	15.77	84.22	34.04
7	6	Portugal	31.85	21.13	33.95	13.07	86.93	52.98
7	6	Qatar	18.15	33.34	34.88	13.62	86.37	51.49
7	5	Syria	19.87	30.02	29.9	20.21	79.79	49.89
7	4	West Bank	3.8	19.96	57.23	19.01	80.99	23.76
6	6	Albania	16.8	39.33	15.27	28.6	71.4	56.13
6	6	Croatia	19.47	37.65	2.05	40.83	59.17	57.12
6	5	Djibouti	9.08	38.74	20.51	31.67	68.33	47.82
6	5	Gabon	15.5	24.55	30.48	29.48	70.53	40.05
6	4	Iran	8.82	20.37	36.6	34.21	65.79	29.19
6	5	Iraq	21.95	27.31	19.61	31.12	68.87	49.26
6	4	Israel	7.76	17.94	34.58	39.71	60.28	25.7
6	6	Italy	19.62	32.41	20.36	27.62	72.39	52.03
6	4	Ivory Coast	0.95	21.62	33.21	44.23	55.78	22.57
6	3	Liberia	0.43	12.09	38.53	48.95	51.05	12.52
6	6	Macedonia	25.18	36.62	4.92	33.28	66.72	61.8
6	6	Namibia	0.45	58.54	2.42	38.59	61.41	58.99
6	4	Nigeria	4.01	19.56	30.26	46.17	53.83	23.57
6	5	Senegal	4.26	26.59	21.77	47.38	52.62	30.85
6	6	Somalia	18.56	34.01	3.96	43.46	56.53	52.57
6	5	South France	21.43	27.72	7.3	43.55	56.45	49.15
6	6	Spain	23.58	31.13	19.69	25.6	74.4	54.71
6	5	Tunisia	10.6	20.17	39.03	30.2	69.8	30.77
6	5	Turkey	25.86	19.74	9.79	44.61	55.39	45.6

All	H/M	Country	High	Moderate	Slight	No Change	All Hazard	High/Moderate
5	5	Armenia	16.66	14.15	1.17	66.02	31.98	30.81
5	2	Benin	2.57	6.44	31.47	59.52	40.48	9.01
5	5	Bosnia & Herzegovina	17.67	18.73	0.64	62.96	37.04	36.4
5	4	Botswana	0.08	24.06	12.36	63.5	36.5	24.14
5	4	Burkina Faso	1.85	20	16.41	6174	38.26	21.85
5	3	Cameroon	1.72	10.36	19.94	67.99	32.02	12.08
5	3	Chad	1.25	11.68	17.94	69.14	30.87	12.93
5	4	Ethiopia	9.88	19.88	11.92	58.32	41.68	29.76
5	4	Ghana	1.96	15.8	27.27	54.96	45.03	17.76
5	5	Kenya	13.62	27.54	8.1	50.74	49.26	41.16
5	4	Mali	1.18	16.1	22.56	60.16	39.84	17.28
5	4	Saudi Arabia	4.09	11.5	24.12	60.29	39.71	15.59
5	5	Serbia	19.39	24.54	0.02	56.05	43.95	43.93
5	3	Sierra Leone	0.12	13.35	34.84	51.69	48.31	13.47
5	5	South Africa	0.03	33.52	4.9	61.55	38.45	33.55
5	3	Sudan	1.74	13.21	18.35	66.7	33.3	14.95
5	2	Togo	1.34	6.54	30.09	62.04	37.97	7.88
5	2	United Arab Emirates	0.14	6.69	32.85	60.31	39.68	6.83
5	3	Western Sahara	0.17	12.43	31.08	56.32	43.68	12.6
4	3	Algeria	3.34	9.41	12.77	74.49	25.52	12.75
4	4	Congo	7.12	9.08	9.36	74.44	25.56	16.2
4	1	Egypt	0.89	3.09	11.92	84.09	15.9	3.98
4	3	Jordan	3.65	6.44	18.64	71.27	28.73	10.09
4	1	Libya	0.6	2.86	13.34	83.2	16.8	3.46
4	3	Mauritania	1.03	9.61	14.13	75.23	24.77	10.64
4	4	Montenegro	9.17	11.07	0.03	79.73	20.27	20.24
4	3	Niger	1.28	10.96	16.87	70.89	29.11	12.24
4	1	Oman	0.18	3.4	15.85	80.58	19.43	3.58
4	3	Yemen	1.87	11.8	15.79	70.54	29.46	13.67

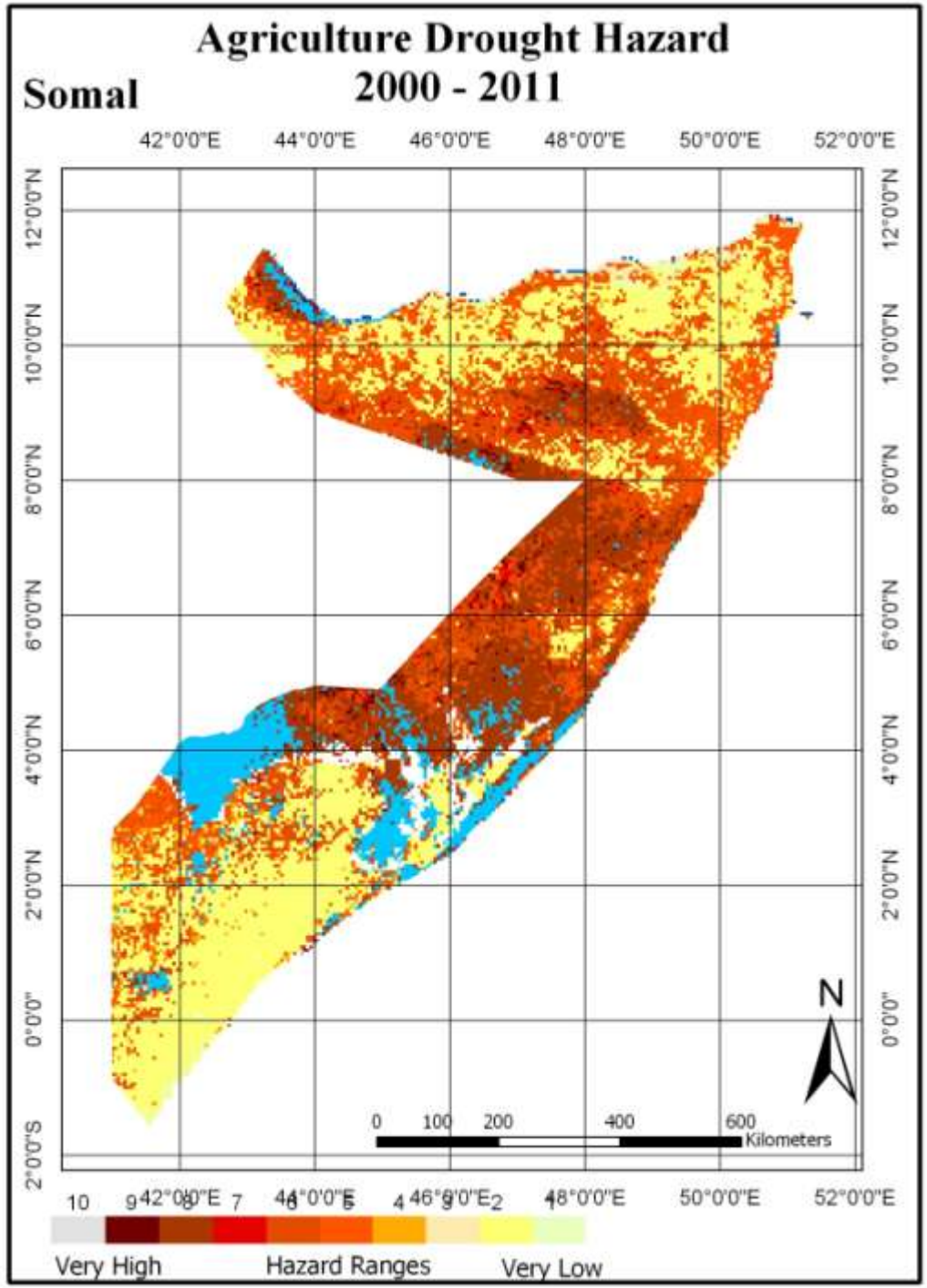
All	H/M	Country	High	Moderate	Slight	No Change	All Hazard	High/Moderate
4	3	Algeria	3.34	9.41	12.77	74.49	25.52	12.75
4	4	Congo	7.12	9.08	9.36	74.44	25.56	16.2
4	1	Egypt	0.89	3.09	11.92	84.09	15.9	3.98
4	3	Jordan	3.65	6.44	18.64	71.27	28.73	10.09
4	1	Libya	0.6	2.86	13.34	83.2	16.8	3.46
4	3	Mauritania	1.03	9.61	14.13	75.23	24.77	10.64
4	4	Montenegro	9.17	11.07	0.03	79.73	20.27	20.24
4	3	Niger	1.28	10.96	16.87	70.89	29.11	12.24
4	1	Oman	0.18	3.4	15.85	80.58	19.43	3.58
4	3	Yemen	1.87	11.8	15.79	70.54	29.46	13.67
3	1	Gambia	0.69	0.96	9.33	89.01	10.98	1.65
3	1	Guinea	0.03	1.59	11.96	86.42	13.58	1.62
3	2	Malawi	3.36	5.38	3.22	88.04	11.96	8.74
3	3	Zimbabwe	0.03	10.13	3.57	86.27	13.73	10.16
2	1	Angola	0.2	3.5	2.07	94.14	5.77	3.7
2	1	Lesotho	0	3.11	4	92.89	7.11	3.11
2	2	Mozambique	0.21	4.8	1.85	93.14	6.86	5.01
1	1	Burundi	1.44	1.16	0.84	96.55	3.44	2.6
1	1	C African Republic	0	0.07	1.25	98.68	1.32	0.07
1	1	Congo D R C	0.46	0.76	1.08	97.7	2.3	1.22
1	1	Guinea-Bissau	0.16	0.11	2.57	97.16	2.84	0.27
1	1	Madagascar	0.05	1.96	1.24	96.74	3.25	2.01
1	1	Rwanda	0.46	0.89	0.49	98.17	1.84	1.35
1	1	Swaziland	0.1	0.6	0.35	98.95	1.05	0.7
1	1	Tanzania	0.66	1.66	1.46	96.22	3.78	2.32
1	1	Uganda	1.39	1.2	1.18	96.23	3.77	2.59
1	1	Zambia	0.04	0.52	1.17	98.27	1.73	0.56

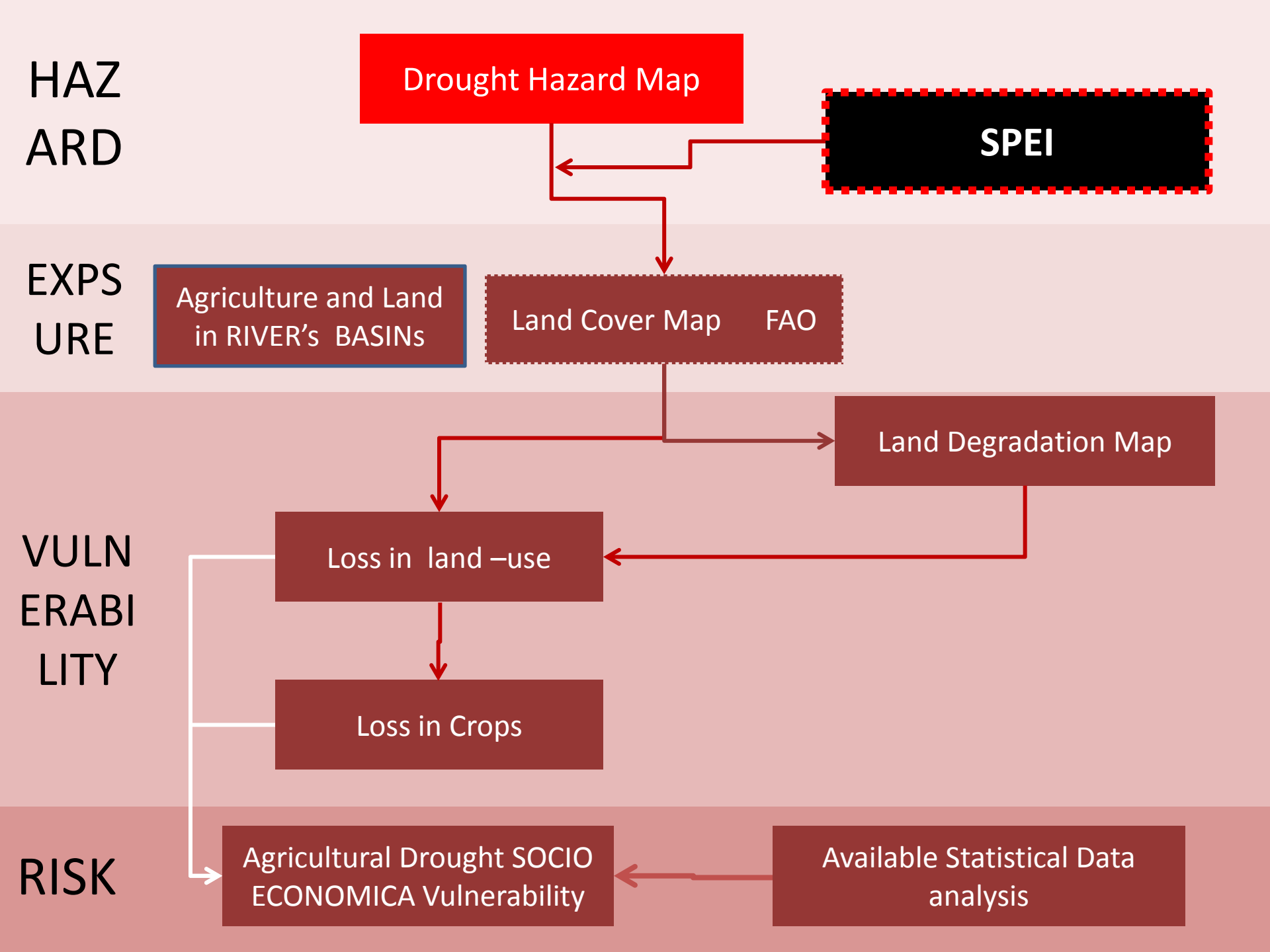

Agriculture Drought Hazard
Spain
2000 - 2011
8°0'0"W
4°0'0"W
0°0'0"
46°0'0"N
42°0'0"N
38°0'0"N
34°0'0"N
0 100 200 400 600
Kilometers
10 9 8 7 6 5 4 3 2 1
Very High
Hazard Ranges
Very Low
N

High	0.03%
Moderate	33.52%
Slight	4.90%
No drought	61.55%



High	18.56%
Moderate	34.01%
Slight	3.96%
No drought	43.46%




HAZ
ARD
Drought Hazard Map
SPEI
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Agriculture and Land in RIVER's BASINs
Land Cover Map FAO
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VULN
ERABI
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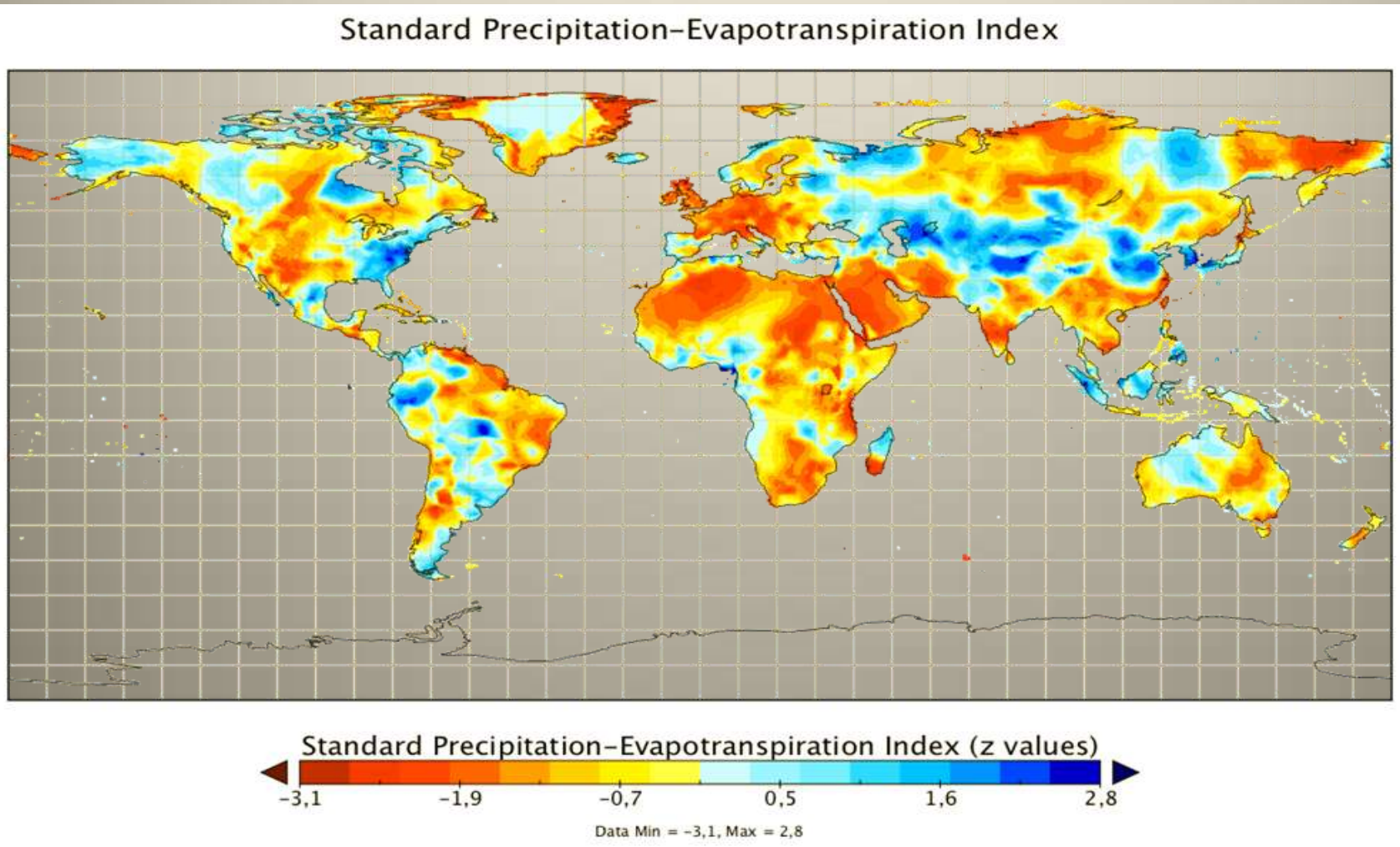
Loss in land –use
Loss in Crops
RISK
Agricultural Drought SOCIO ECONOMICA Vulnerability
Available Statistical Data analysis

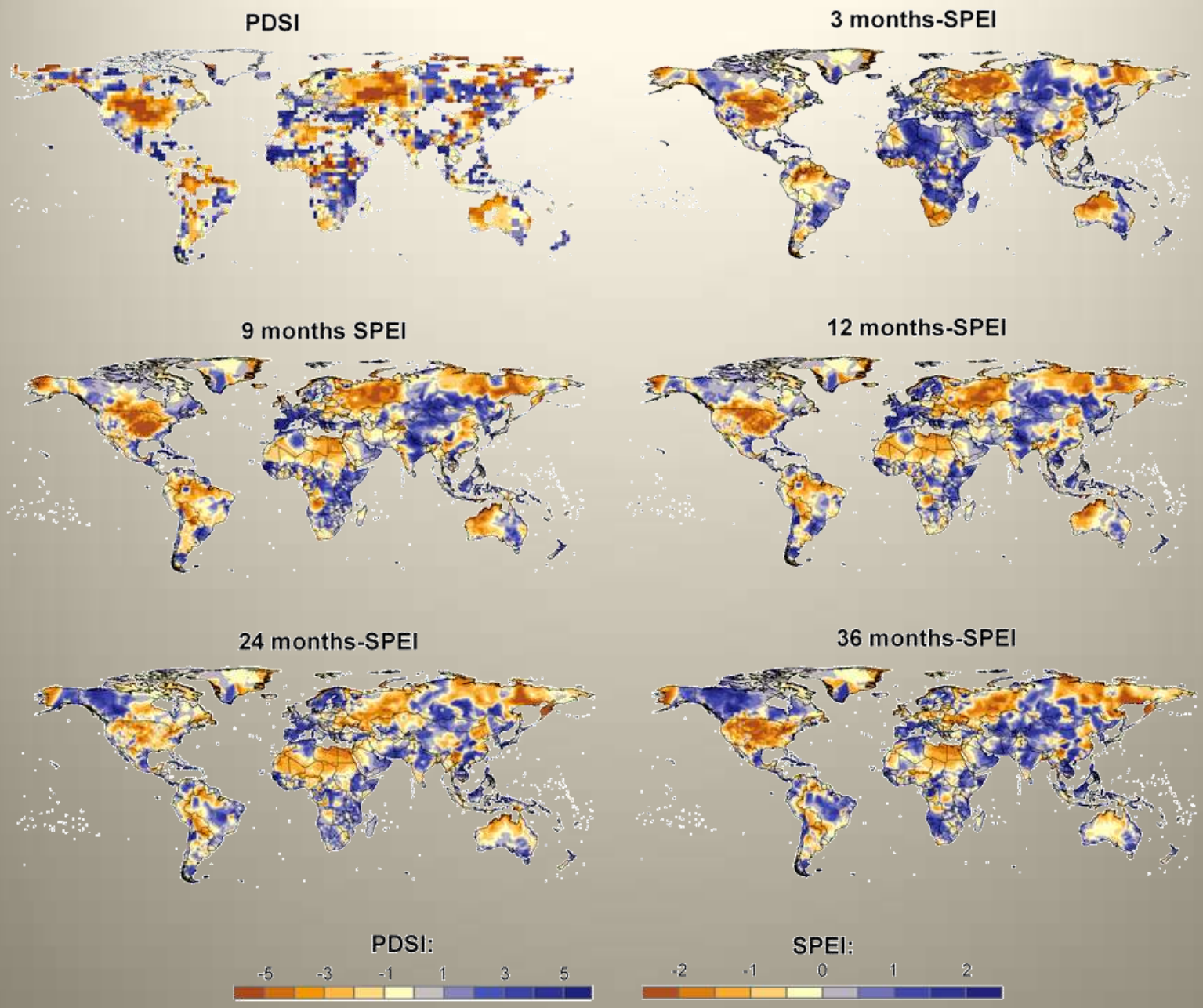
Standardized Precipitation-Evapotranspiration Index (SPEI)

All currently available gridded drought datasets at continental and global scales are based on either the PDSI or the sc-PDSI. A new global drought dataset based on the **Standardized Precipitation-Evapotranspiration Index (SPEI)** has been developed, which covers time scales from 1-48 months at a spatial resolution of 0.5°, and provides temporal coverage for the period 1901-2006.

This dataset represents an improvement in spatial resolution and operative capability of previous gridded drought datasets

SPEIbase: A Global 0.5° gridded SPEI dataset

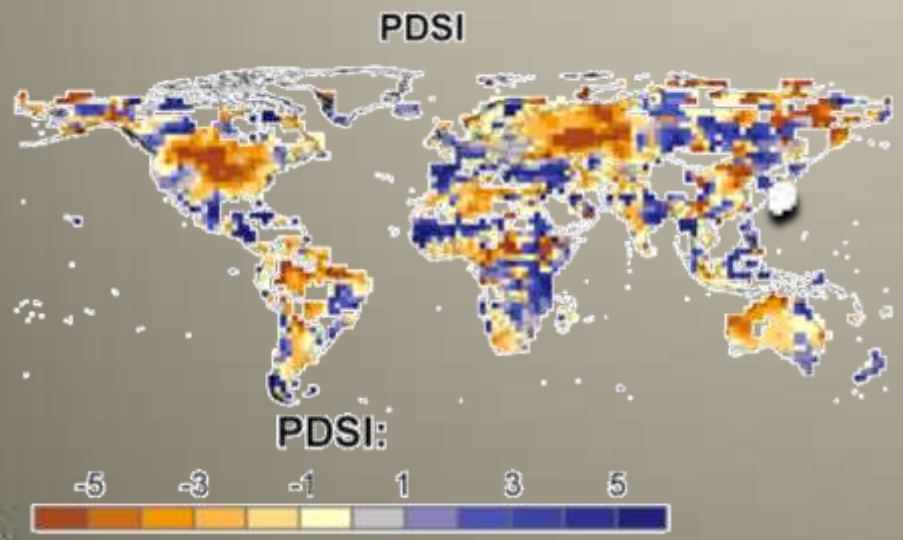




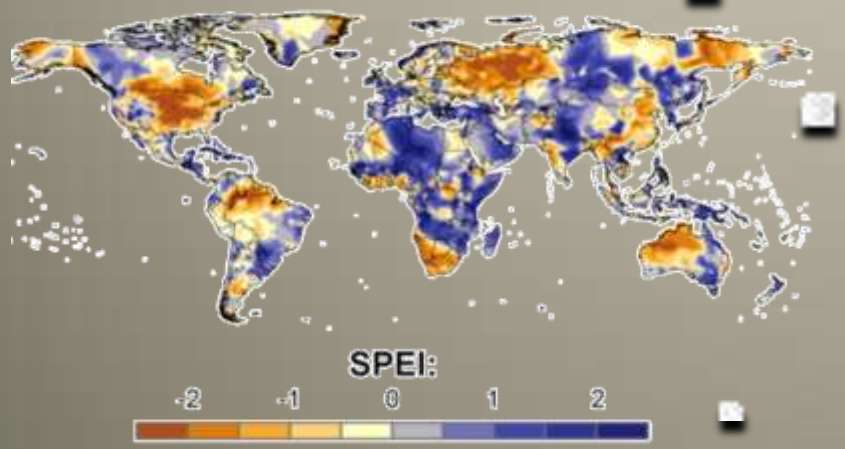
Spatial distribution of the UCAR PDSI and the SPEI (3, 9, 12, 24, and 36 months) for the European continent, August 1936. (clic for a larger version)

PDSI

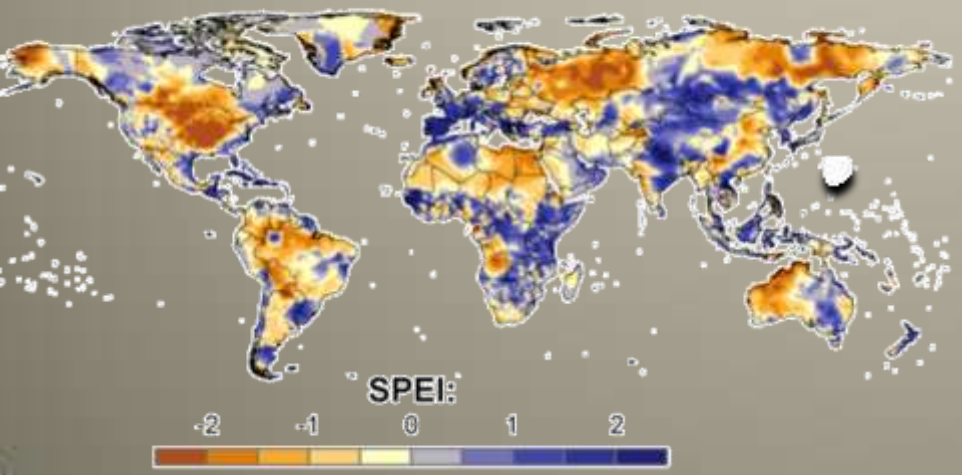
spatial resolution of 0.5°, and covers the period 1901–2006



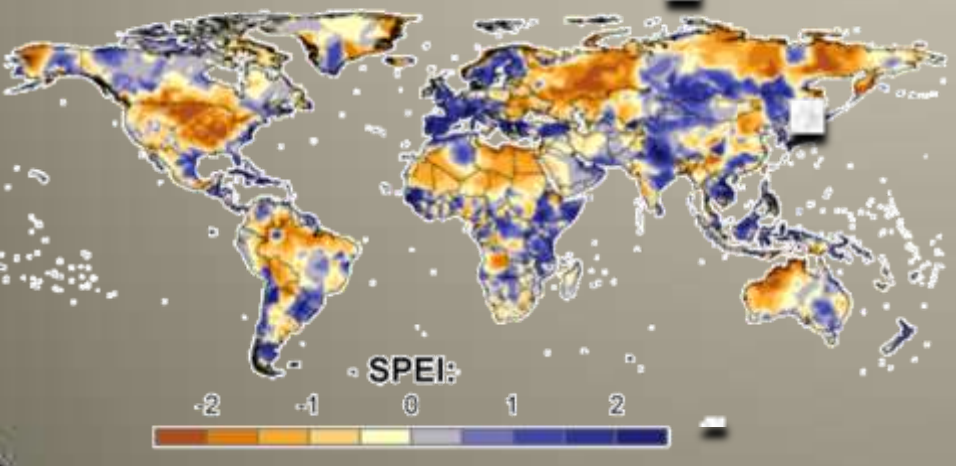
SPEI



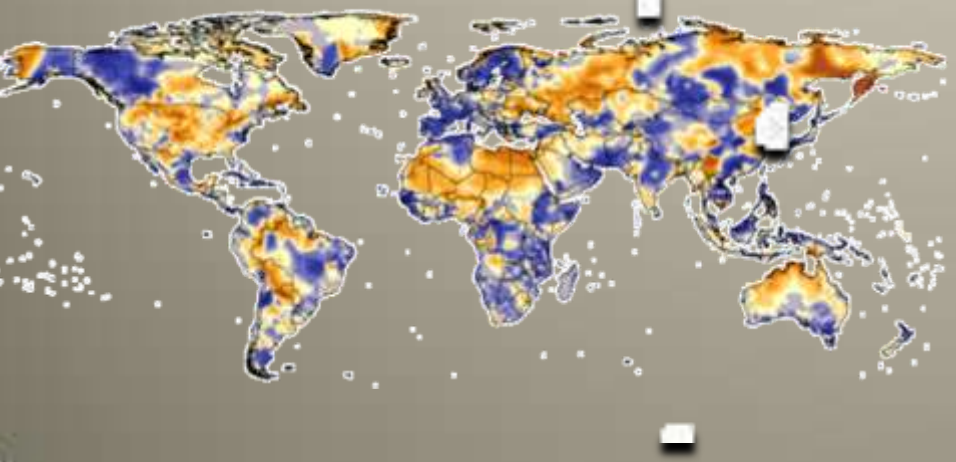
SPEI



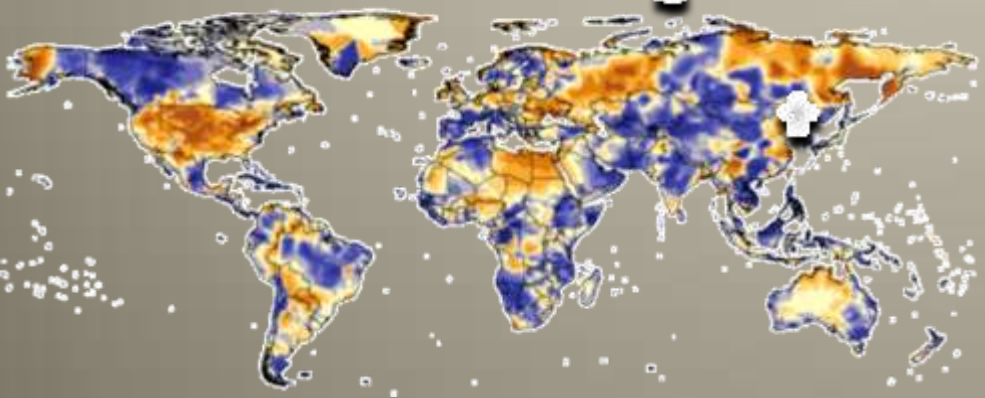
SPEI

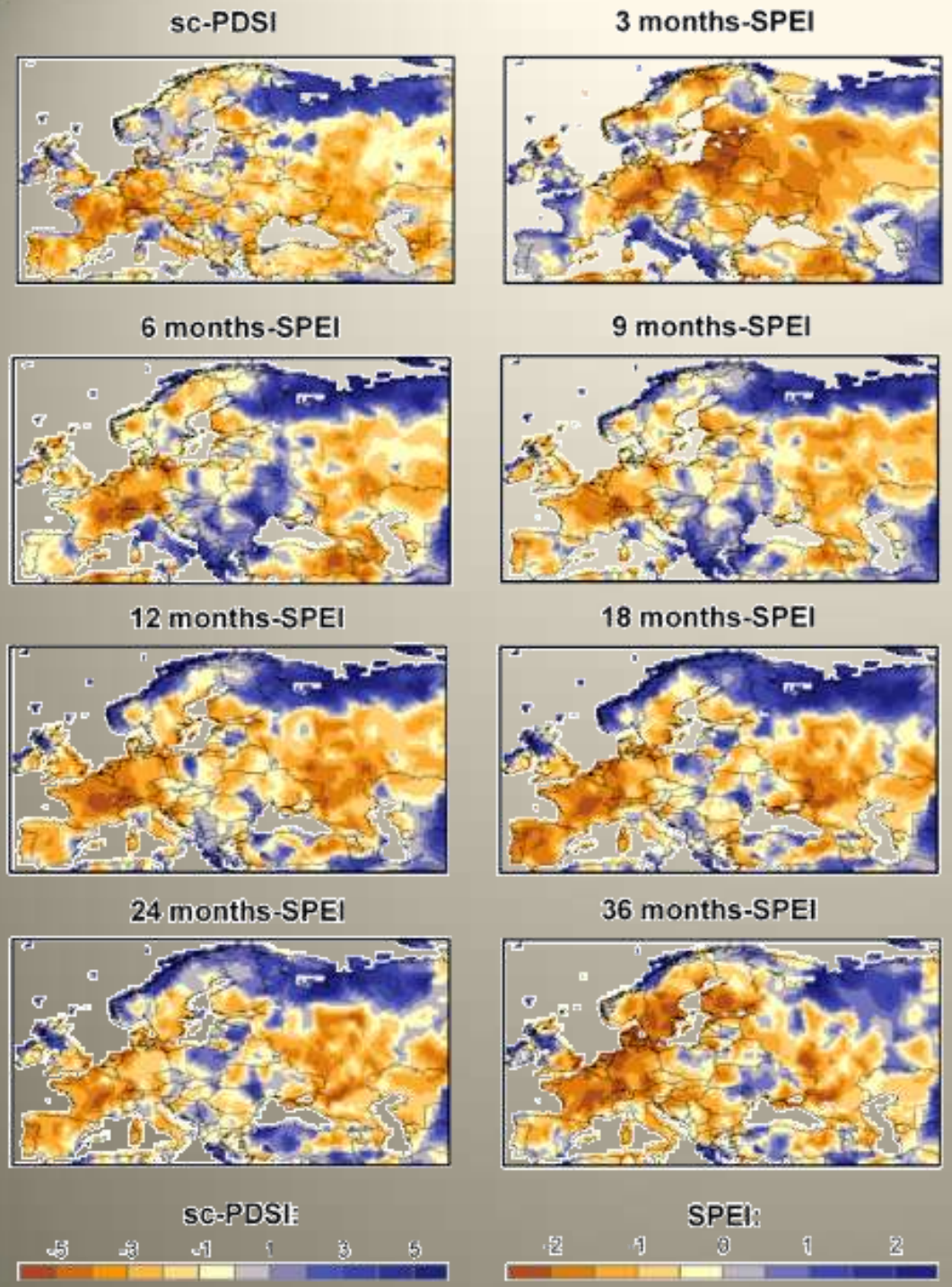


SPEI



SPEI

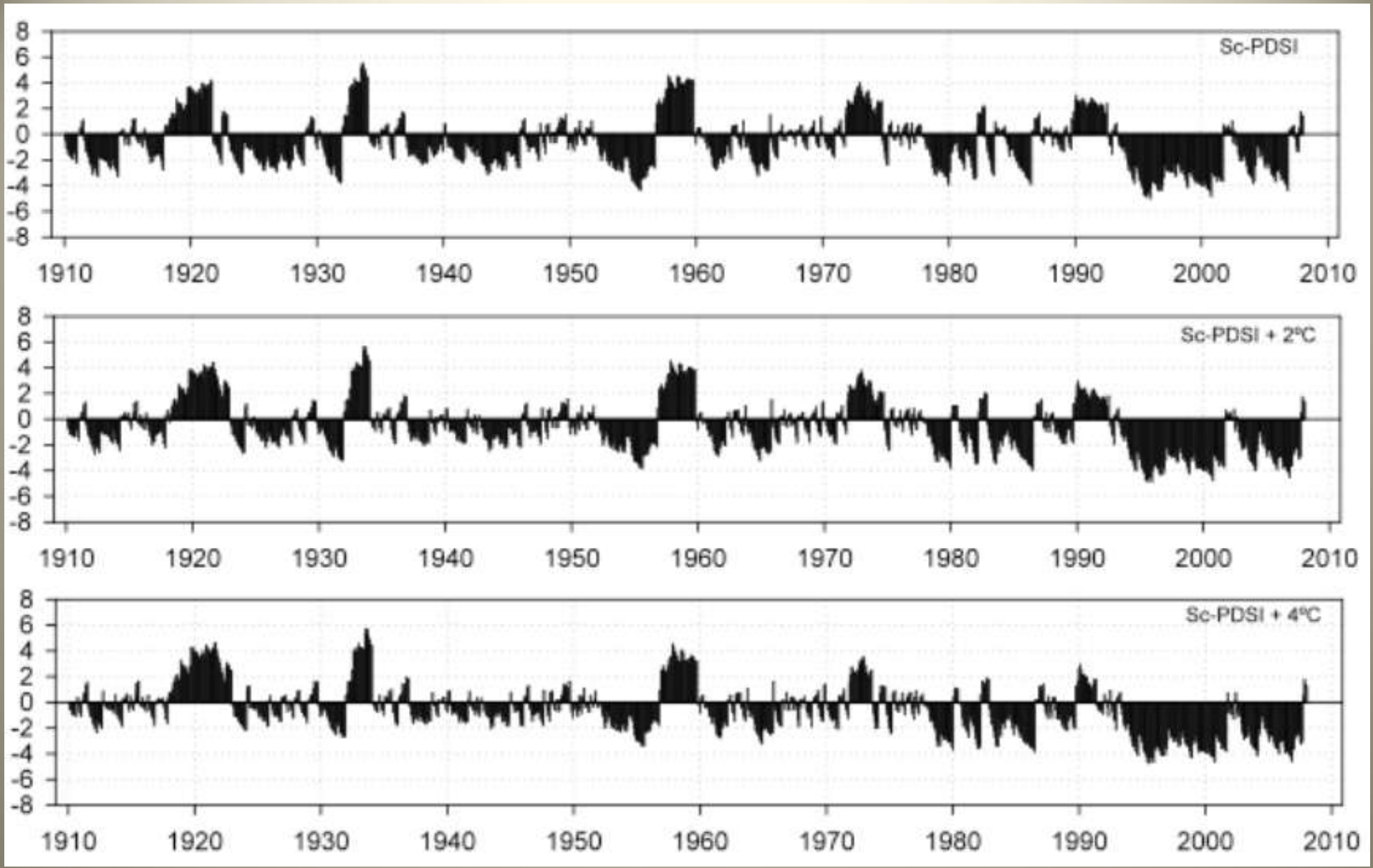




Spatial distribution of the CRU sc-PDSI and the SPEI (3, 6, 9, 12, 18, 24 and 36 months) for the European continent, November 1949.

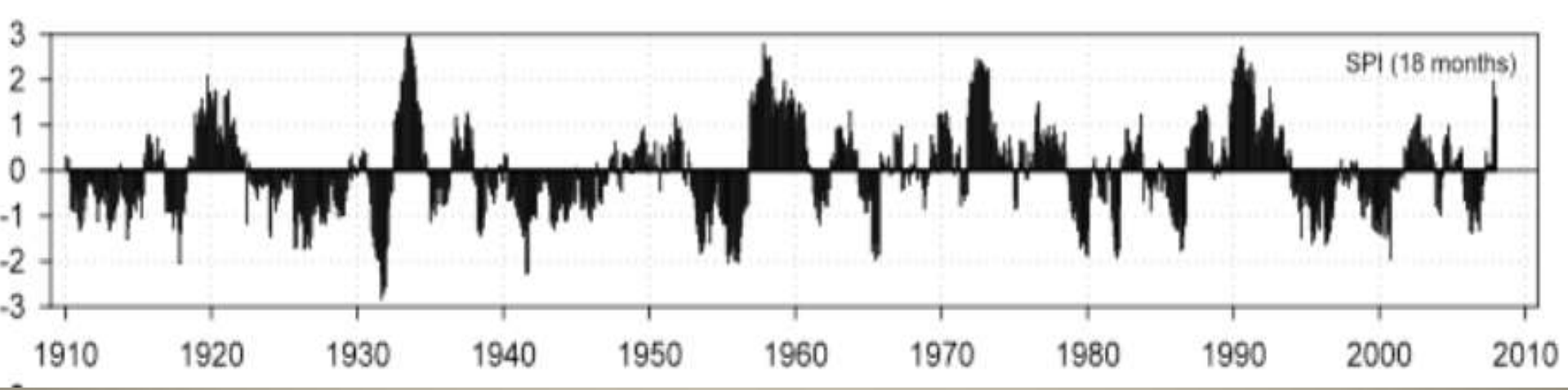
a similar comparison involving the CRU sc-PDSI dataset for Europe over 2 months in which large regions were affected by drought conditions that were recorded by both the sc-PDSI and the SPEI

. For November 1949 the sc-PDSI showed that the most severe drought conditions were in central Europe (central France, Germany, and Switzerland), although the majority of Europe was affected by dry conditions (negative values in the sc-PDSI). For large areas of northern Russia and some parts of Finland, Norway, and the British Isles the sc-PDSI showed very humid conditions. The pattern was similar to the maps obtained from the SPEI, particularly at time scales of 12 months or longer. Nevertheless, there were also major differences.

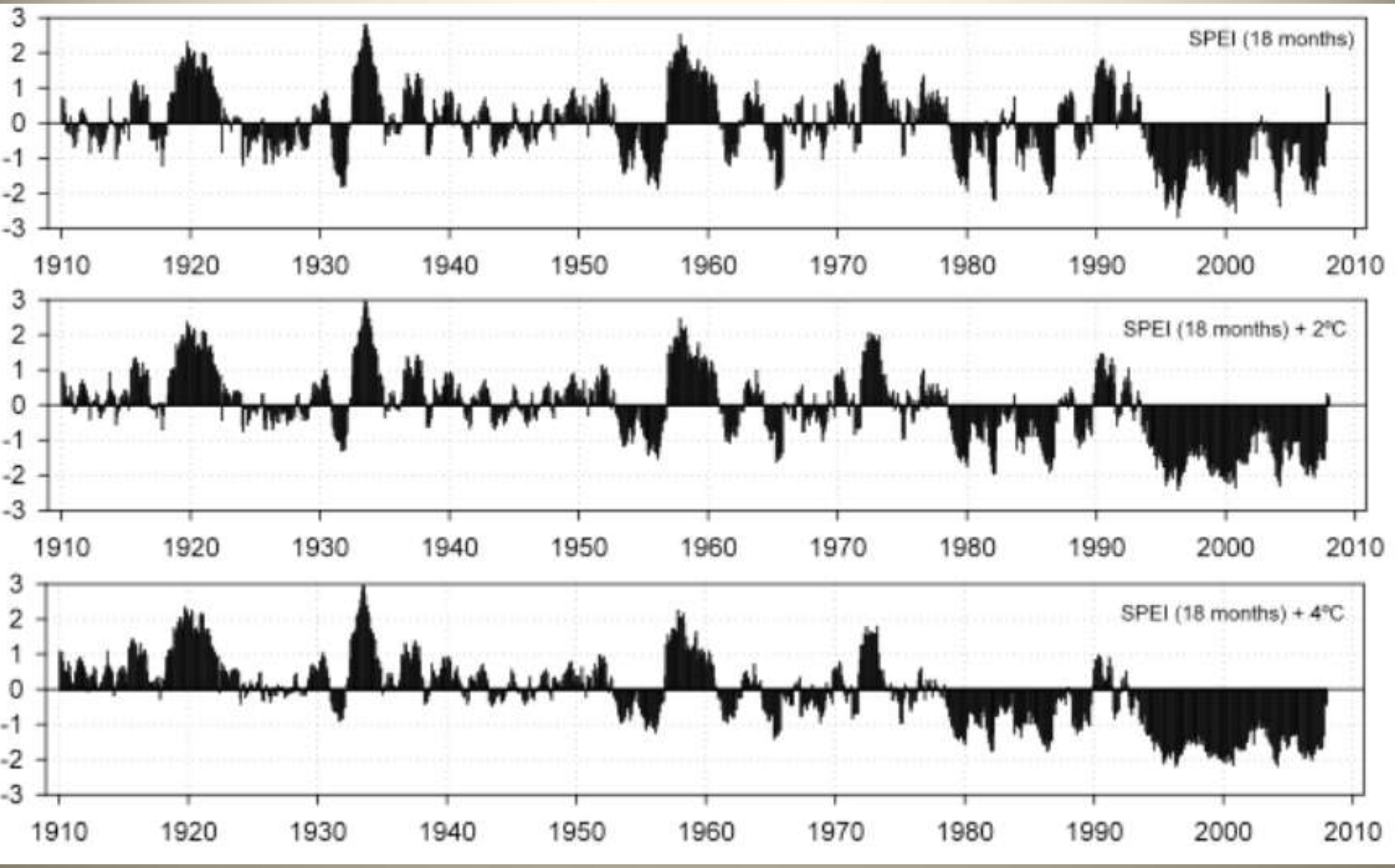


sc-PDSI at in Valencia (Spain) (1910–2007).

http://sac.csic.es/spei/spei_index.html



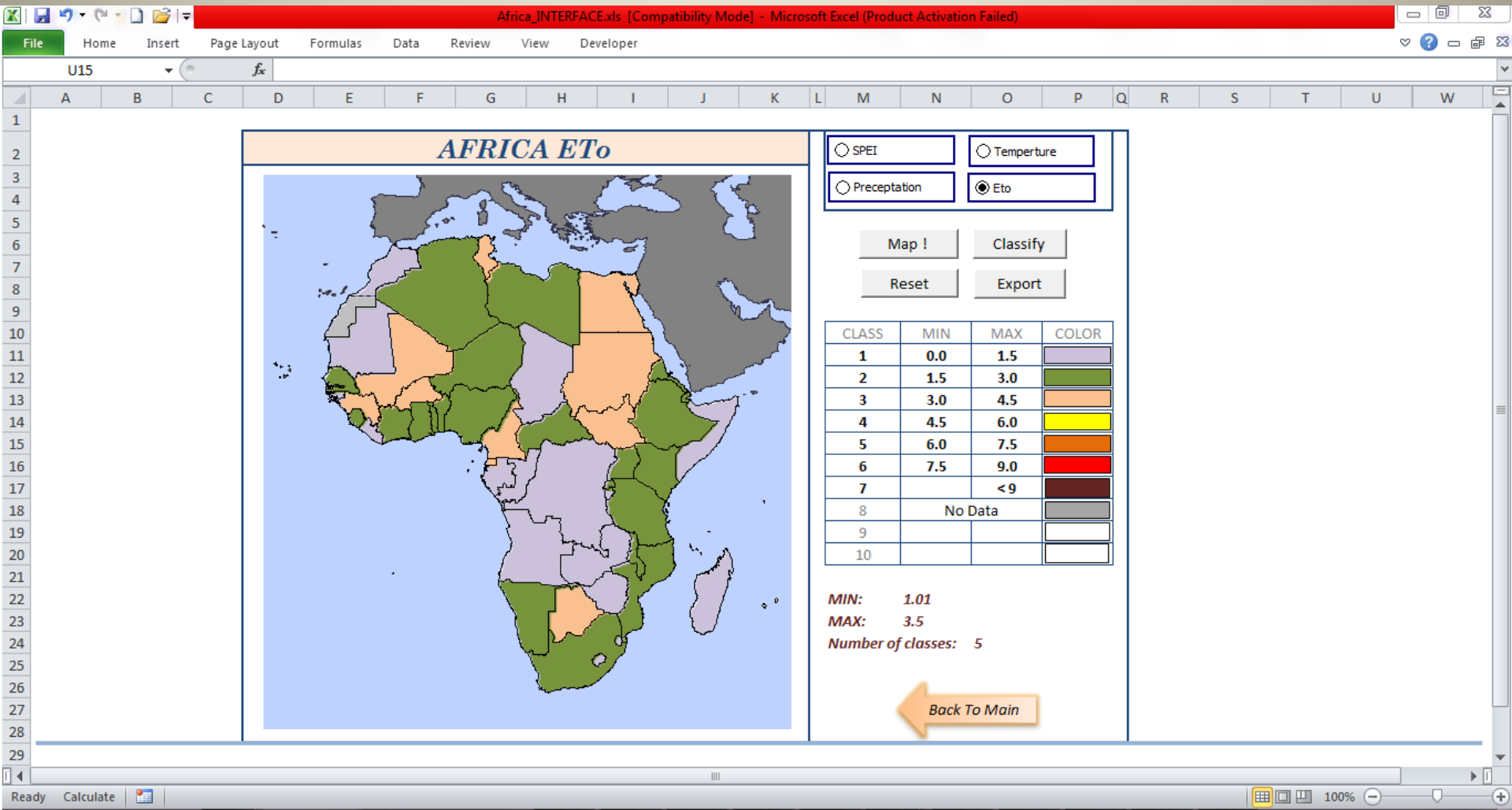
SPI at in Valencia (Spain) (1910–2007).

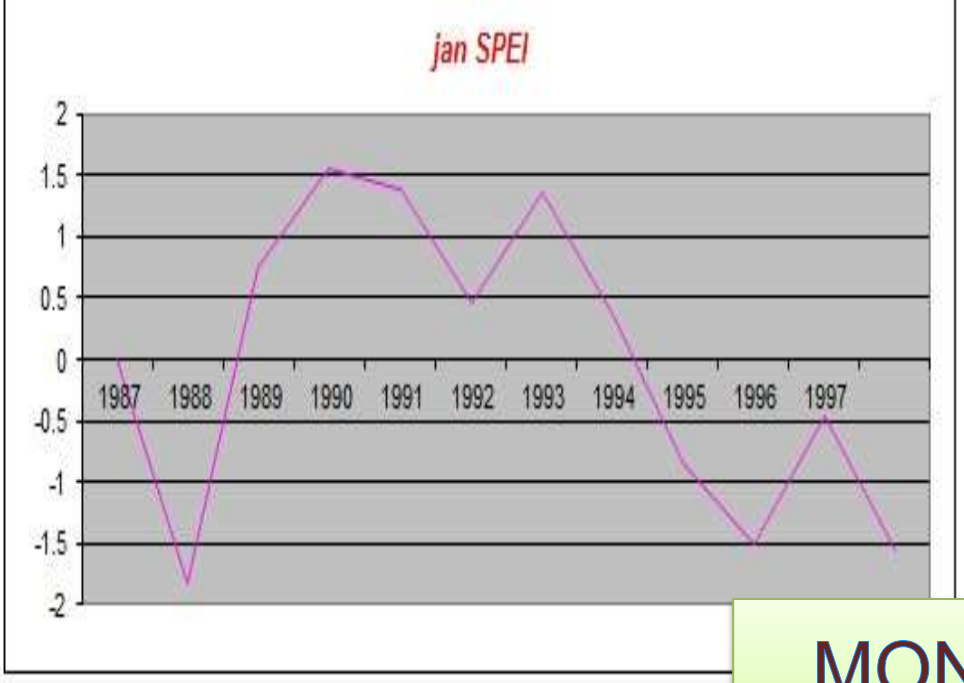


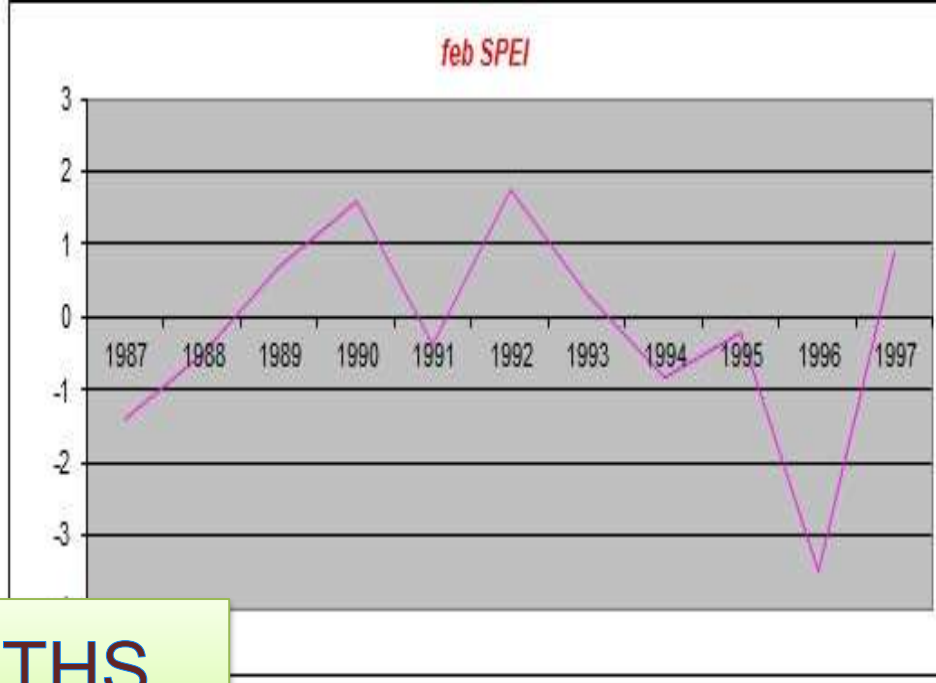
SPEI at in Valencia (Spain) (1910–2007).

ACSAD Started a cooperation with the Egyptian ARC – Central Laboratory for Agriculture Climate

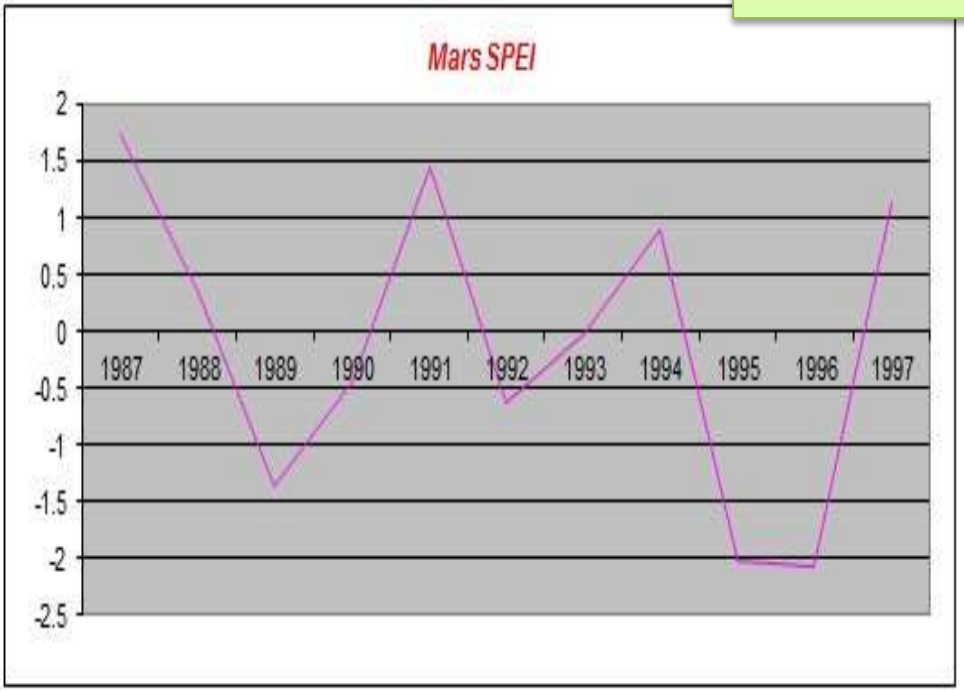
For Developing Program to Calculate SPEI for AFRICA and Compareing the results with CSIC in Spain

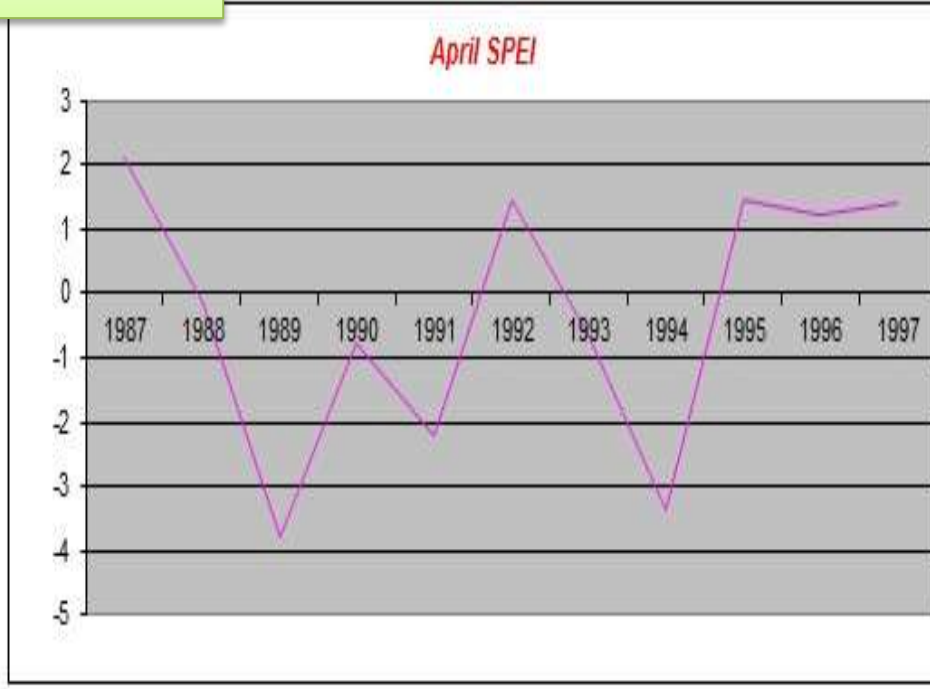


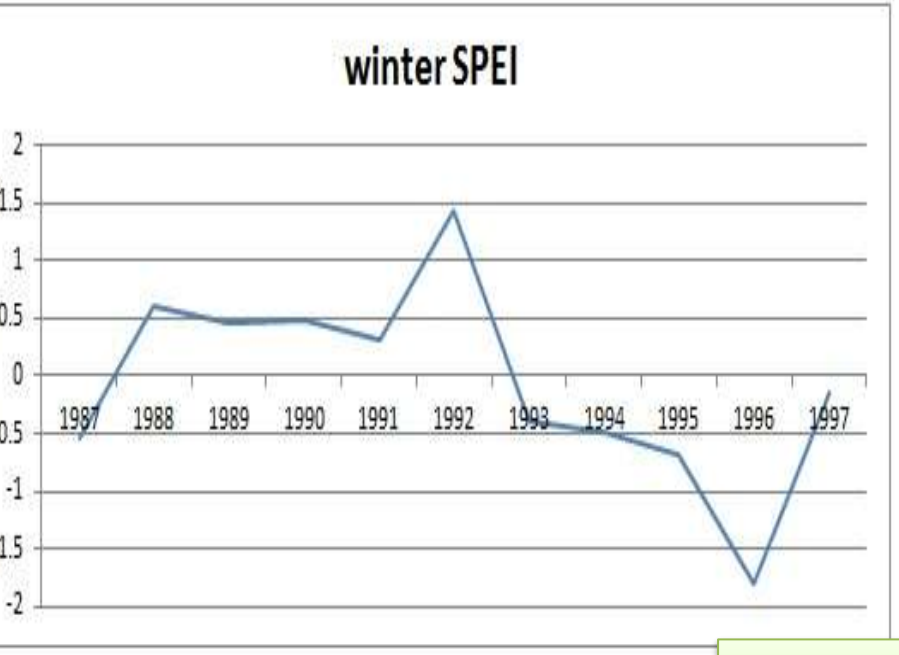

jan SPEI
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997

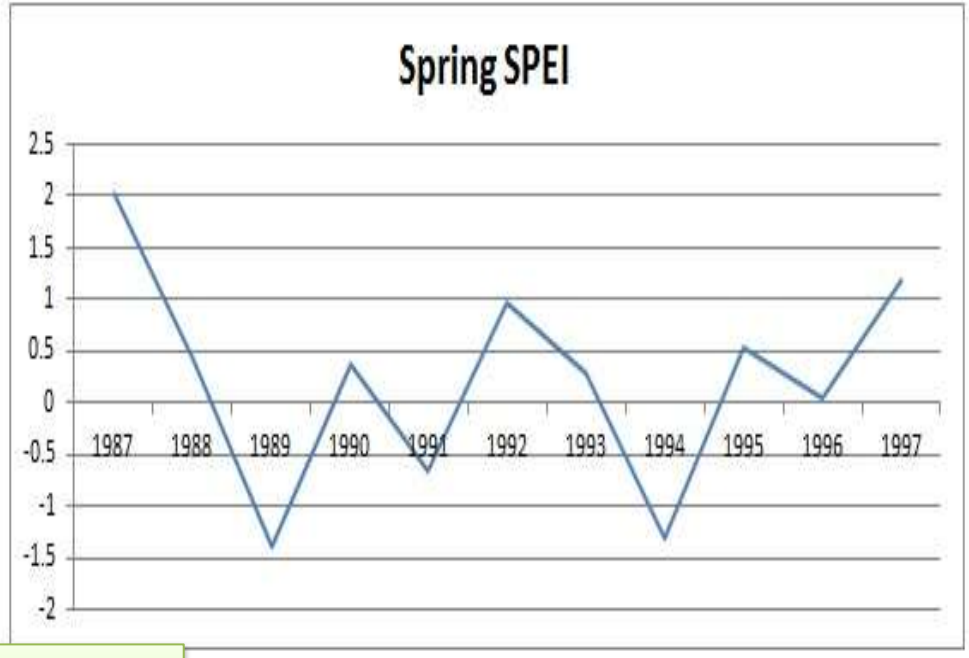

feb SPEI
3
2
1
0
-1
-2
-3
1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997

MONTHS

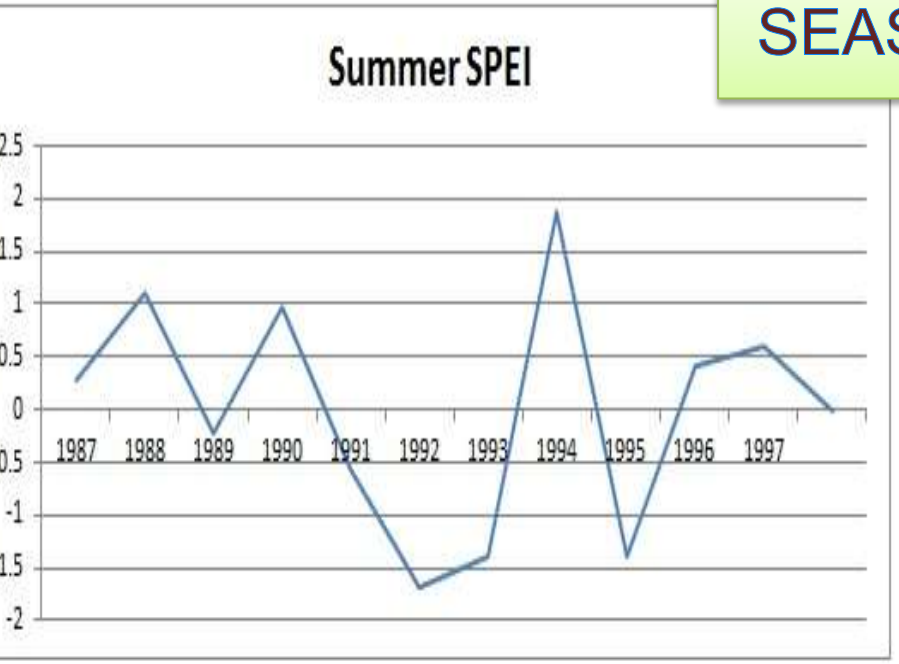

Mars SPEI
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997

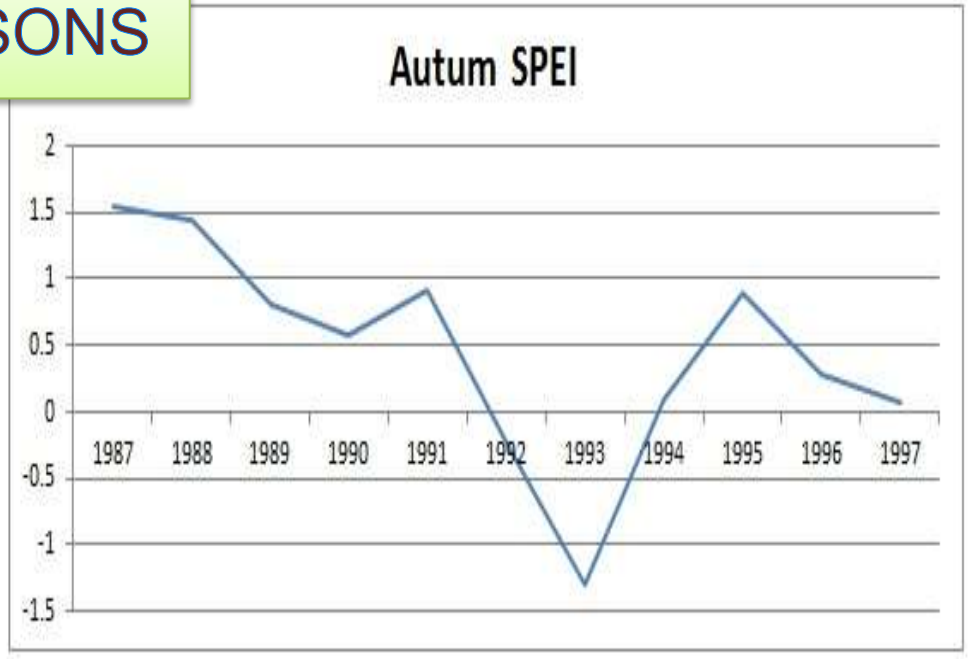

April SPEI
3
2
1
0
-1
-2
-3
-4
-5
1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997


winter SPEI
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997

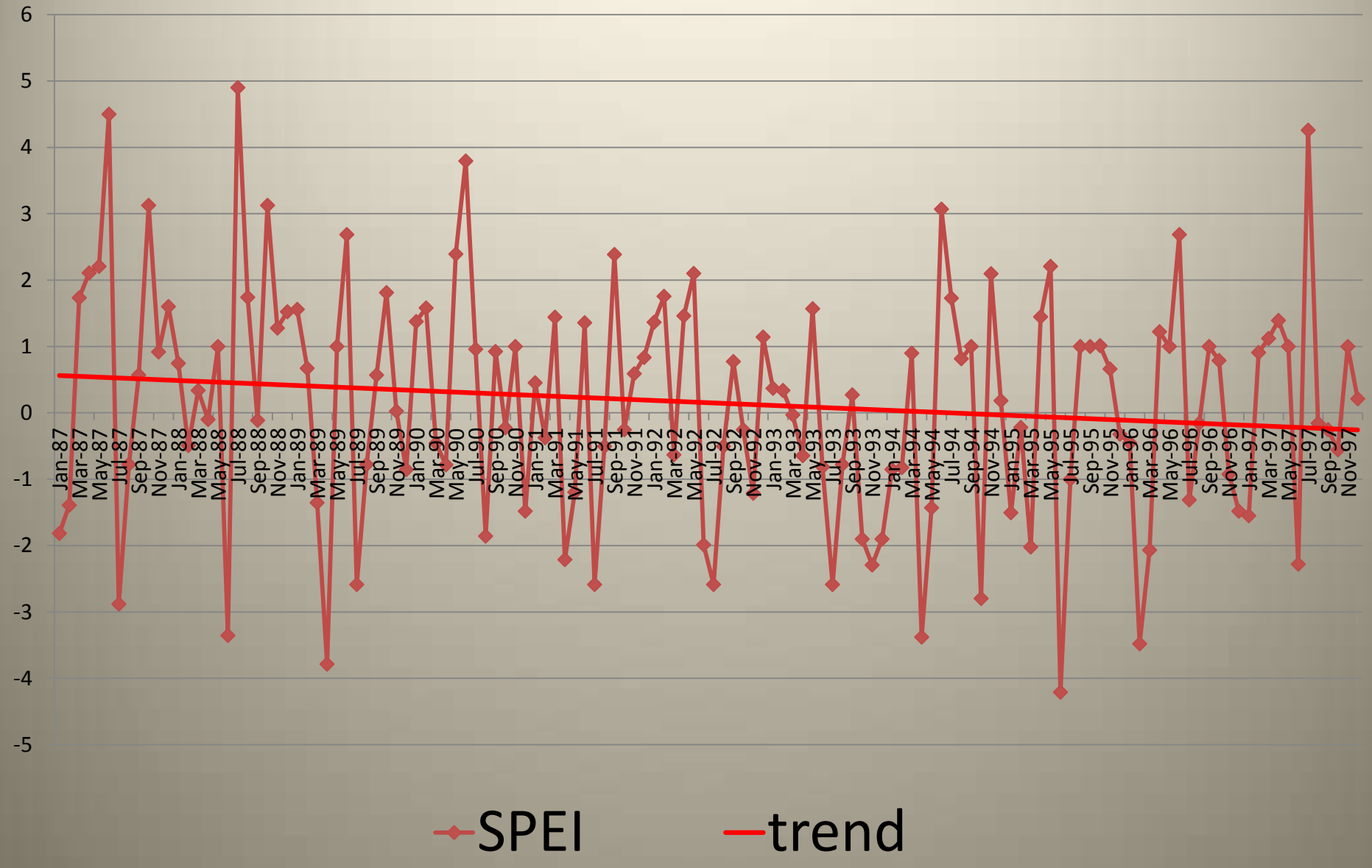

Spring SPEI
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997

SEASONS

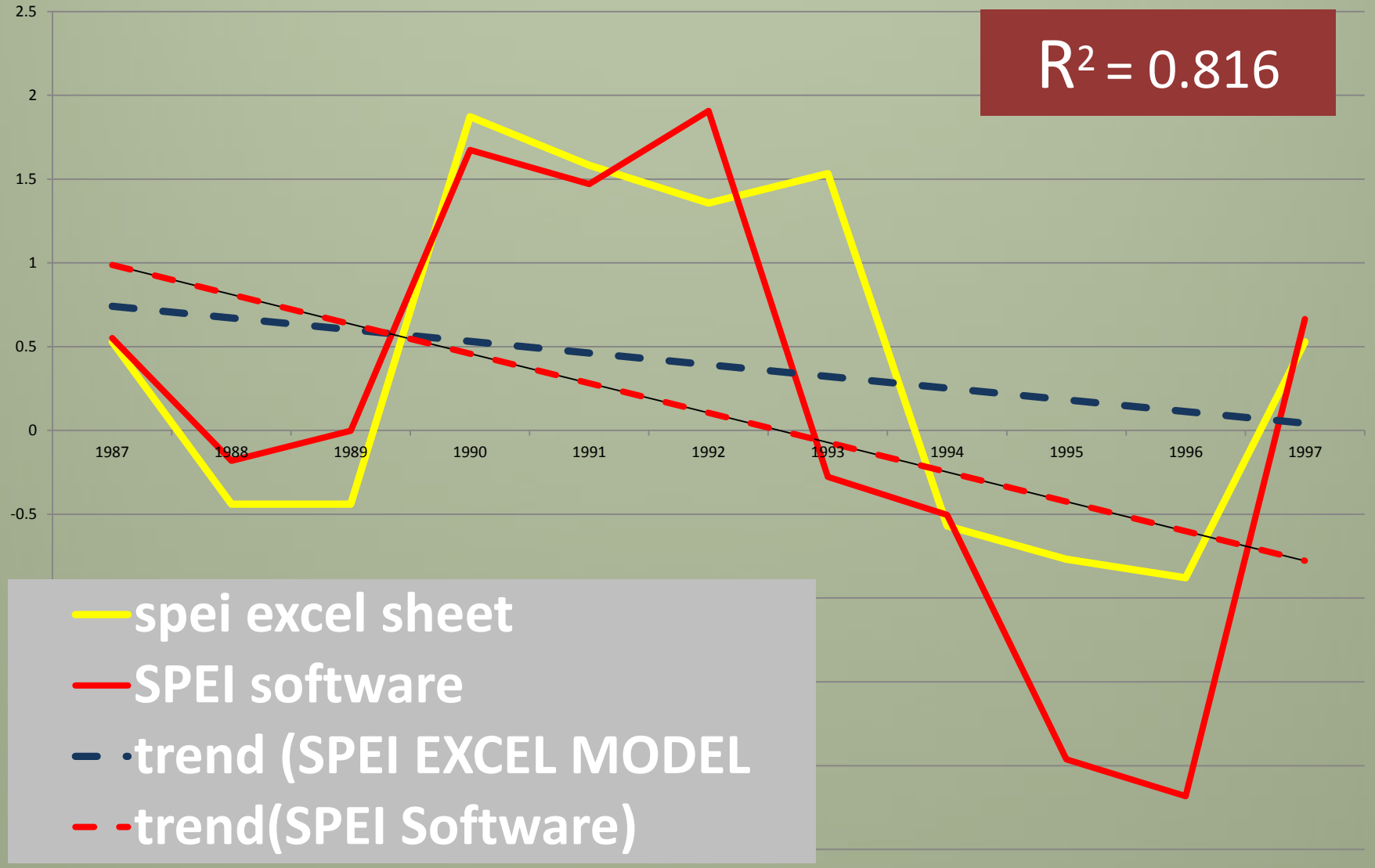

Summer SPEI
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997

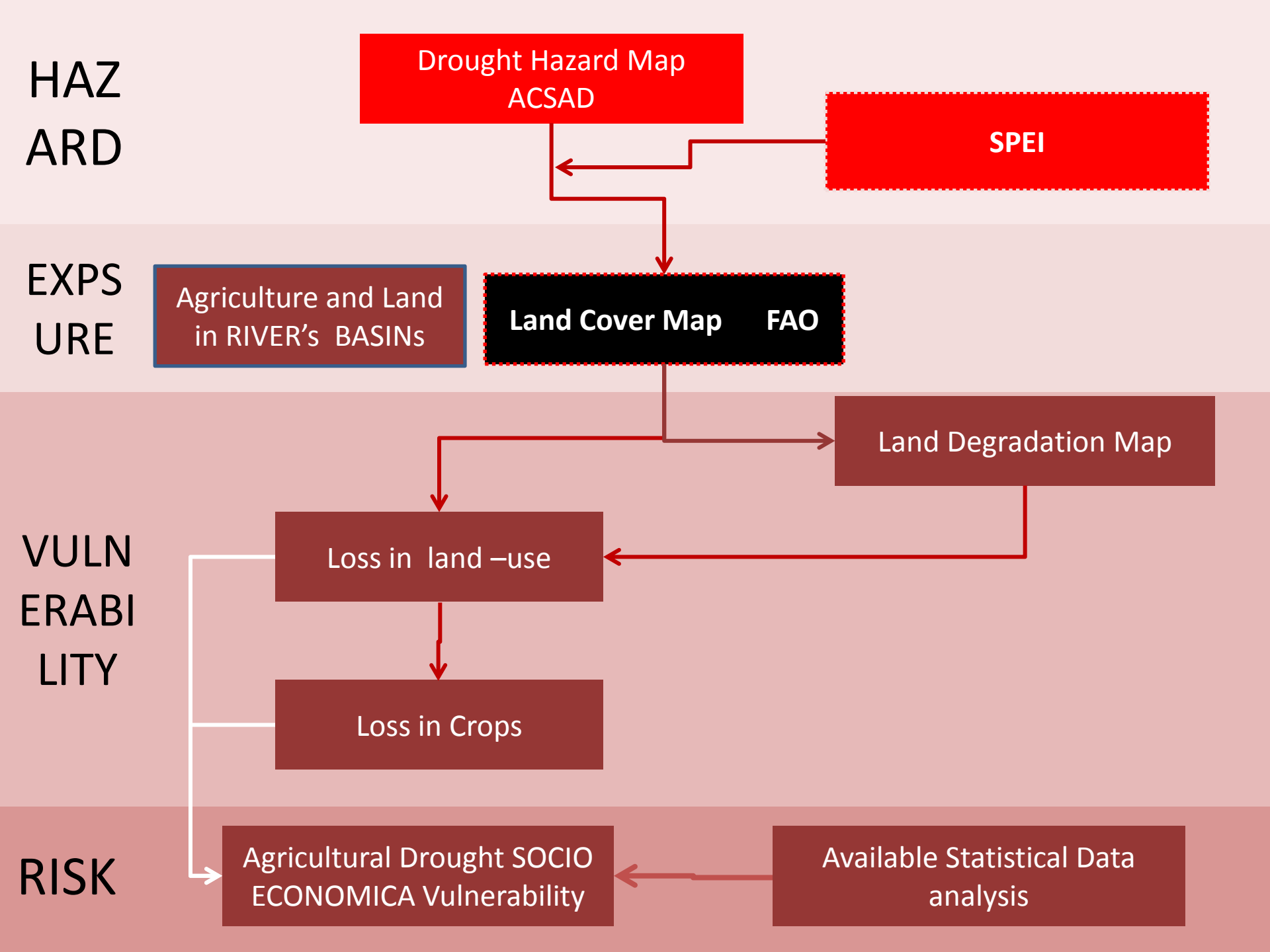

Autum SPEI
2
1.5
1
0.5
0
-0.5
-1
-1.5
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997

SPEI for Cairo



Comparing the results with CSIC results Showing Significant Correlation




HAZ
ARD
Drought Hazard Map
ACSAD
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EXPS
URE
Agriculture and Land
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Land Cover Map FAO
Land Degradation Map
VULN
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Loss in land –use
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ECONOMICA Vulnerability
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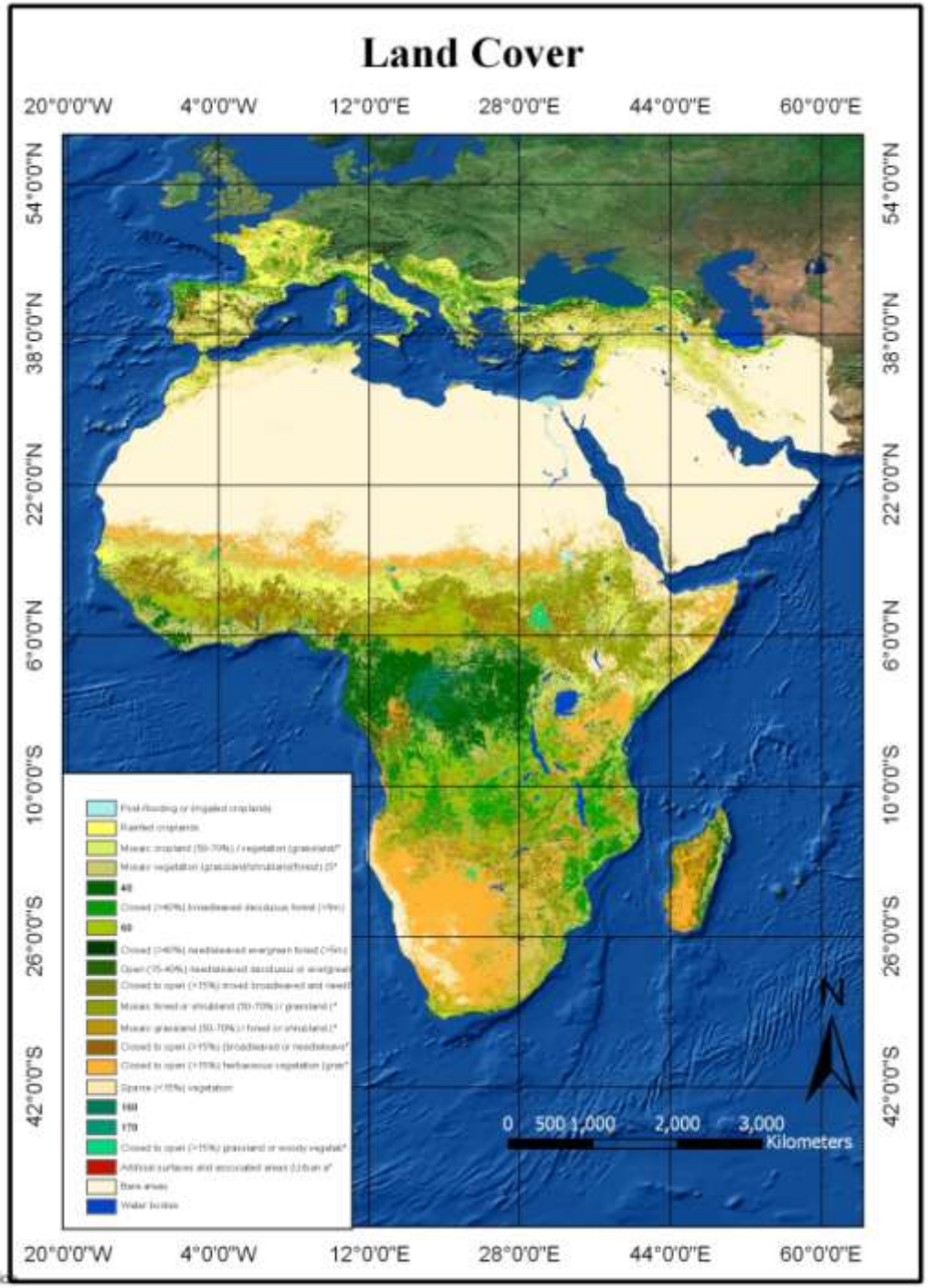
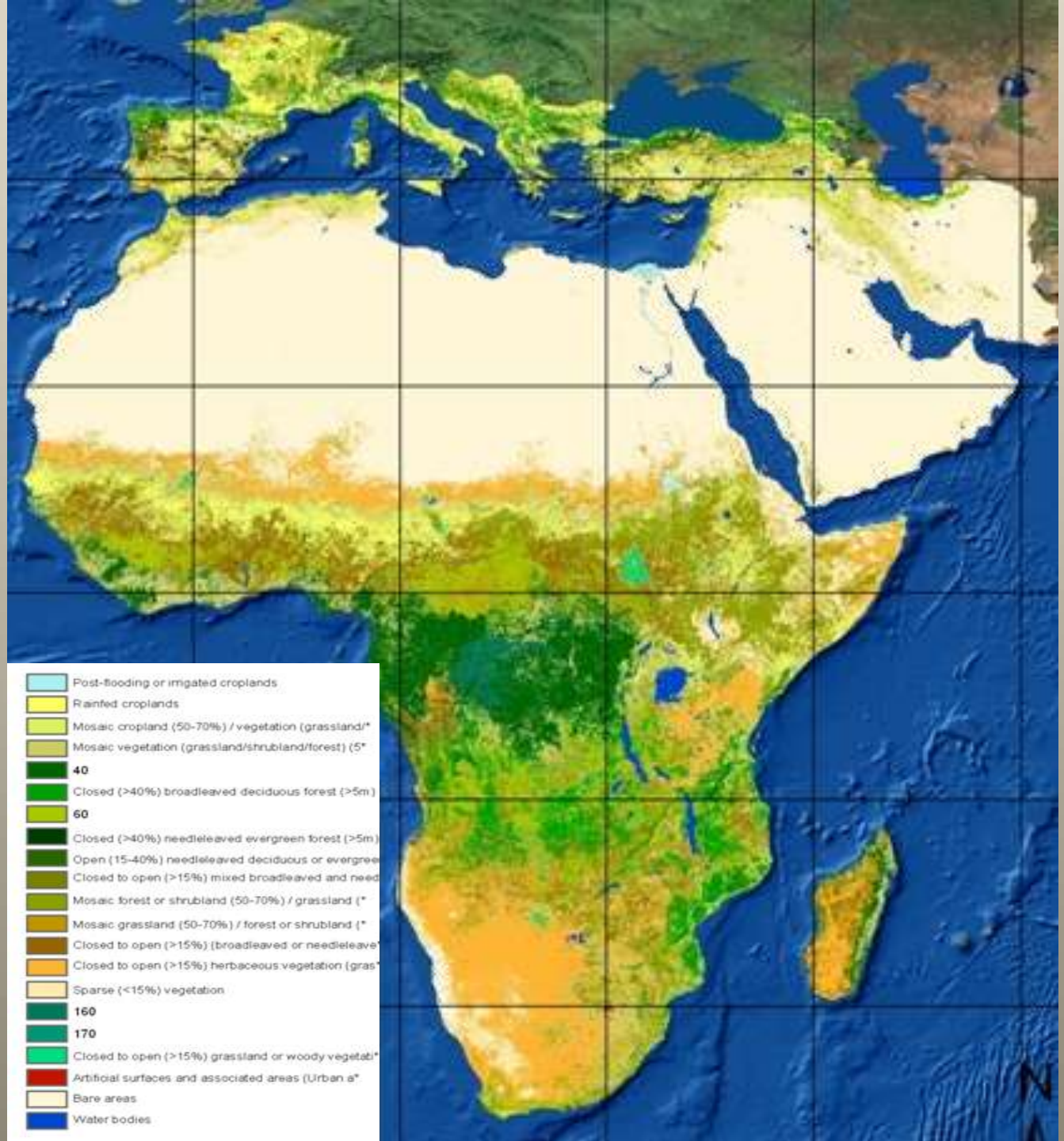


Post-flooding or irrigated croplands
Rainfed croplands
Mosaic cropland (50-70%) / vegetation (grassland/*
Mosaic vegetation (grassland/shrubland/forest) (5*
40
Closed (>40%) broadleaved deciduous forest (>5m)
60
Closed (>40%) needleleaved evergreen forest (>5m)
Open (15-40%) needleleaved deciduous or evergree
Closed to open (>15%) mixed broadleaved and need
Mosaic forest or shrubland (50-70%) / grassland (*
Mosaic grassland (50-70%) / forest or shrubland (*
Closed to open (>15%) (broadleaved or needleleave*
Closed to open (>15%) herbaceous vegetation (gras*
Sparse (<15%) vegetation
160
170
Closed to open (>15%) grassland or woody vegetati*
Artificial surfaces and associated areas (Urban a*
Bare areas
Water bodies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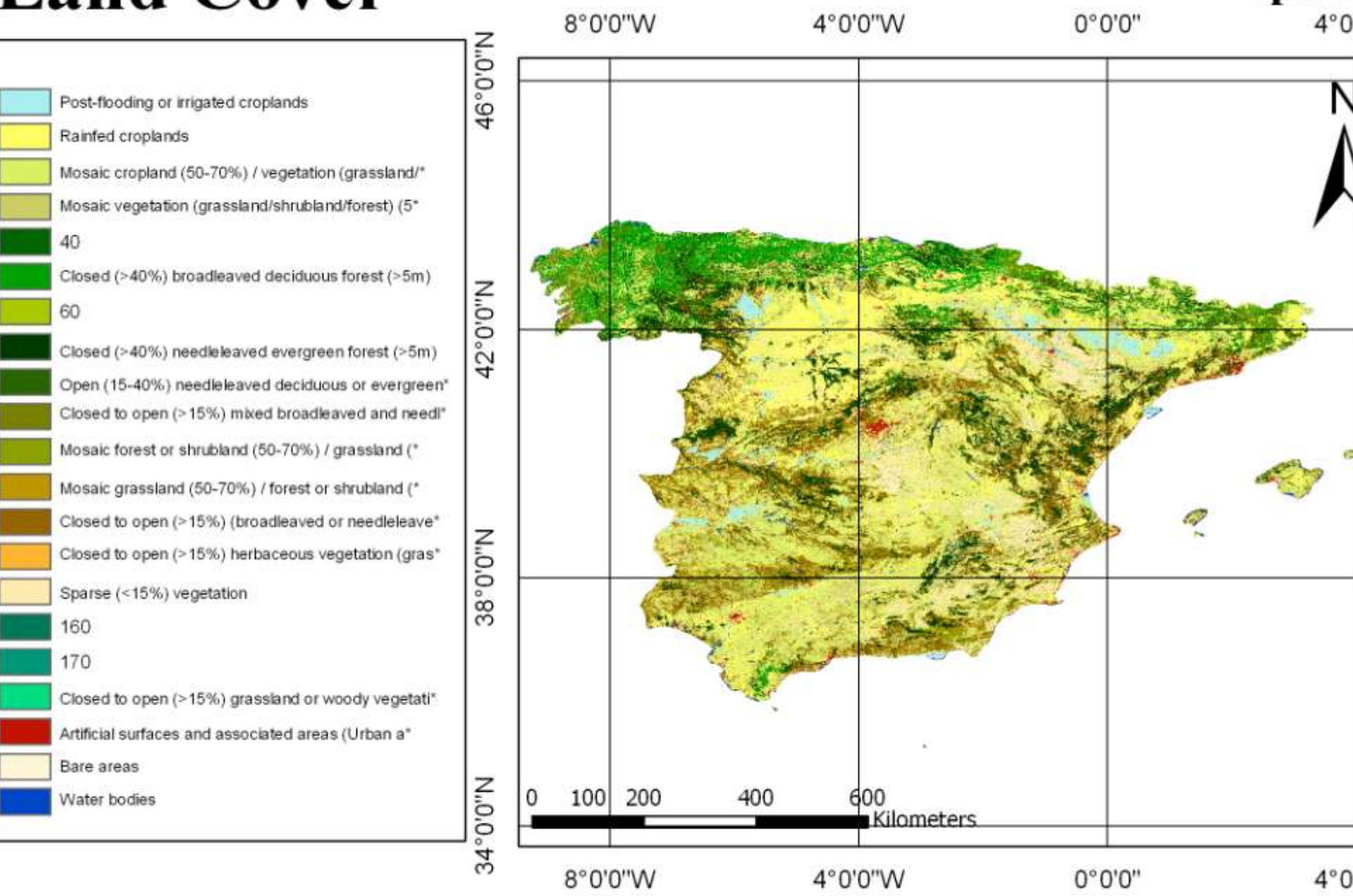
Closed to open (>15%) herbaceous vegetation (gras*
Sparse (<15%) vegetation
160
170
Closed to open (>15%) grassland or woody vegetati*
Artificial surfaces and associated areas (Urban a*
Bare areas
Water bodies
N

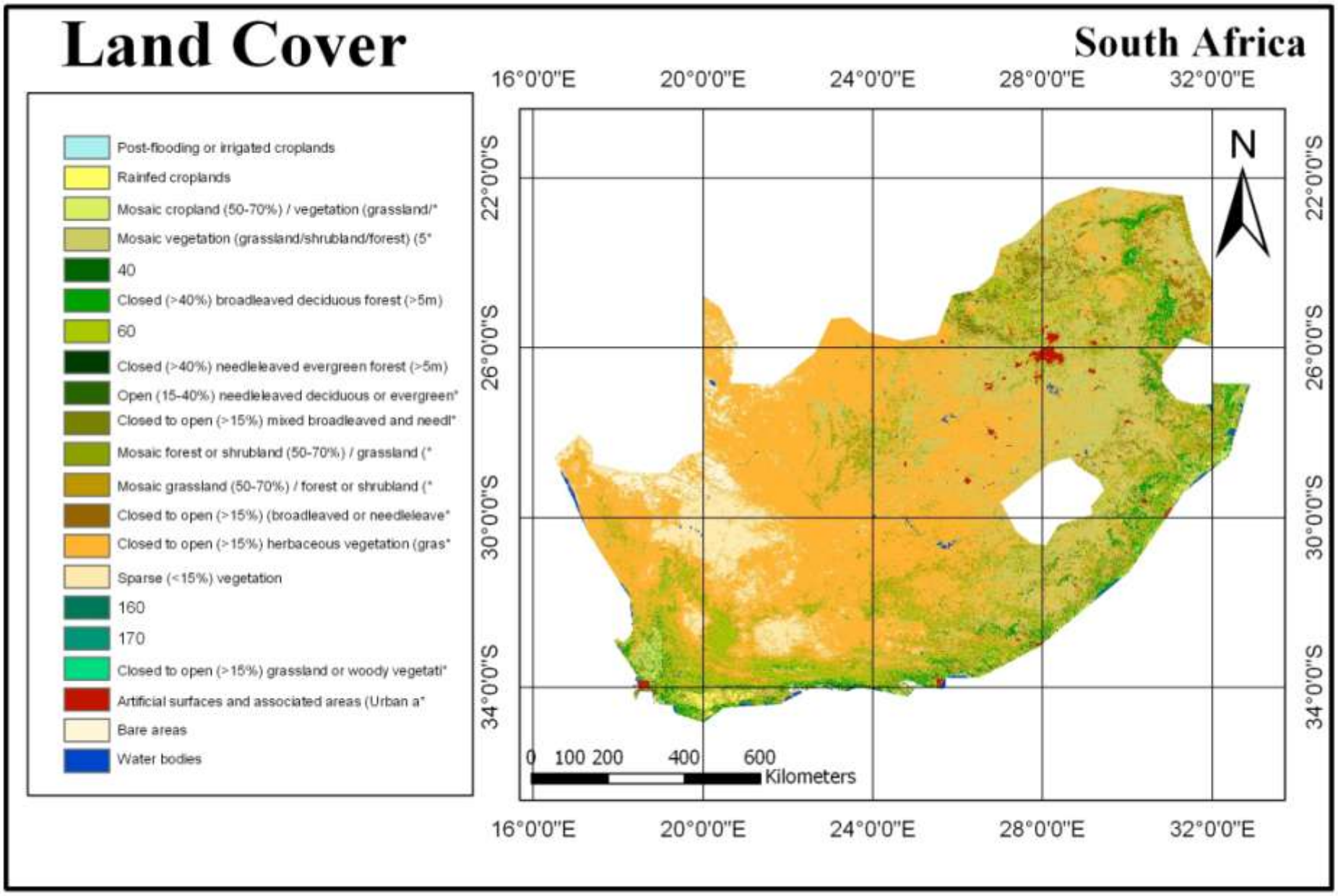
Land Cover

Spain

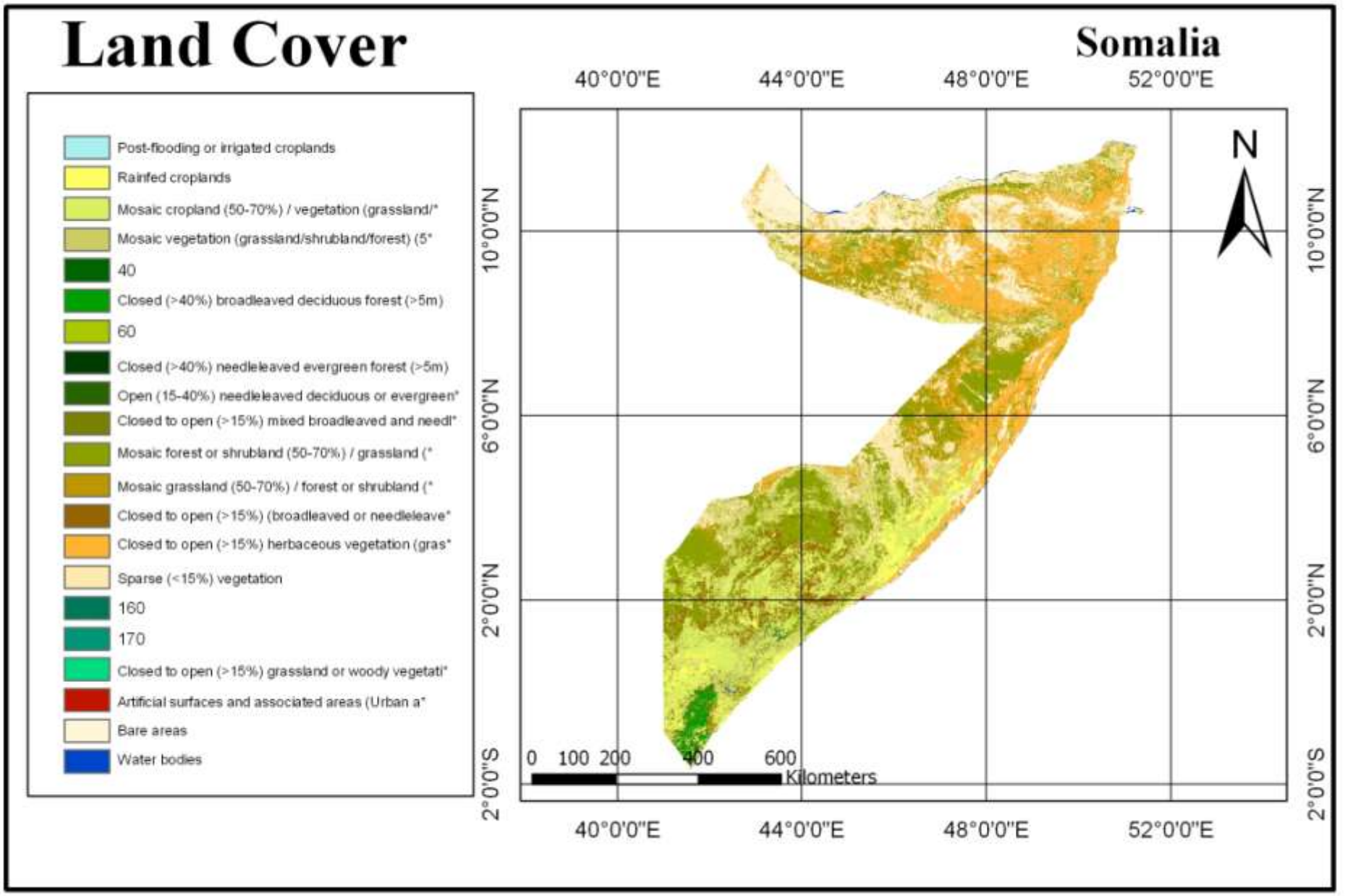


Land Cover

South Africa



Land Cover


Somalia
Post-flooding or irrigated croplands
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Mosaic cropland (50-70%) / vegetation (grassland/*
Mosaic vegetation (grassland/shrubland/forest) (5*
40
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60
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Closed to open (>15%) mixed broadleaved and needl*
Mosaic forest or shrubland (50-70%) / grassland (*
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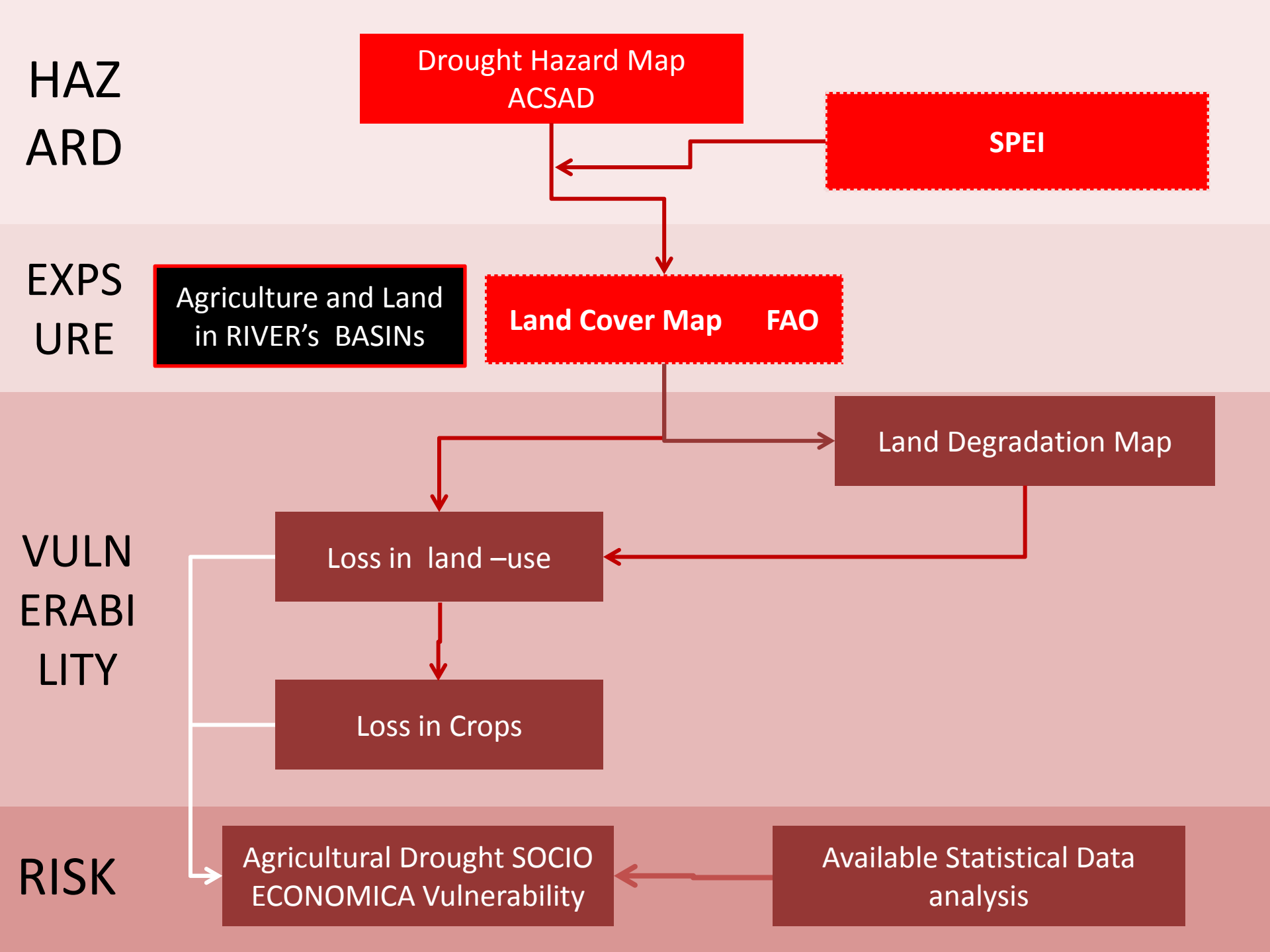
Closed to open (>15%) (broadleaved or needleleave*
Closed to open (>15%) herbaceous vegetation (gras*
Sparse (<15%) vegetation
160
170
Closed to open (>15%) grassland or woody vegetati*
Artificial surfaces and associated areas (Urban a*
Bare areas
Water bodies
40°0'0"E
44°0'0"E
48°0'0"E
52°0'0"E
10°0'0"N
6°0'0"N
2°0'0"N
2°0'0"S
N
0 100 200 400 600
Kilometers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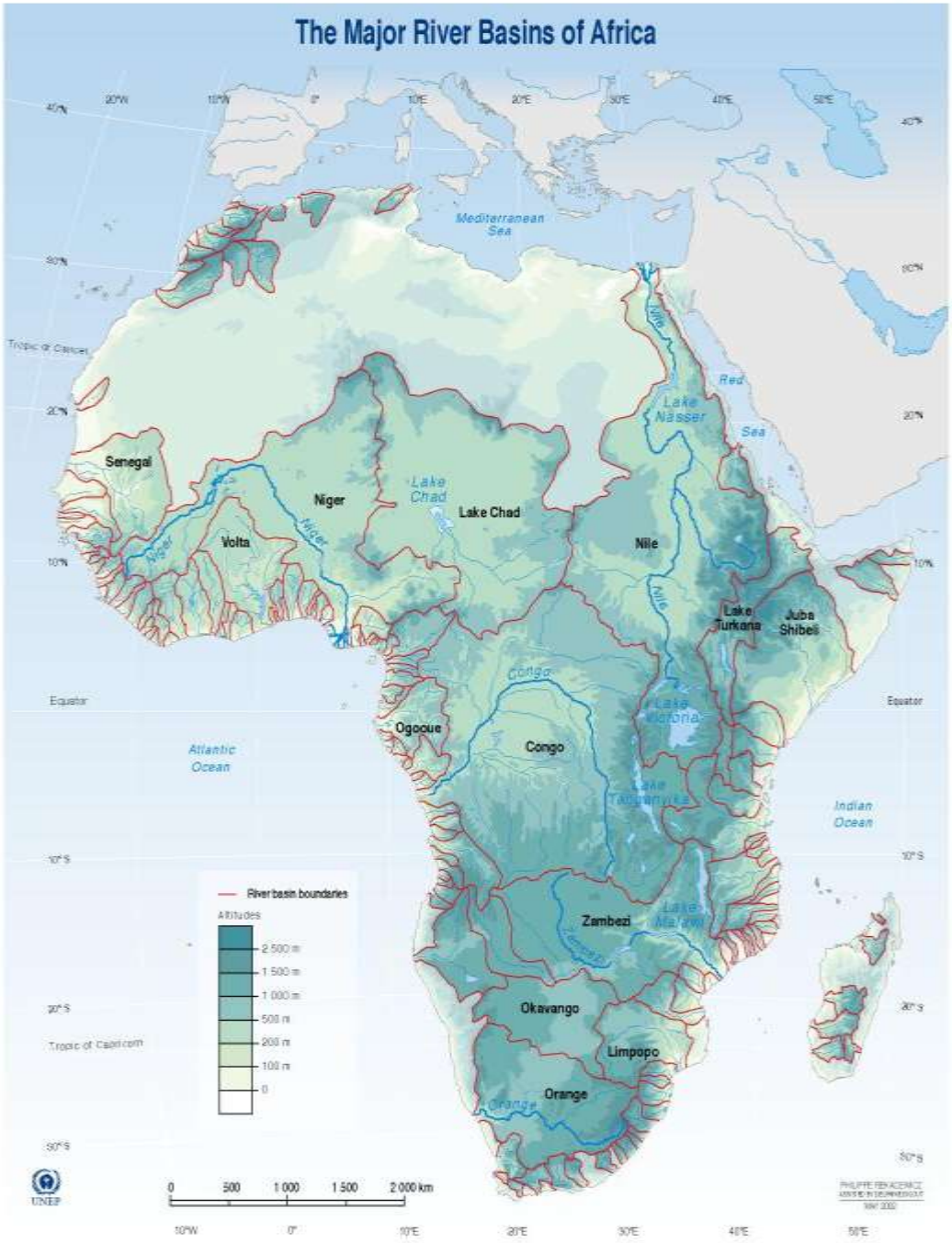
Loss in land –use
Loss in Crops
RISK
Agricultural Drought SOCIO
ECONOMICA Vulnerability
Available Statistical Data
analysis

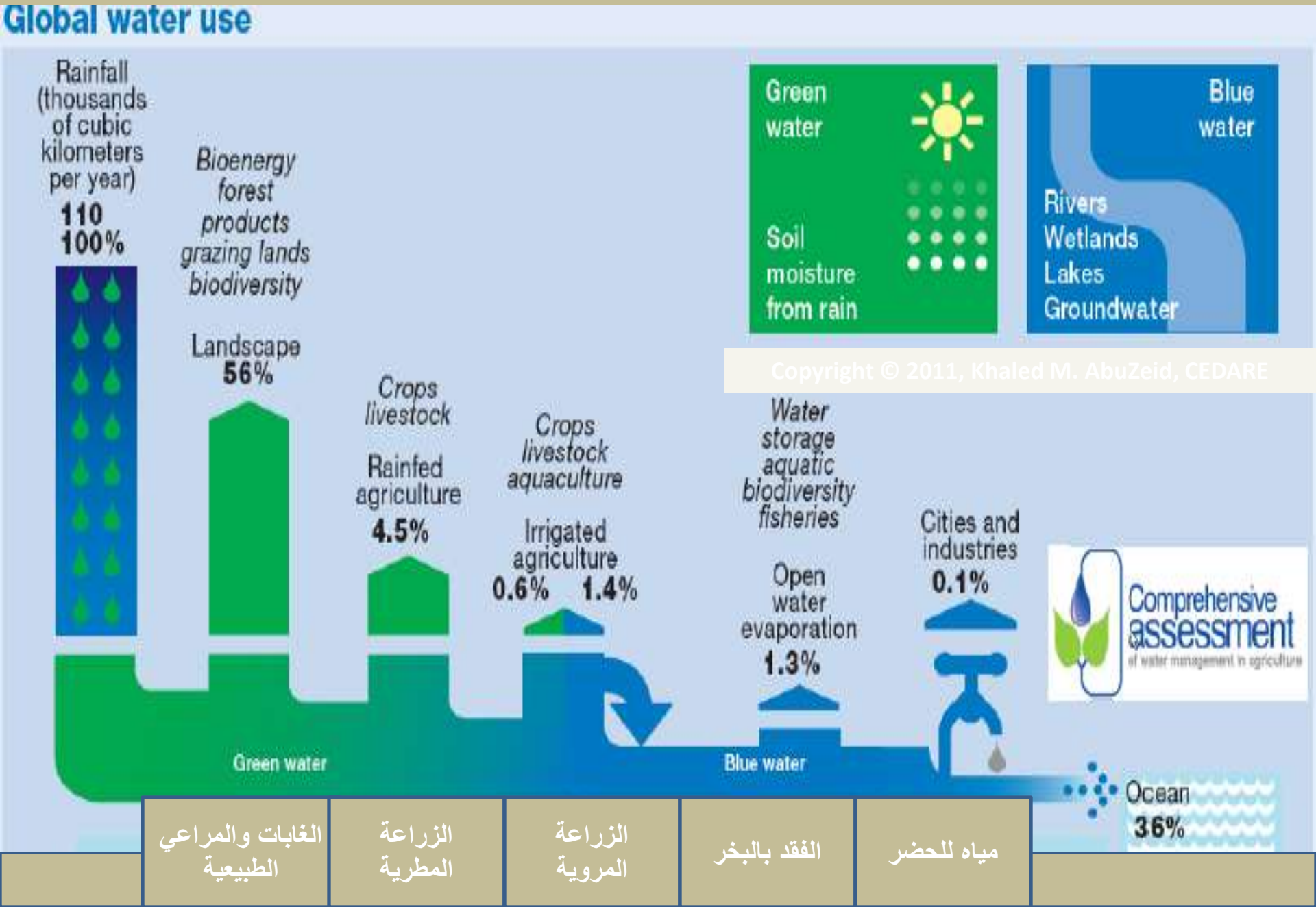
The sustainable management of the 263 trans-boundary rivers or lakes and many hundreds of aquifers, the basins of which contain more than half the territory and population of the world, presents major challenges and is of strategic importance in the immediate and long-term future.

There are 59 trans-boundary river basins in Africa alone, accounting for 80% of the continent's surface water resources. Management of these essential shared resources is crucial for poverty reduction strategies.



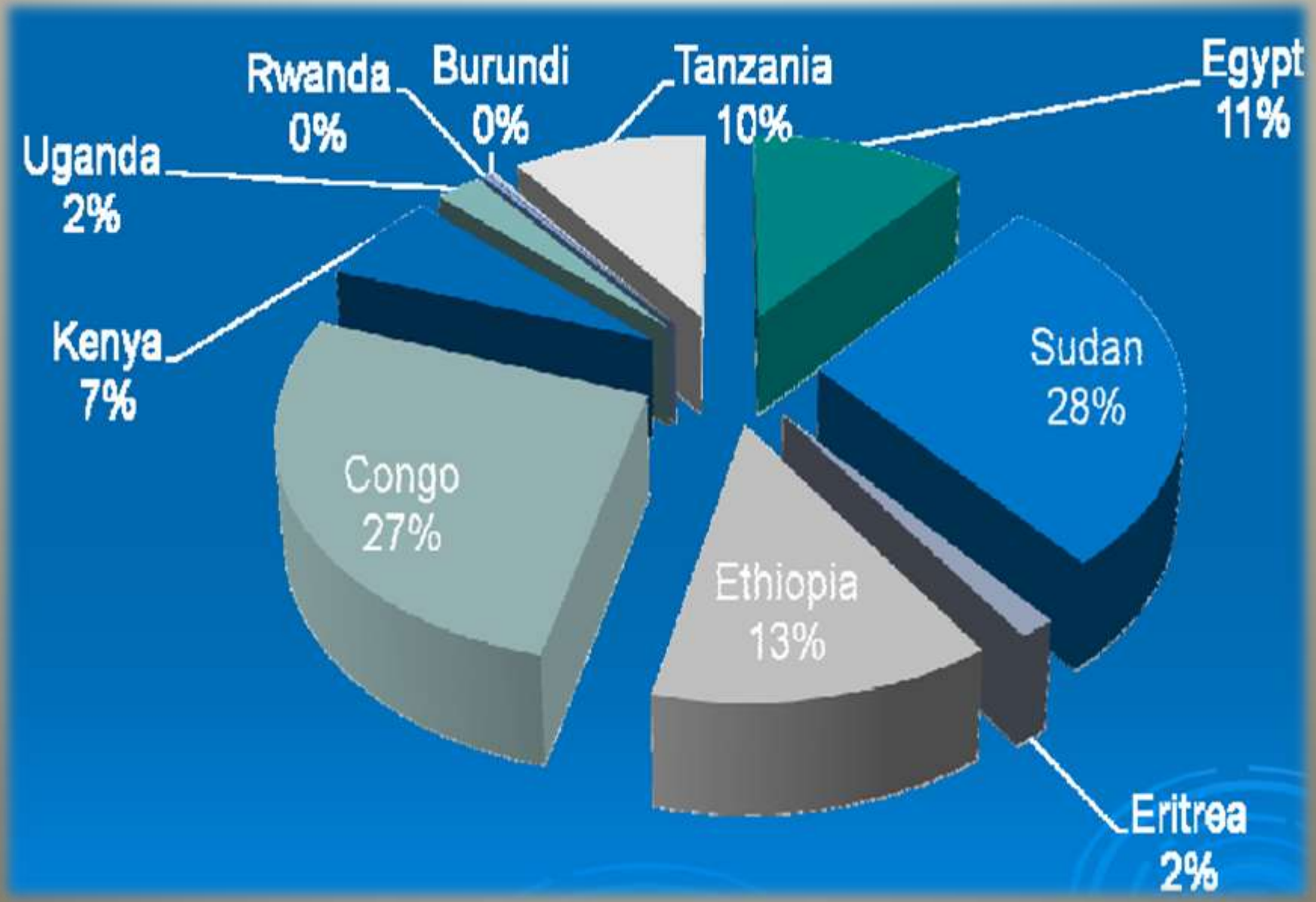
Source: Aaron T. Wolf et al., 1999; Revenga et al., *Watersheds of the World*, World Resources Institute (WRI), Washington DC, 1998; Philippe Rekacewicz, *Atlas de poche*, Livre de poche, Librairie générale française, Paris, 1996 (revised in 2001).

استخدام المياه الخضراء والزرقاء على مستوى العالم

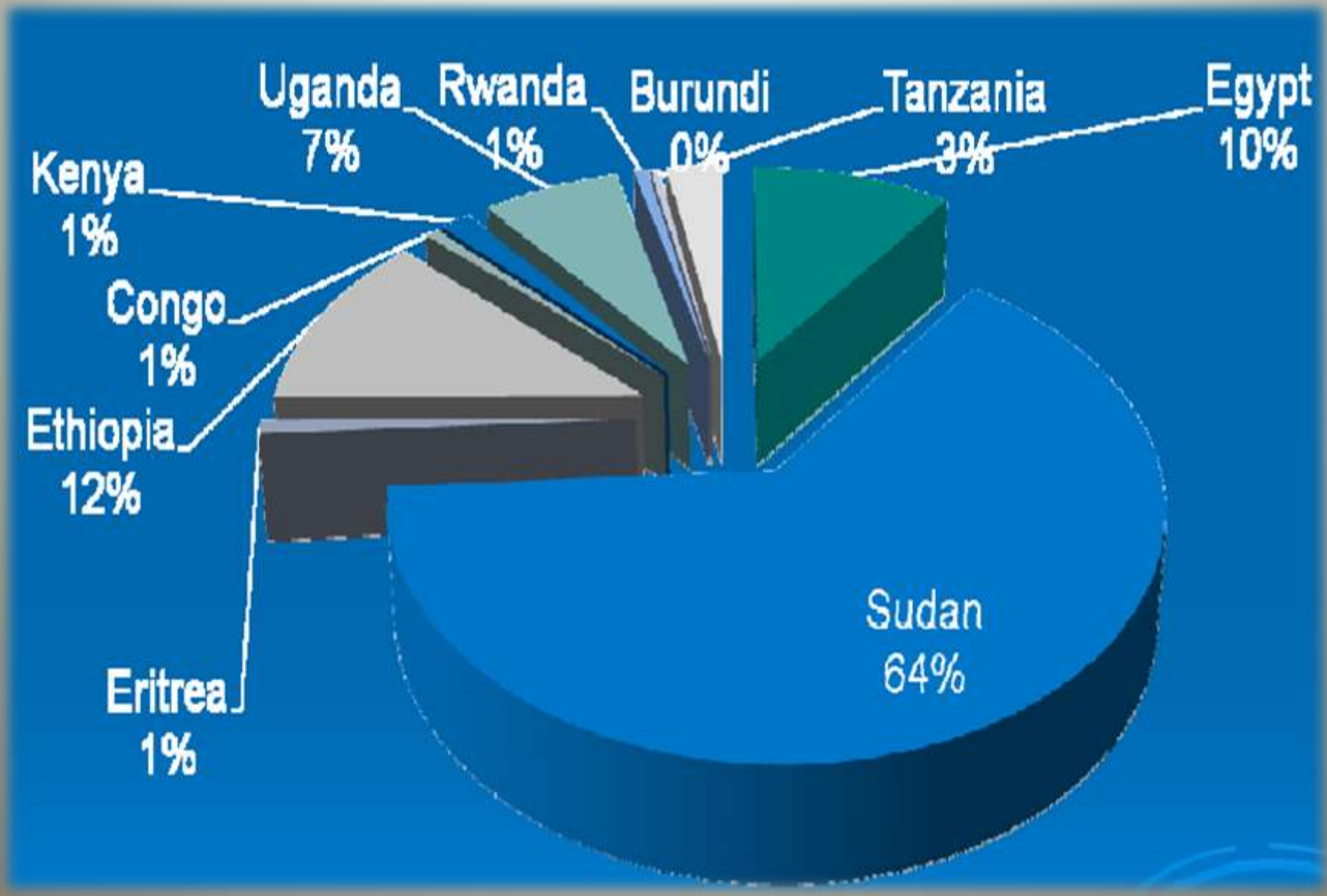


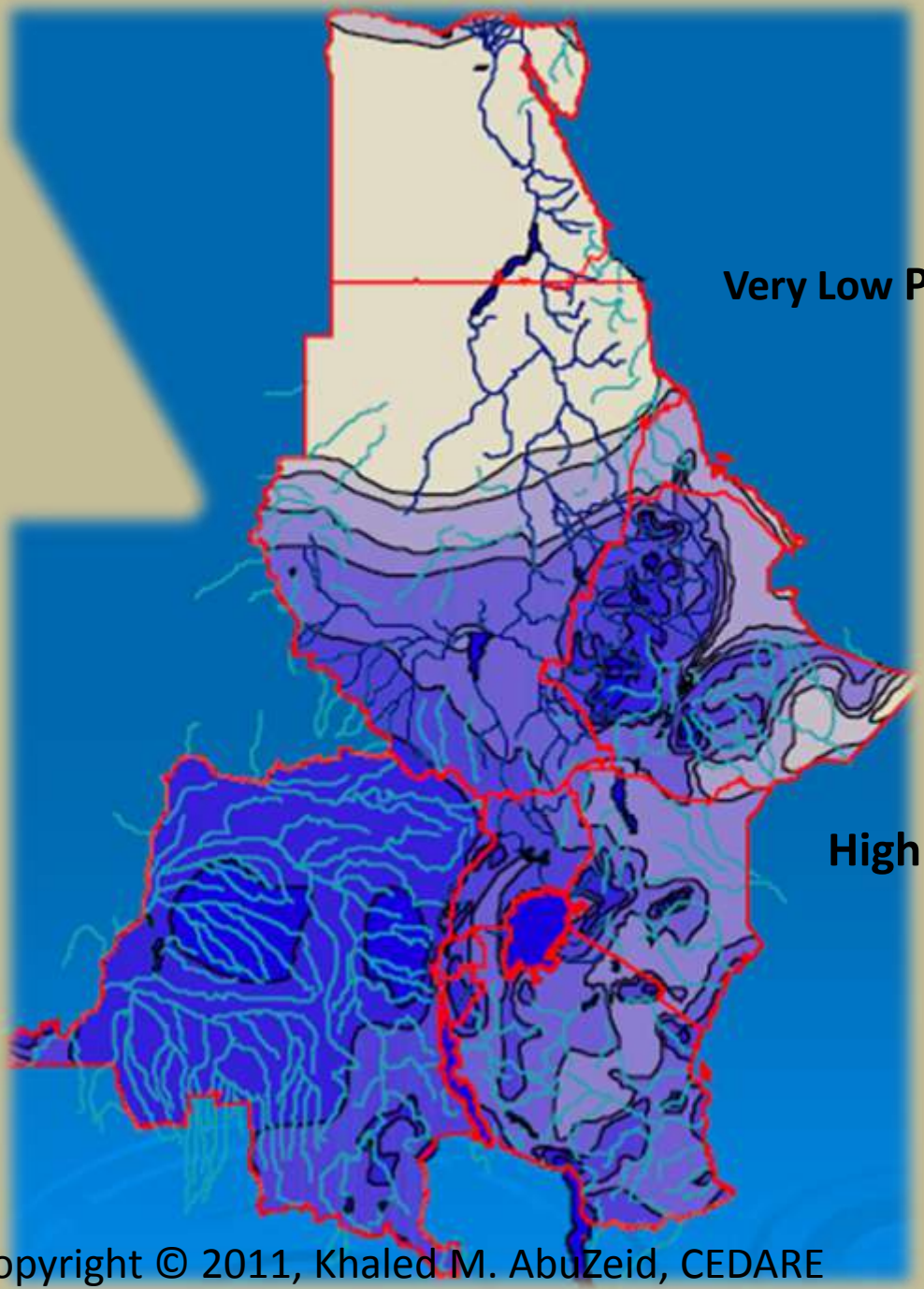
حوض نهر النيل
Nile River Basin

Nile Countries Area (8.9 million km2)



Nile Basin Area (3.0 Million km2)



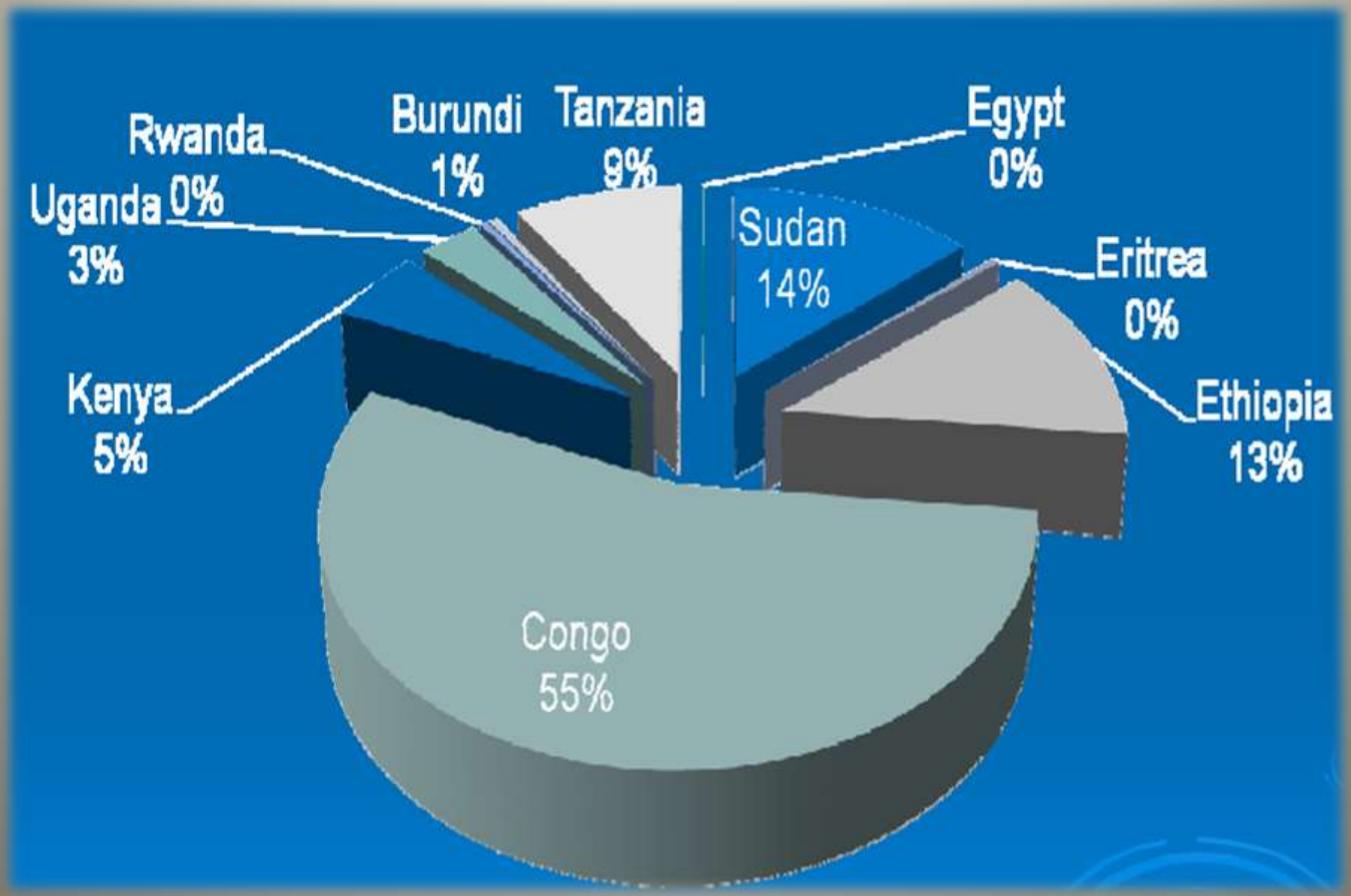


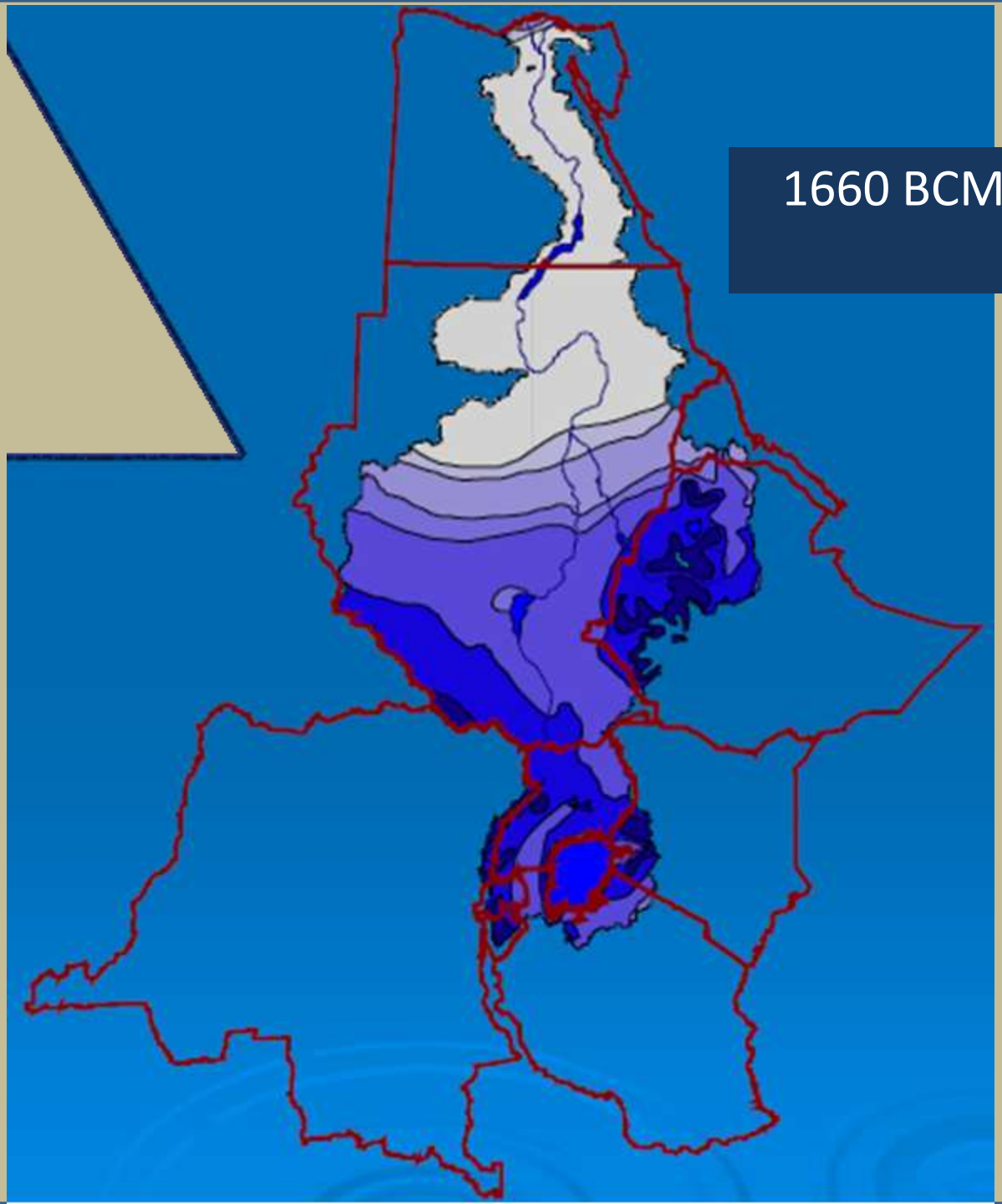
7000 BCM/year annual precipitation on the Nile Basin Countries.

1660 BCM/year annual precipitation on the Nile Basin.

Egypt and Sudan's Use from the Nile is 85.5 BCM/year.

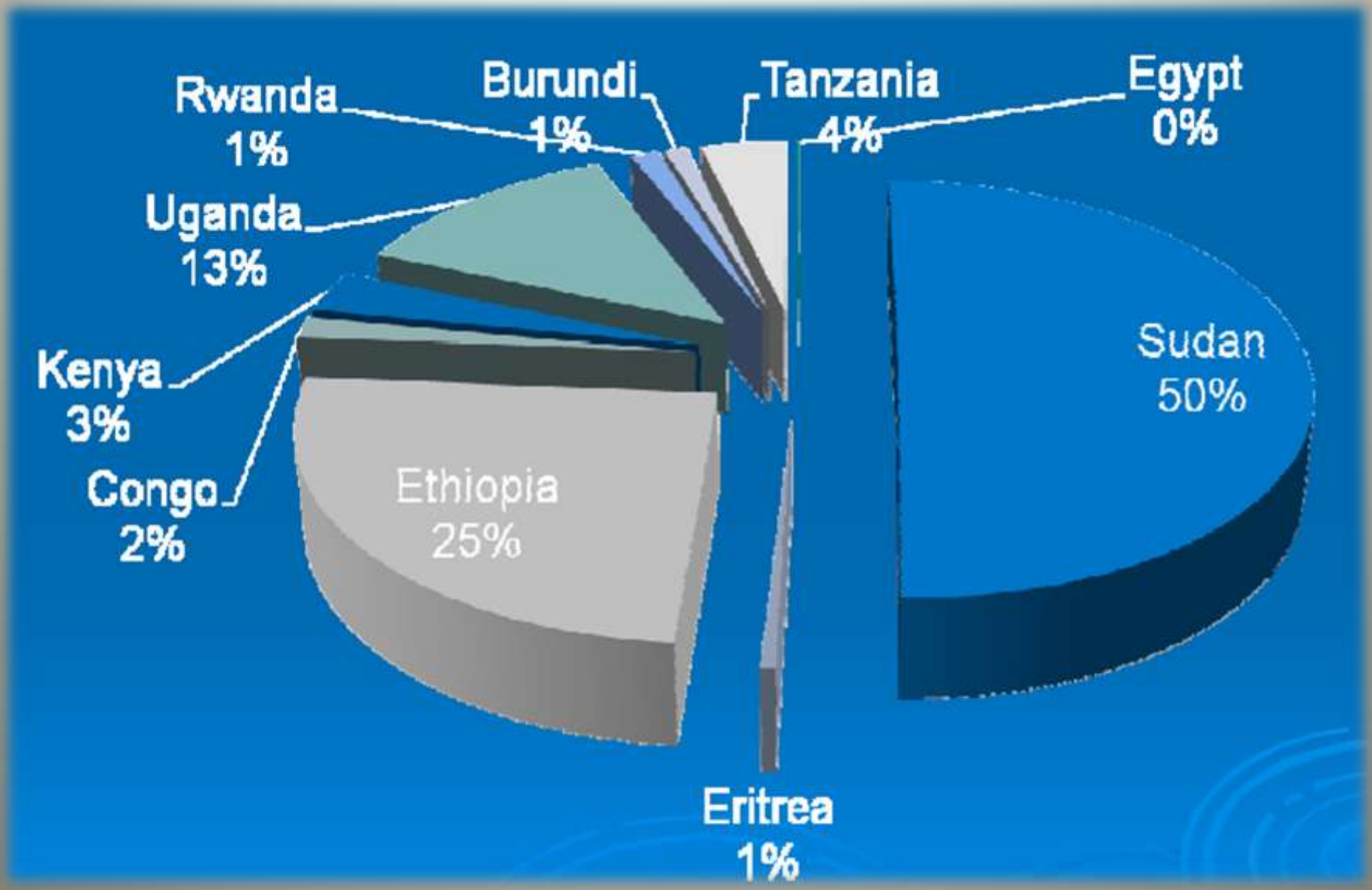
7000 BCM/Y Nile Countries Rainfall (Green Water)



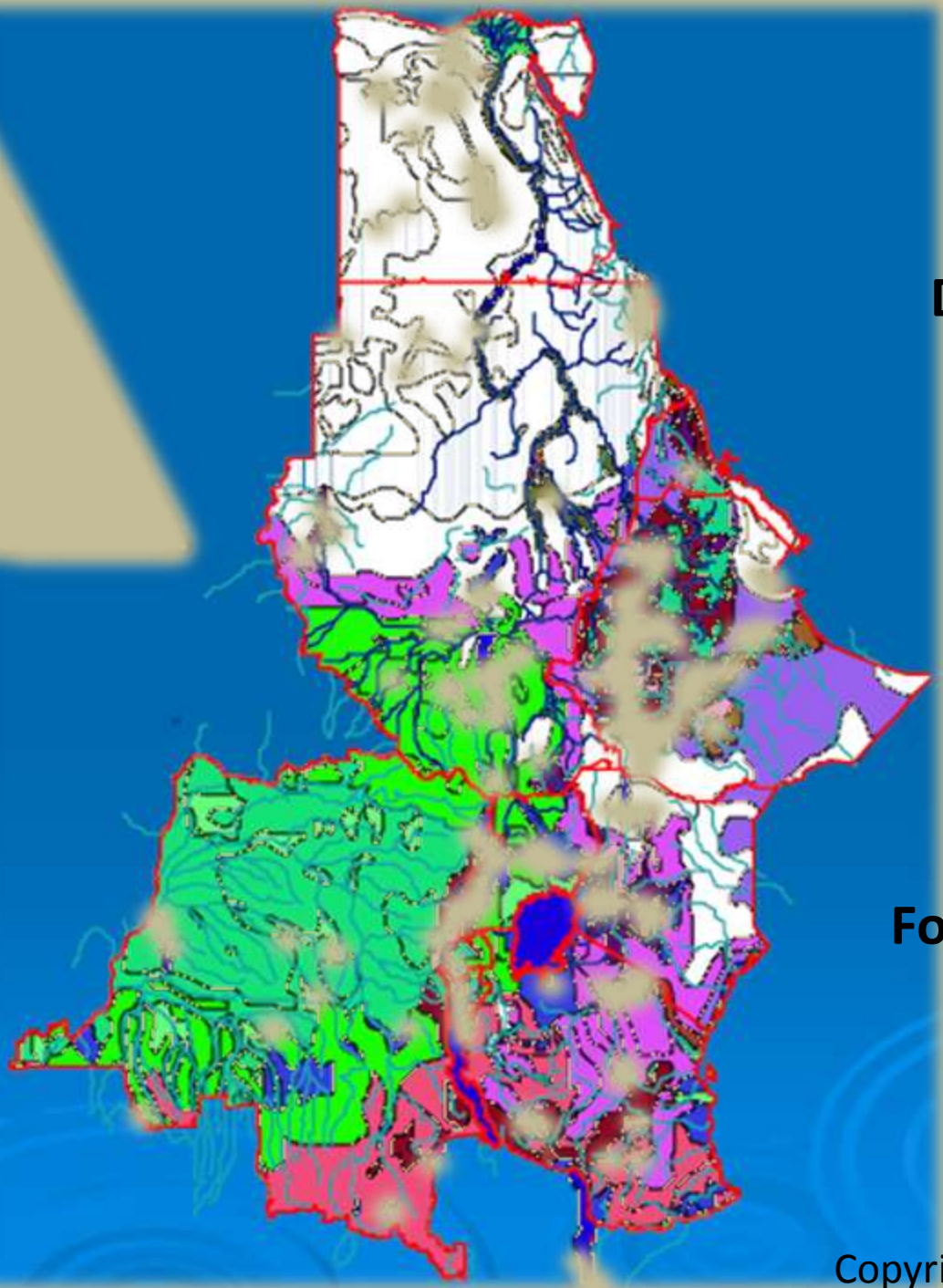


1660 BCM/Y Rainfall on Nile Basin (Blue Water)

1660 BCM/Y Nile Basin Rainfall (Green Water)



Land Use & Rivers

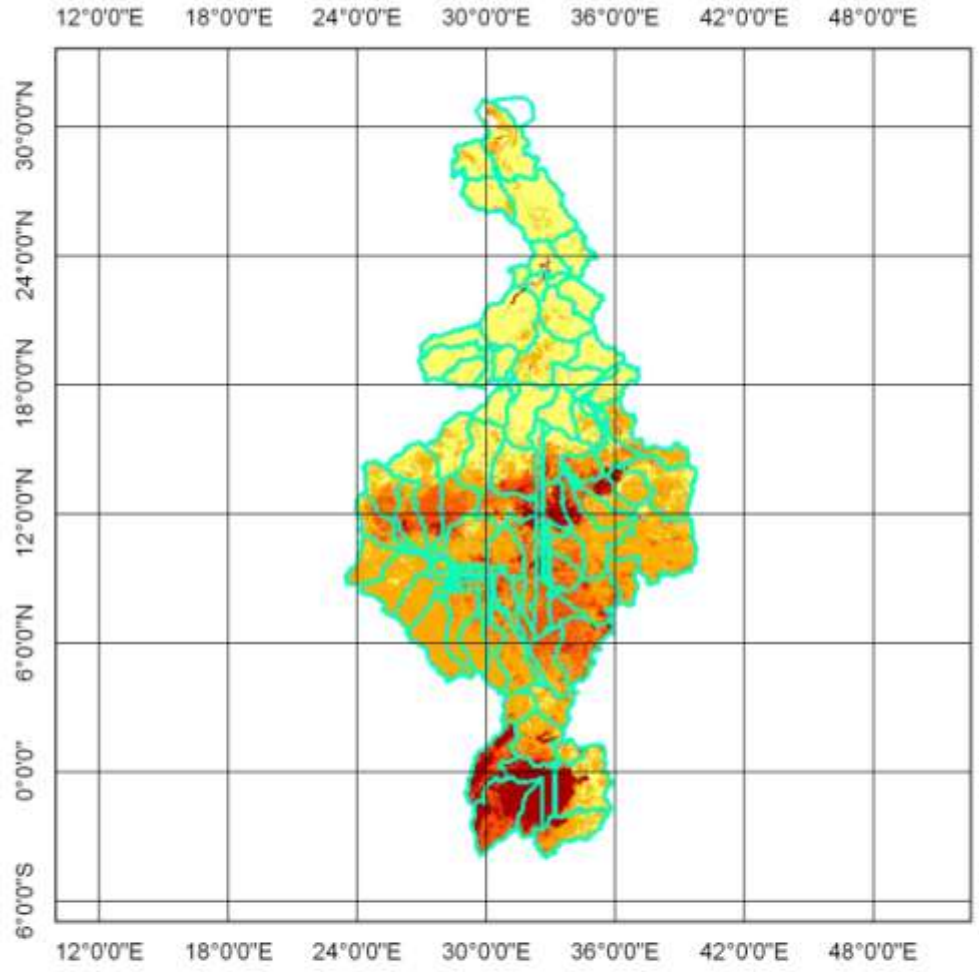


Desert & Semi Desert

Forests & other Vegetation

Agriculture Drought Intensity

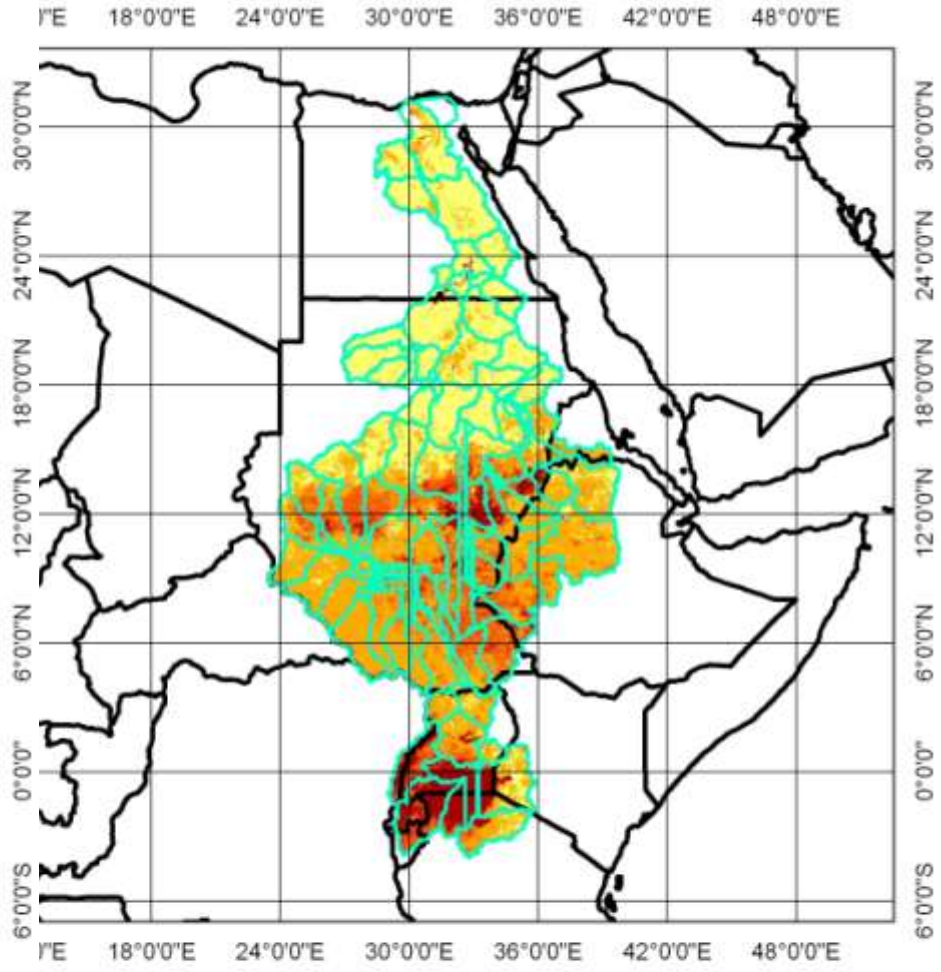
Nile basin



0 No Intensity
1 Low Intensity
2 Mod. Intensity
3 High Intensity

Agriculture Drought Intensity

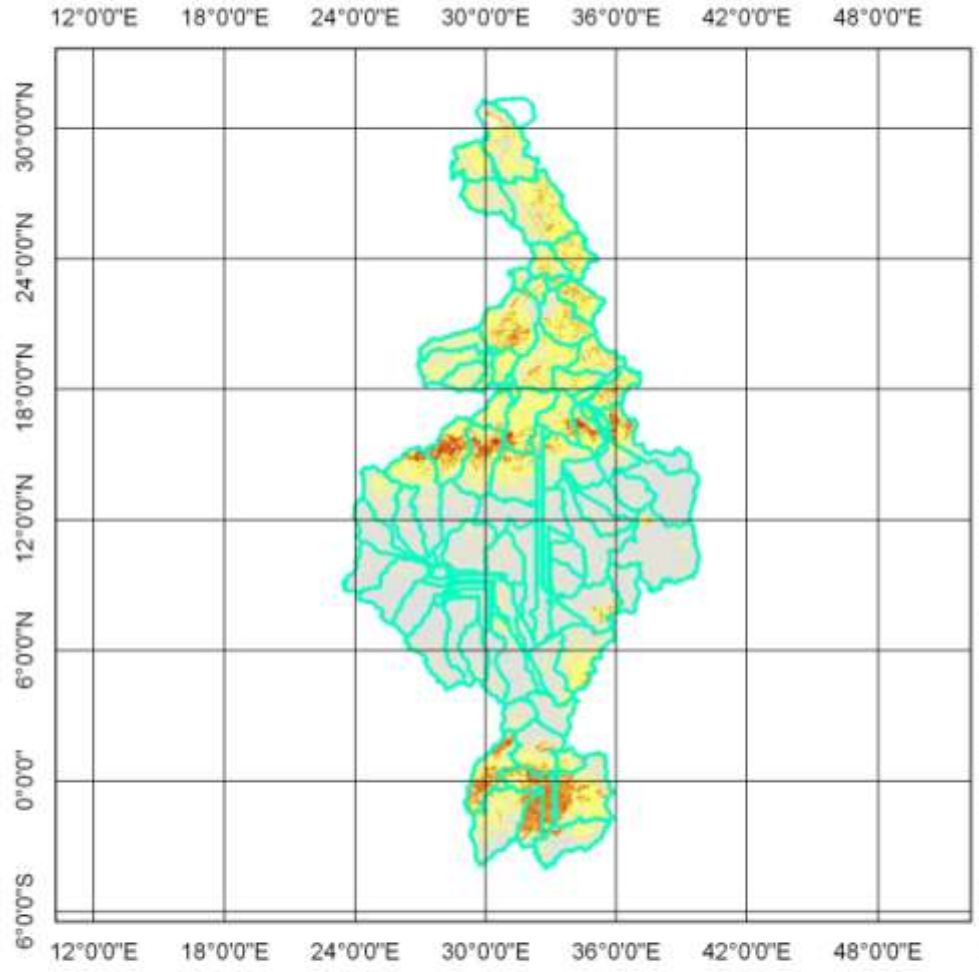
le basin



0 No Intensity
1 Low Intensity
2 Mod. Intensity
3 High Intensity

Agriculture Drought Variability

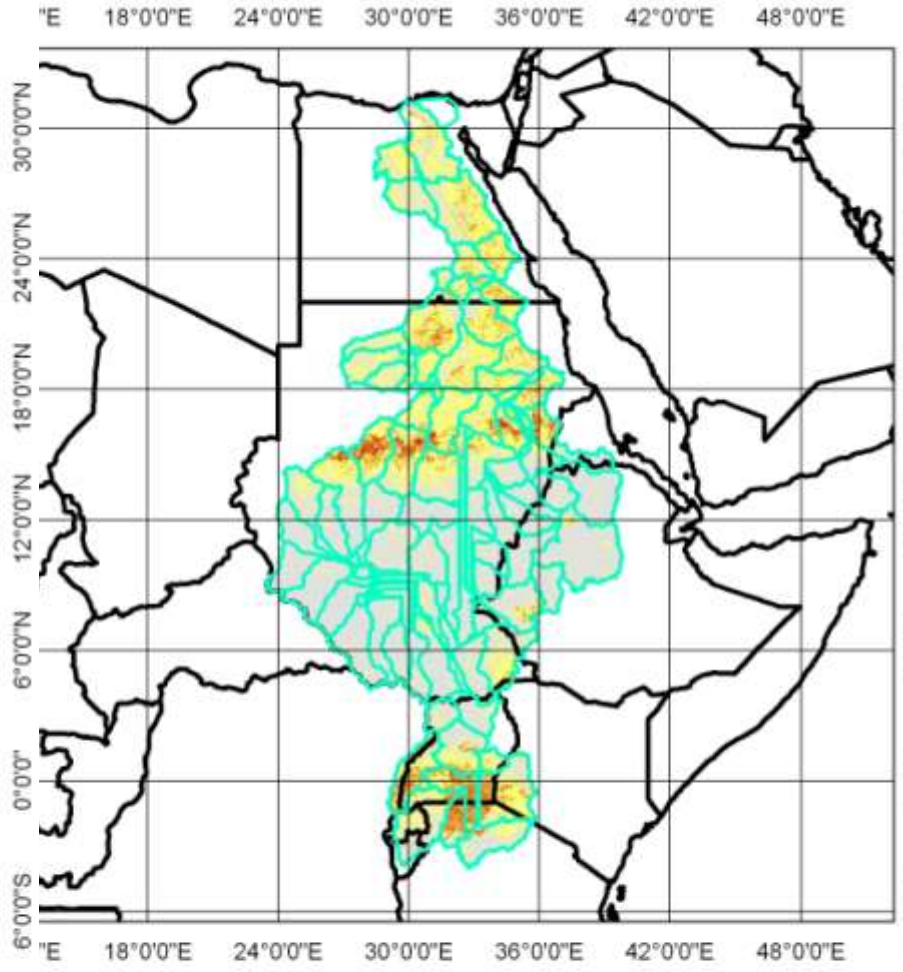
Nile basin



0 No Varaible
1 Low Variable
2 Mod. Variable
3 High Variable

Agriculture Drought Variability

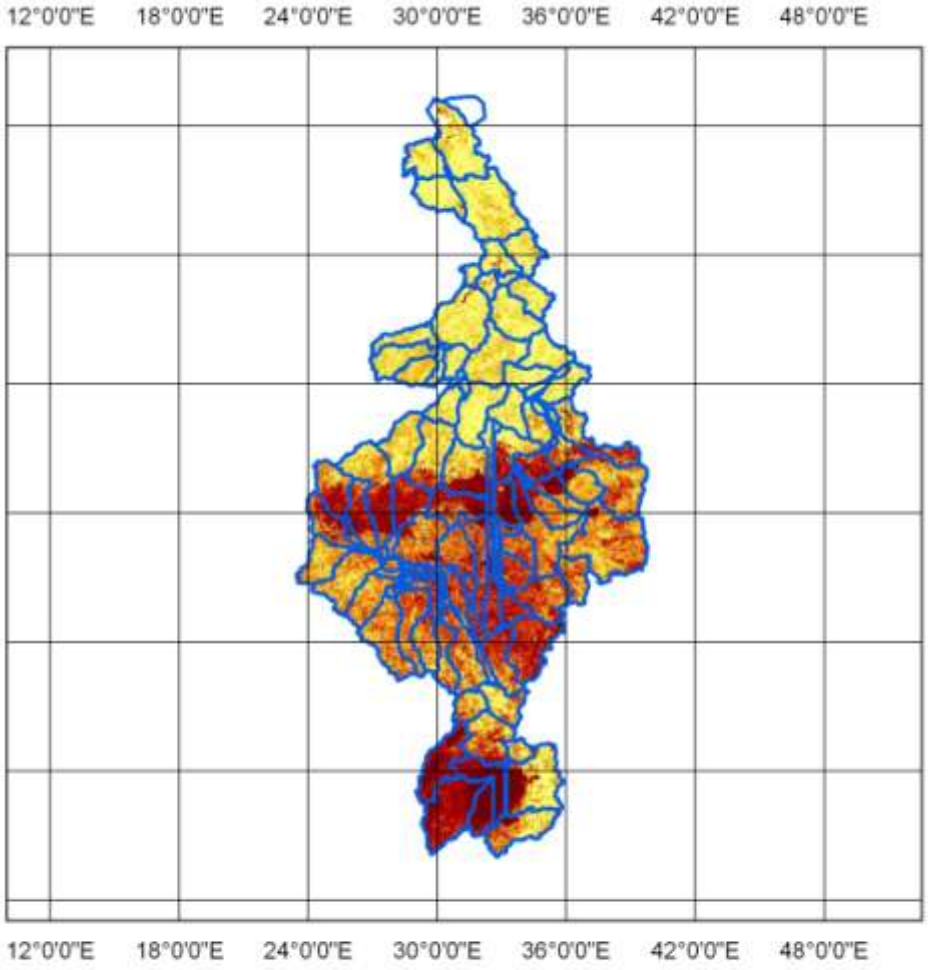
le basin



0 No Varaible
1 Low Variable
2 Mod. Variable
3 High Variable

Agriculture Drought Frequency

Nile basin



< 3
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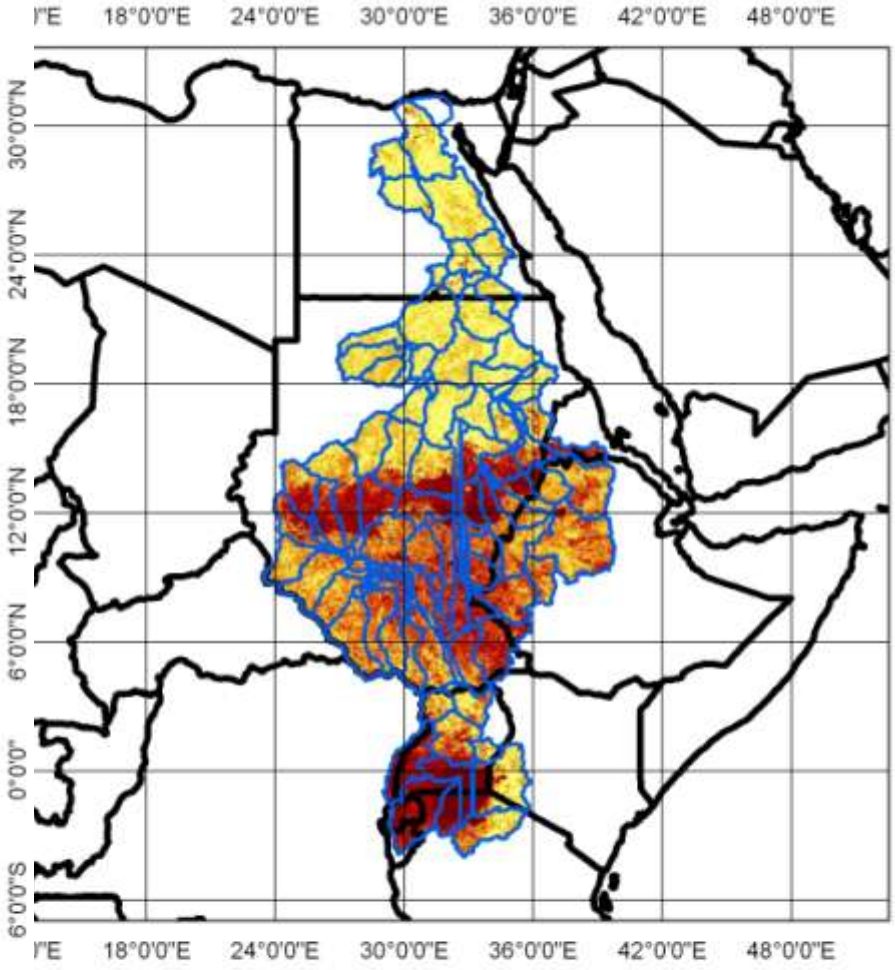
Agriculture Drought Frequency

le basin



< 3
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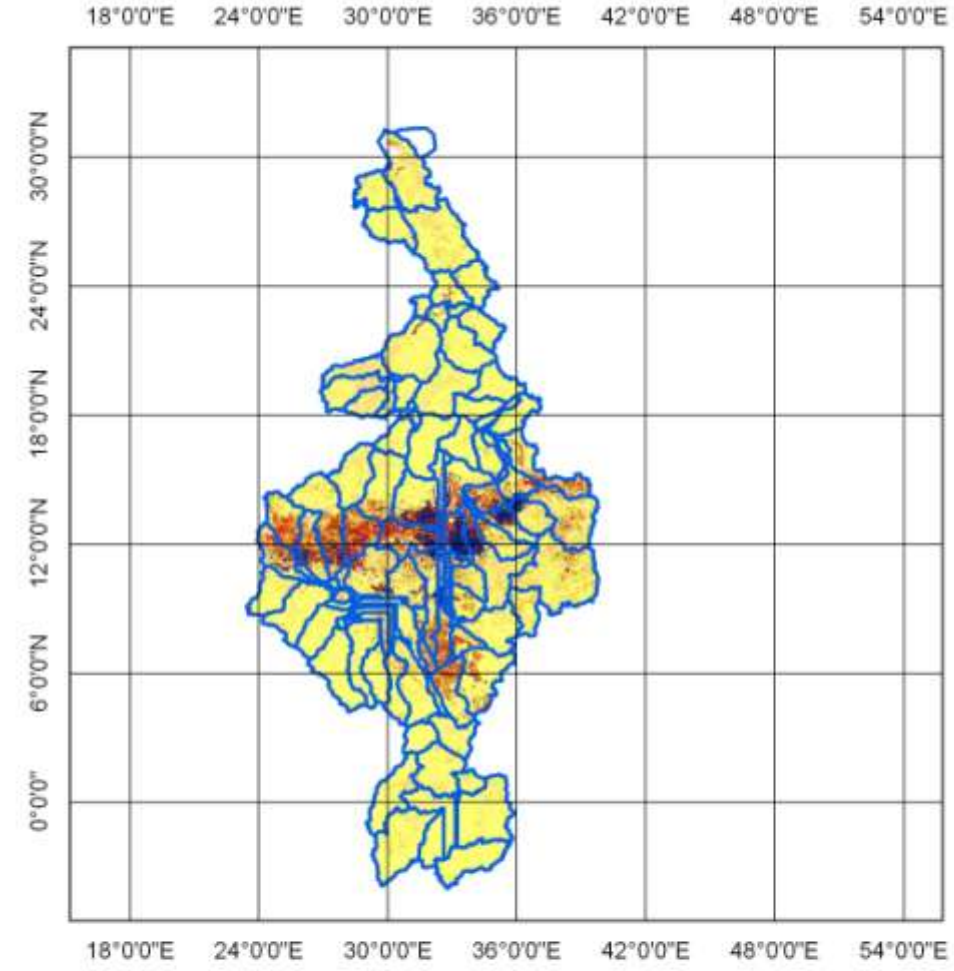
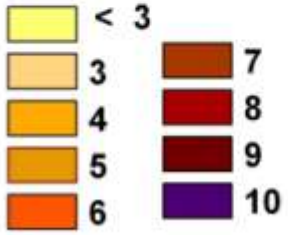
Agriculture Drought Consecutive

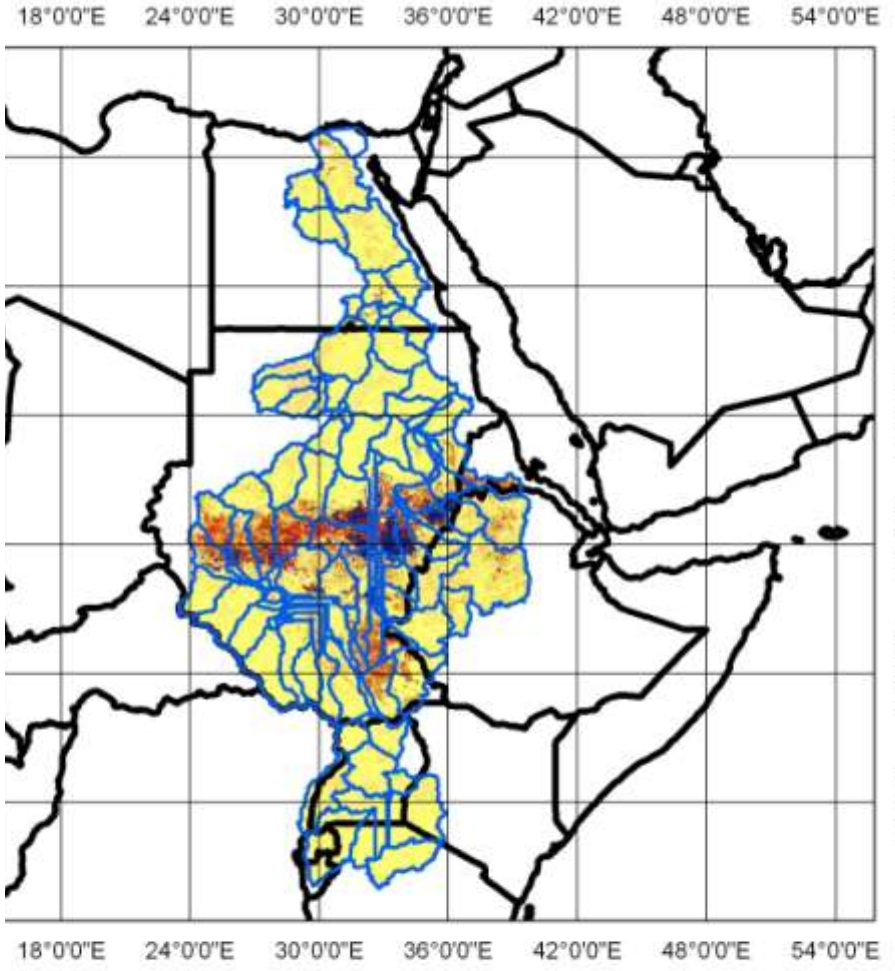
Nile basin

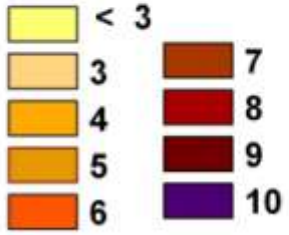




Agriculture Drought Consecutive

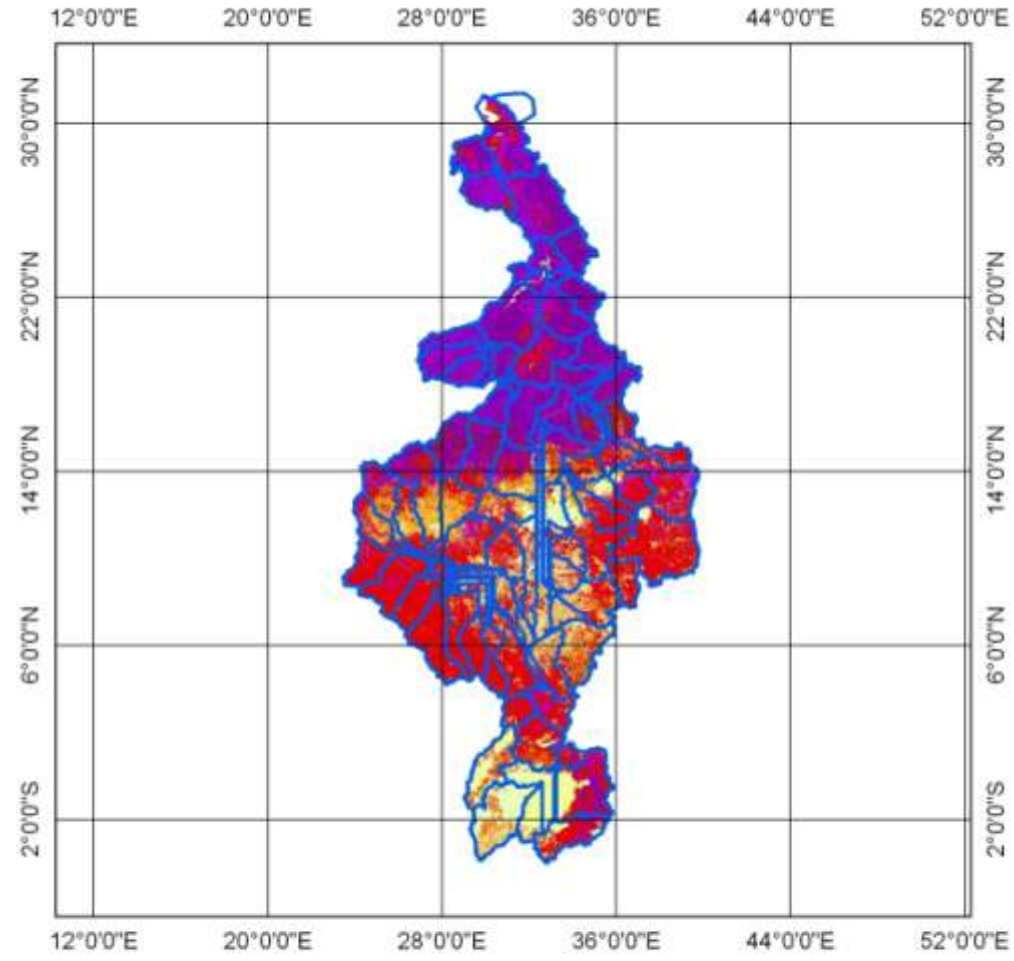
Nile basin





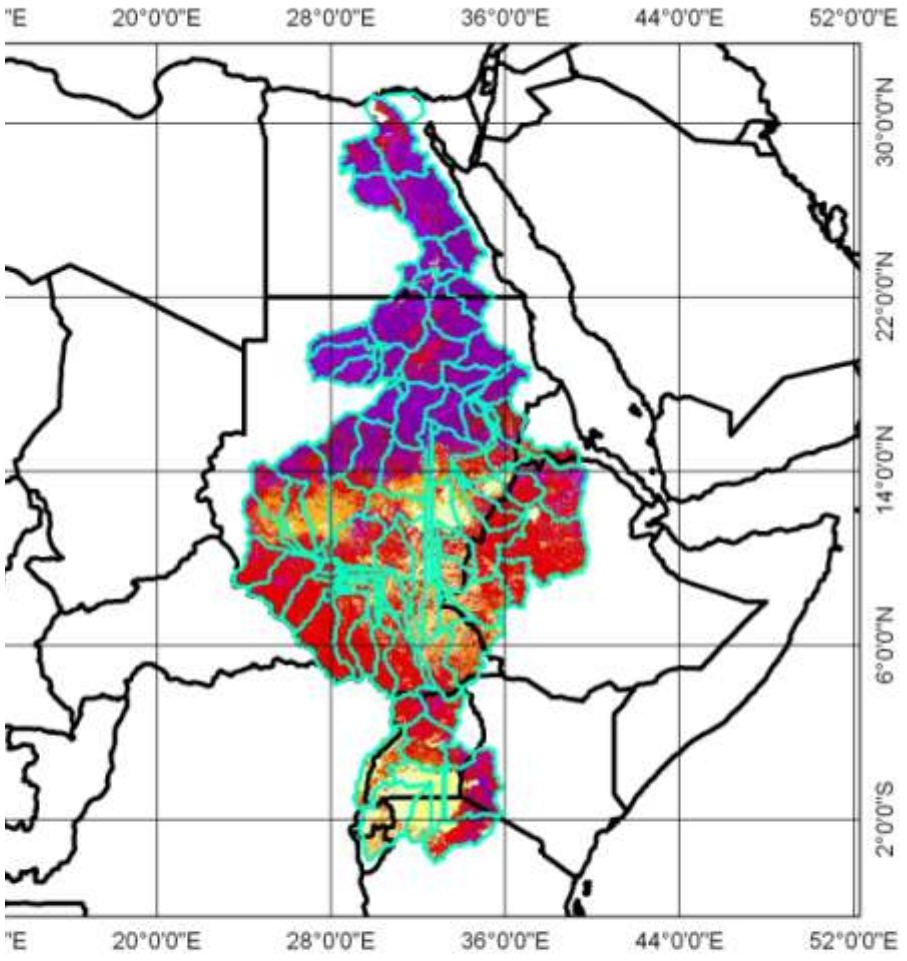
Agriculture Drought Hazard

Nile basin



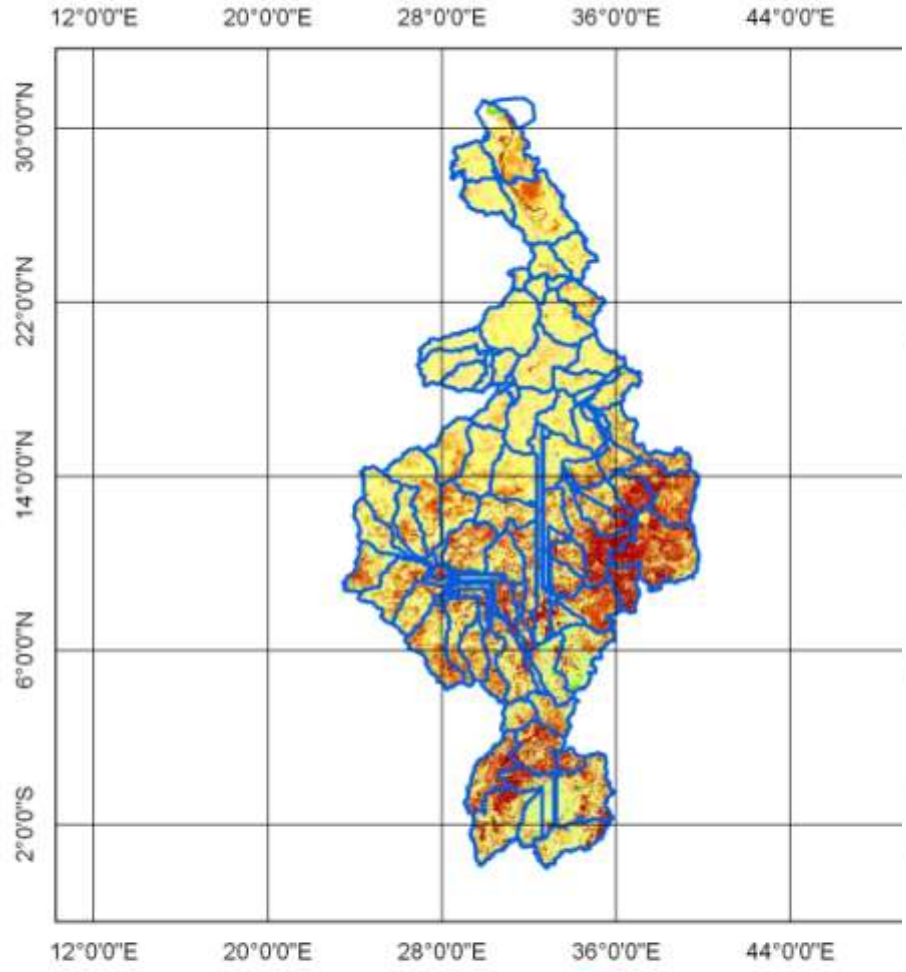
Agriculture Drought Hazard

le basin



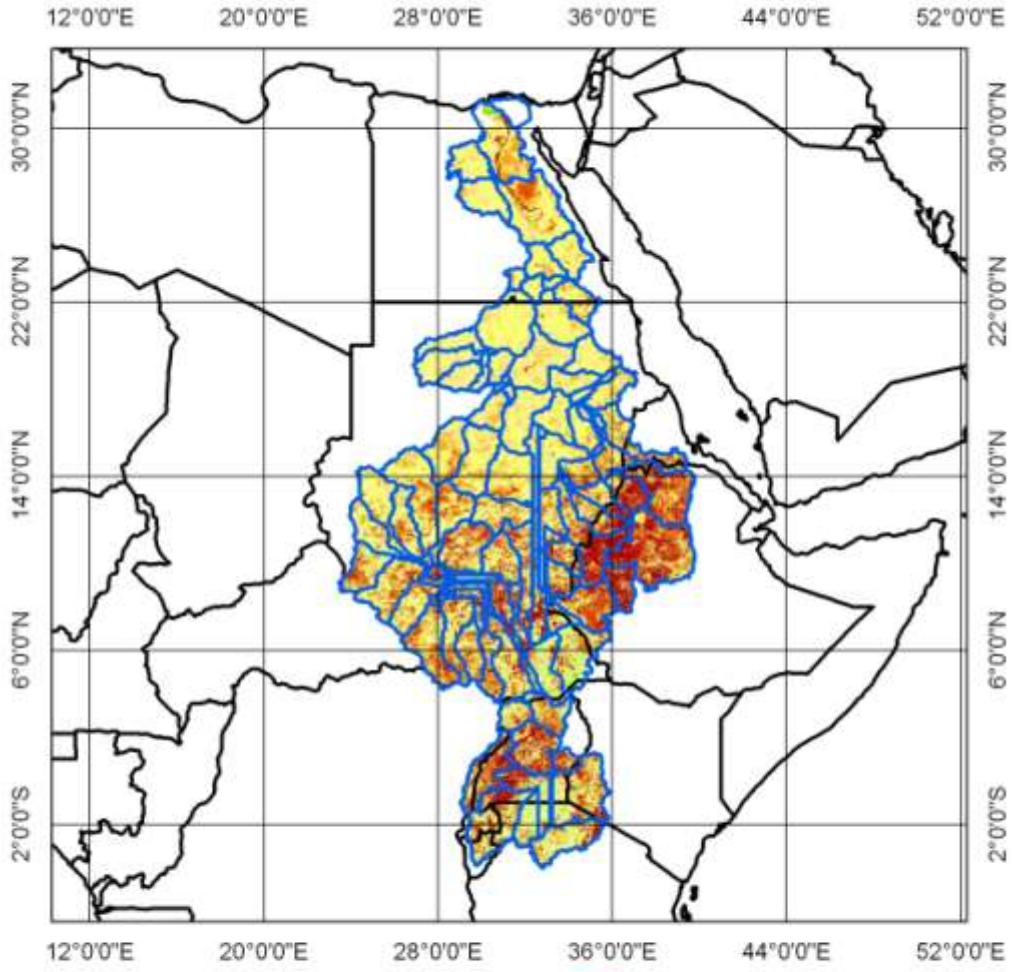
Vegetation Changes 2000 - 2011

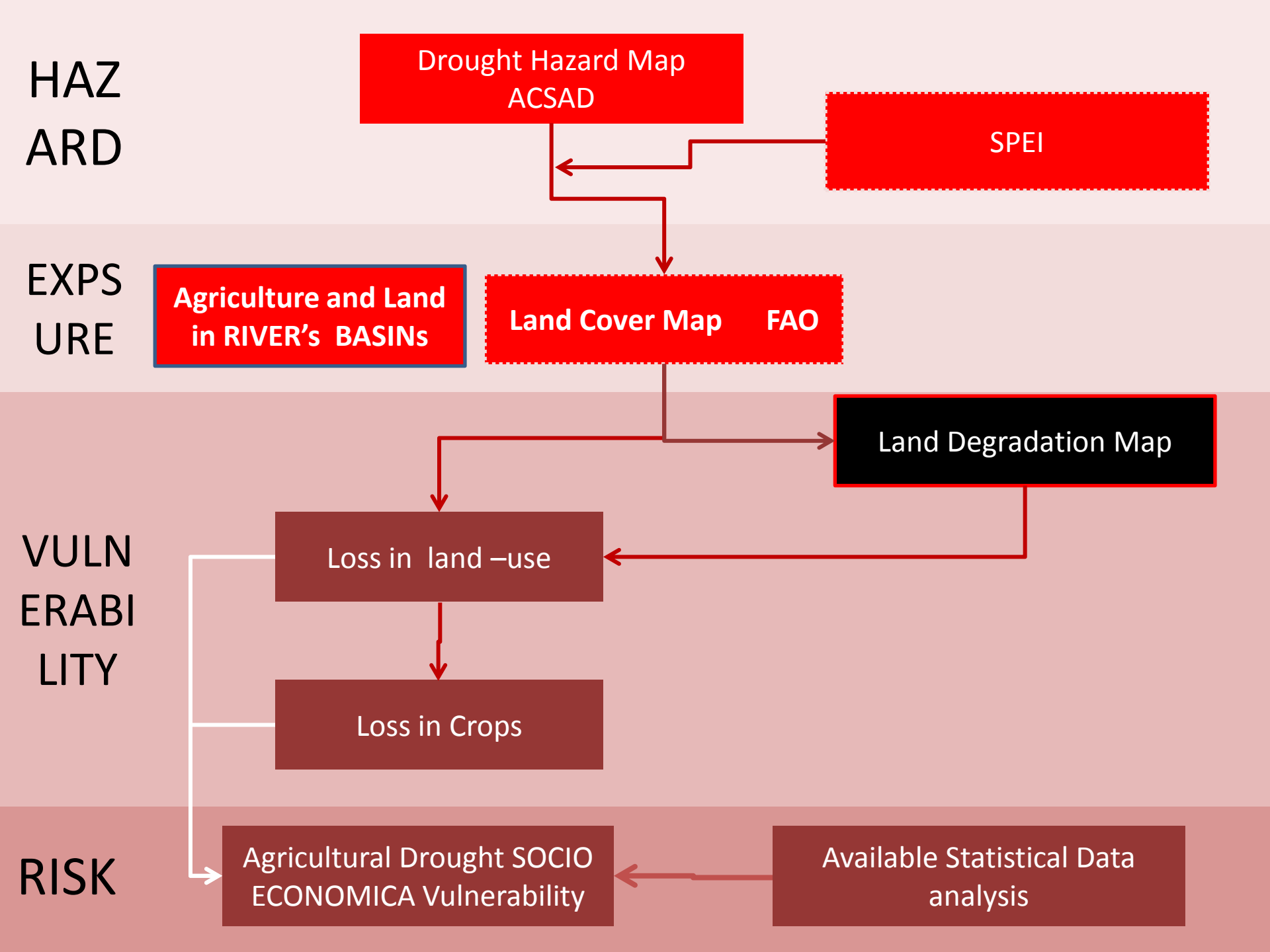
Nile basin



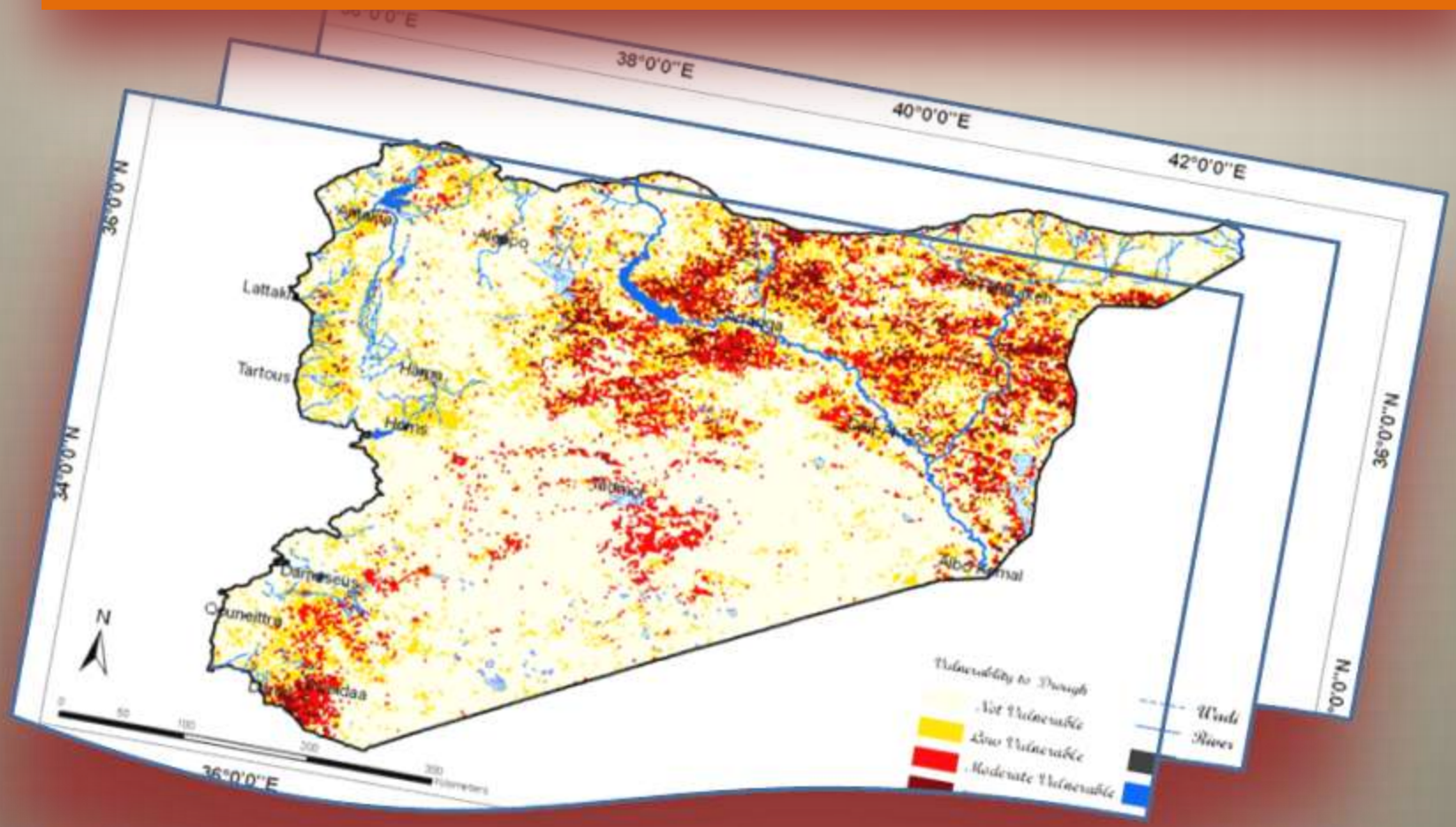
Vegetation Changes 2000 - 2011

Nile basin




HAZ
ARD
Drought Hazard Map
ACSAD
SPEI
EXPS
URE
Agriculture and Land in RIVER's BASINs
Land Cover Map FAO
Land Degradation Map
VULN
ERABI
LITY
Loss in land –use
Loss in Crops
RISK
Agricultural Drought SOCIO ECONOMICA Vulnerability
Available Statistical Data analysis

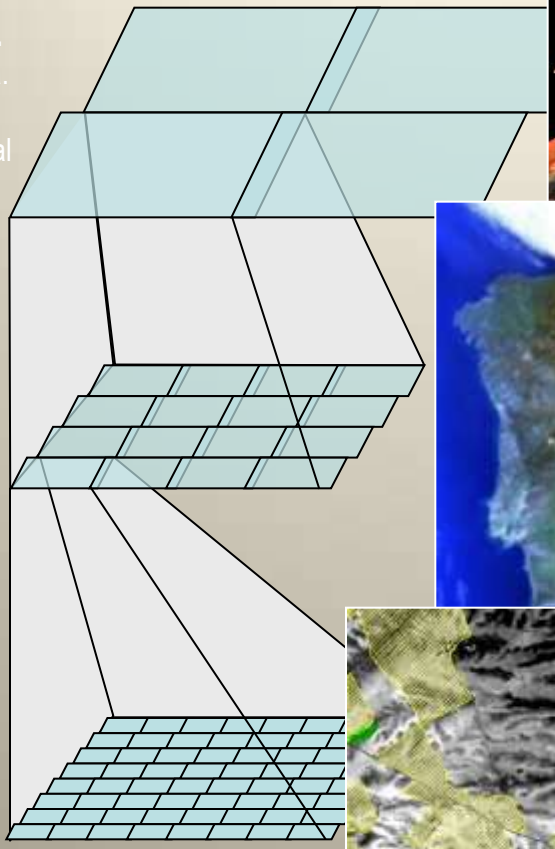
خرائط تدهور الأراضي في سورية



Continental to regional level.
AVHRR Pathfinder (8 km) data.
Large scale climatological, meteorological and bio-physical factors

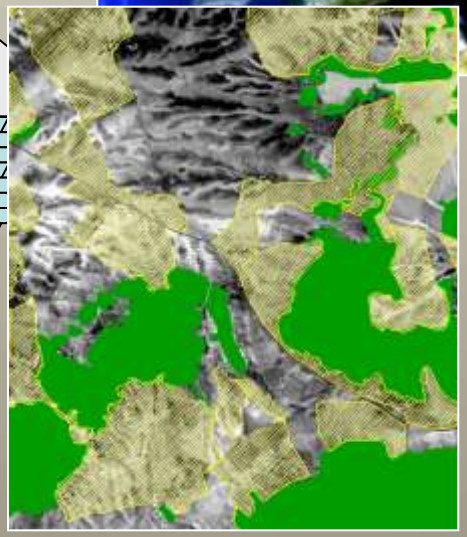
Regional to national level.
AVHRR (1 km), MODIS, MERIS data.
National policies, soil types, vegetation types, large scale management practices.

Local Level
Various high resolution data (Landsat, ASTER, HyMap).
Management practices, field history

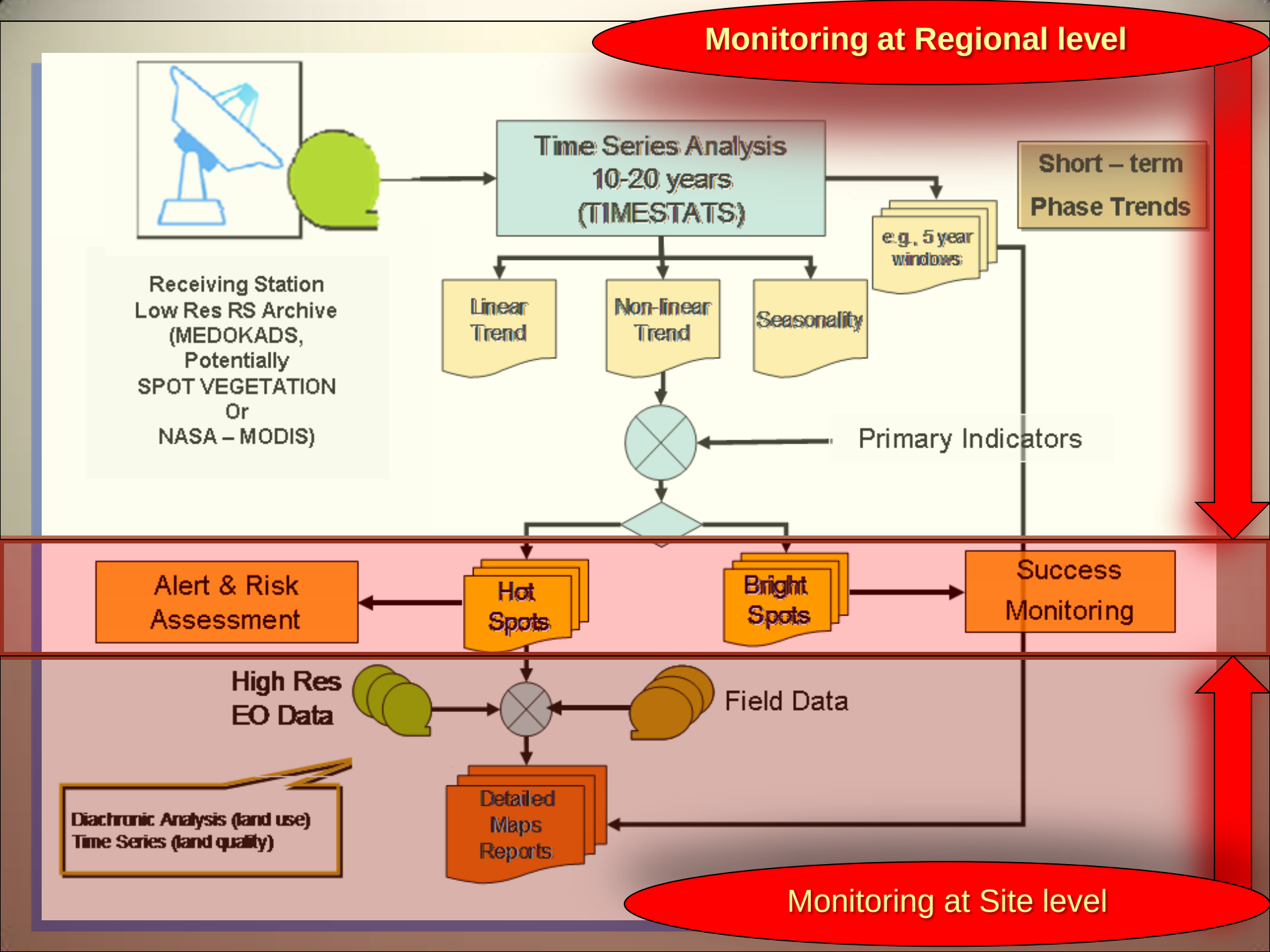


NOAA AVHRR Pathfinder, 8 km, Continuous Time Series of 20 Years

NOAA MEDOKADS, 1 km, Continuous Time Series of up to 10 Years (MERIS, MODIS ...)



Landsat, ASTER, IRS ... 15-30 m, Time Series


Monitoring at Regional level
Receiving Station
Low Res RS Archive
(MEDOKADS,
Potentially
SPOT VEGETATION
Or
NASA – MODIS)
Time Series Analysis
10-20 years
(TIMESTATS)
Short – term
Phase Trends
e.g., 5 year windows
Linear Trend
Non-linear Trend
Seasonality
Primary Indicators
Alert & Risk Assessment
Hot Spots
Bright Spots
Success Monitoring
High Res EO Data
Field Data
Diachronic Analysis (land use)
Time Series (land quality)
Detailed Maps Reports
Monitoring at Site level

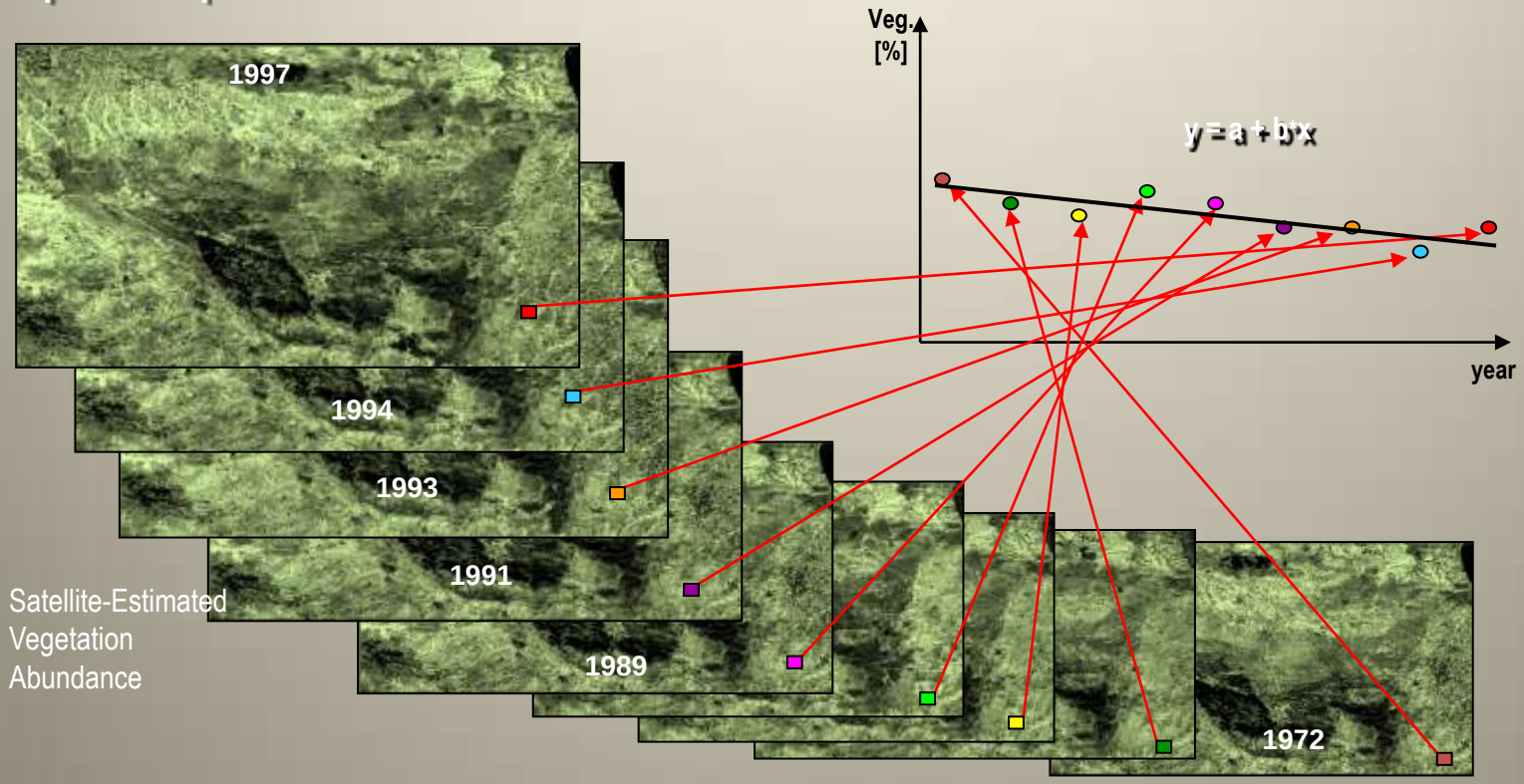
TimeStats©
V1.0

Trend model used in the TimeStats software package

$$NDVI_t = \alpha + \beta_1 \cdot t + \left(\sum_{i=1}^{NoOfLags} \beta_i NDVI_{t-i} \right) + \left(\sum_{j=1}^{NoOfX} \sum_{k=1}^{NoOfLags} \beta_{jk} X_{jk} \right) + \left(\sum_{m=1}^{NoOfHarm} a_m \cos \cdot 2\pi \frac{1}{P_m} \cdot t + b_m \sin 2\pi \frac{1}{P_m} \cdot t \right) + \varepsilon$$

Constant	linear trend	stochastic component	external variables	Periodic components (cycles, long-periodical trends	white-noise

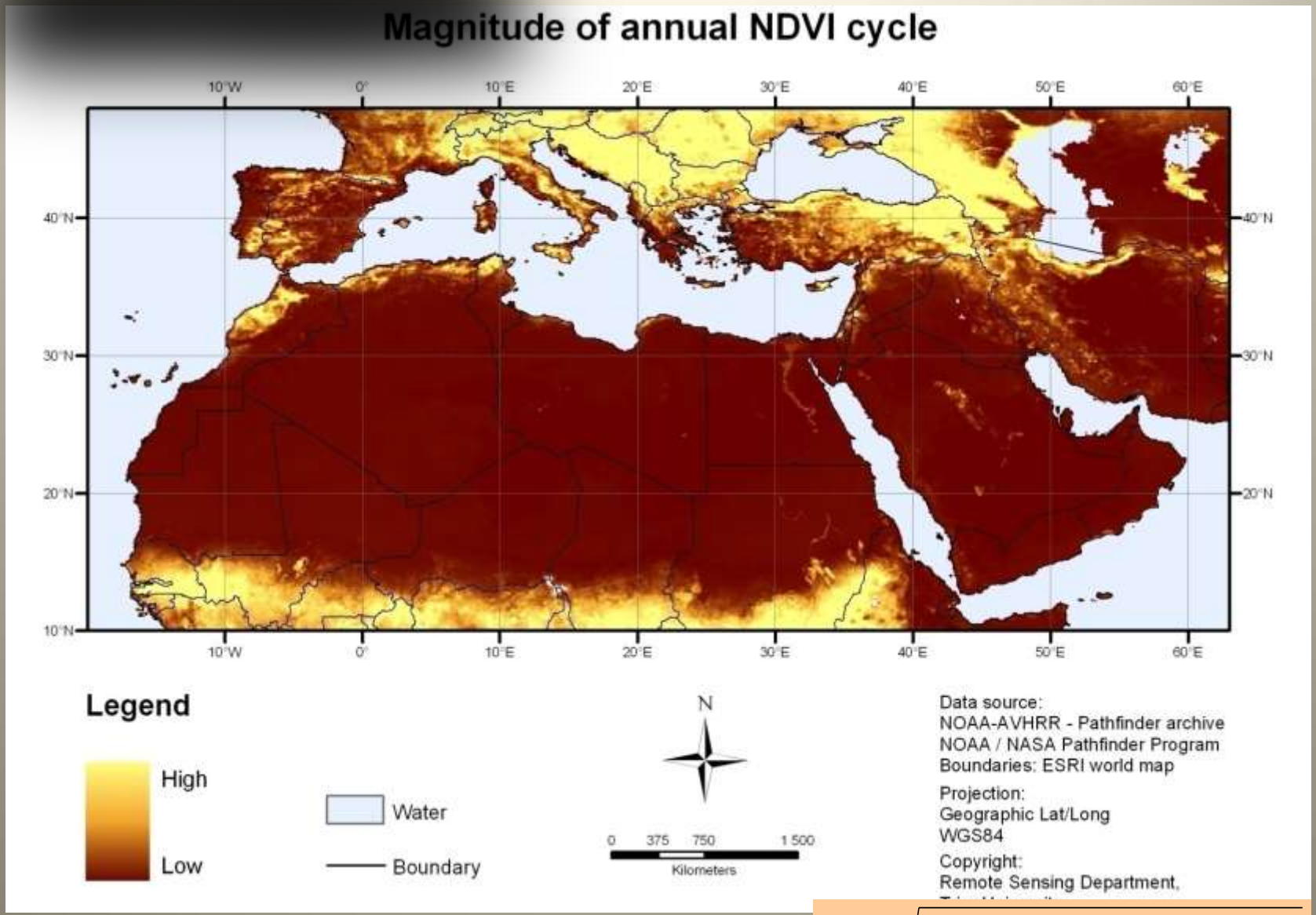
Spatio-temporal Indicators



TimeStats is a collection of established methods in time-series analysis (TSA) to retrieve different sources of variability in spatial-temporal databases on a pixel-by-pixel basis.

Max VDVI WHERE?

Cyclic compounds

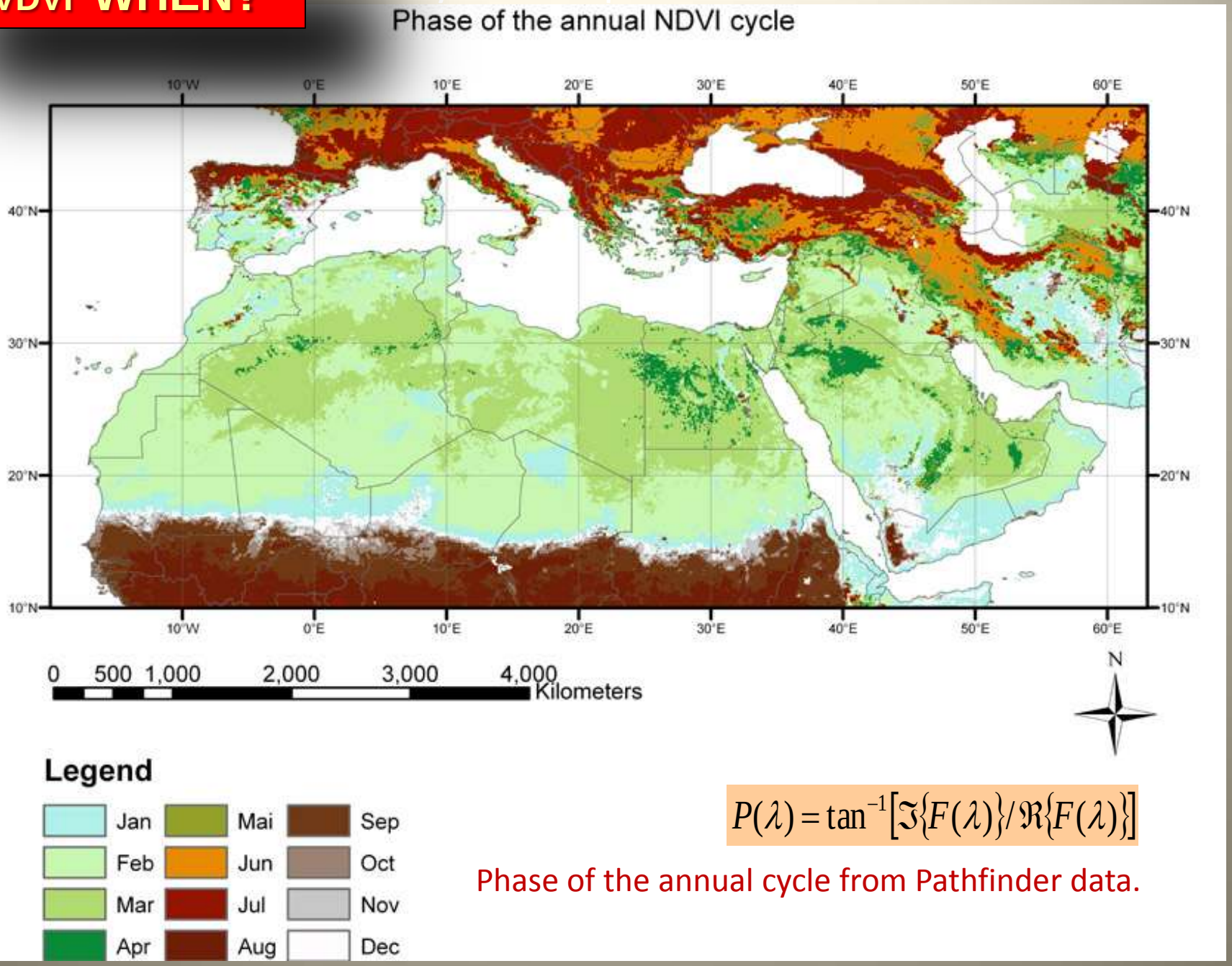


Power of the annual cycle from Pathfinder data.

$$I(\lambda) = \frac{\sqrt{real(F(\lambda))^2 + imaginary(F(\lambda))^2}}{N}$$

Max VDVI WHEN?

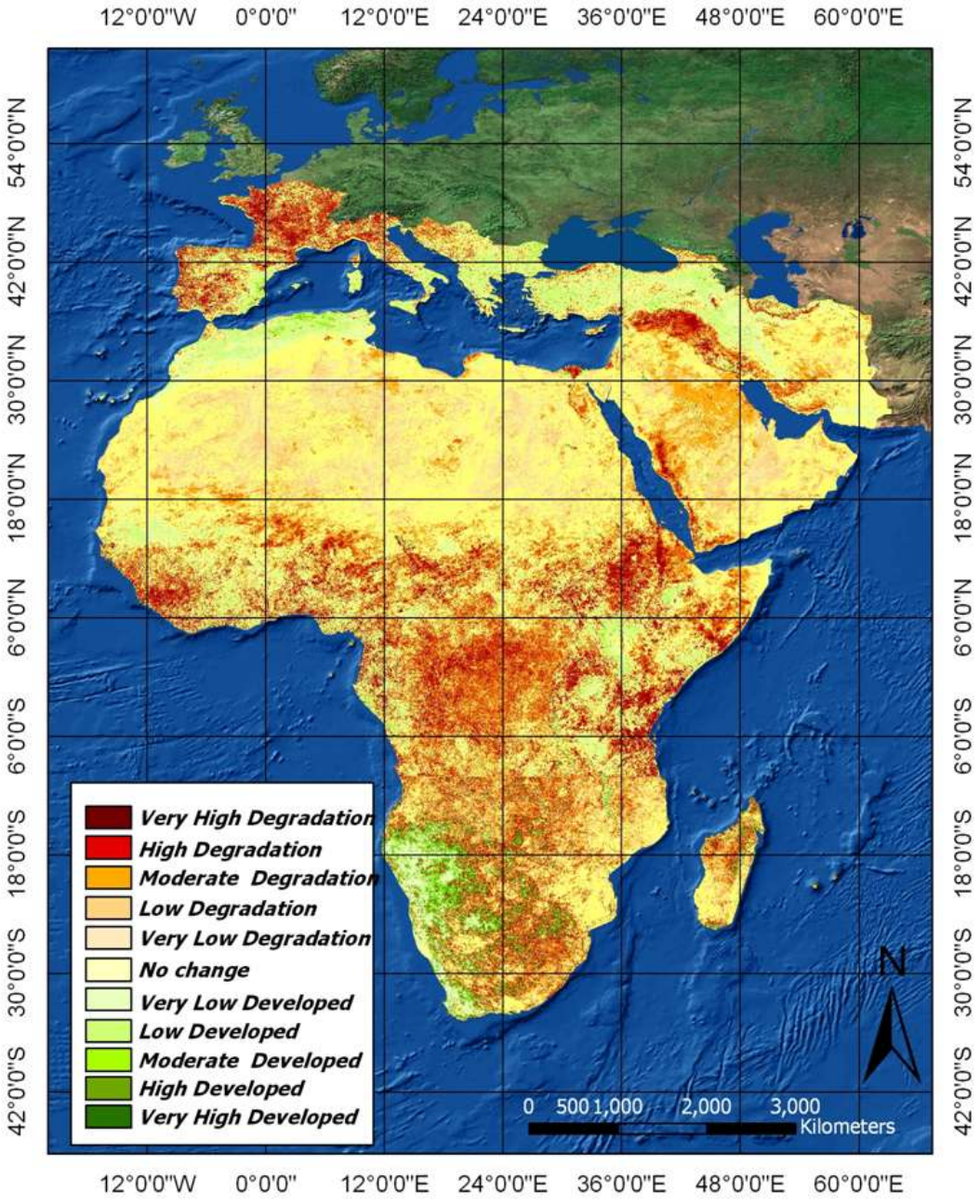
Cyclic compounds

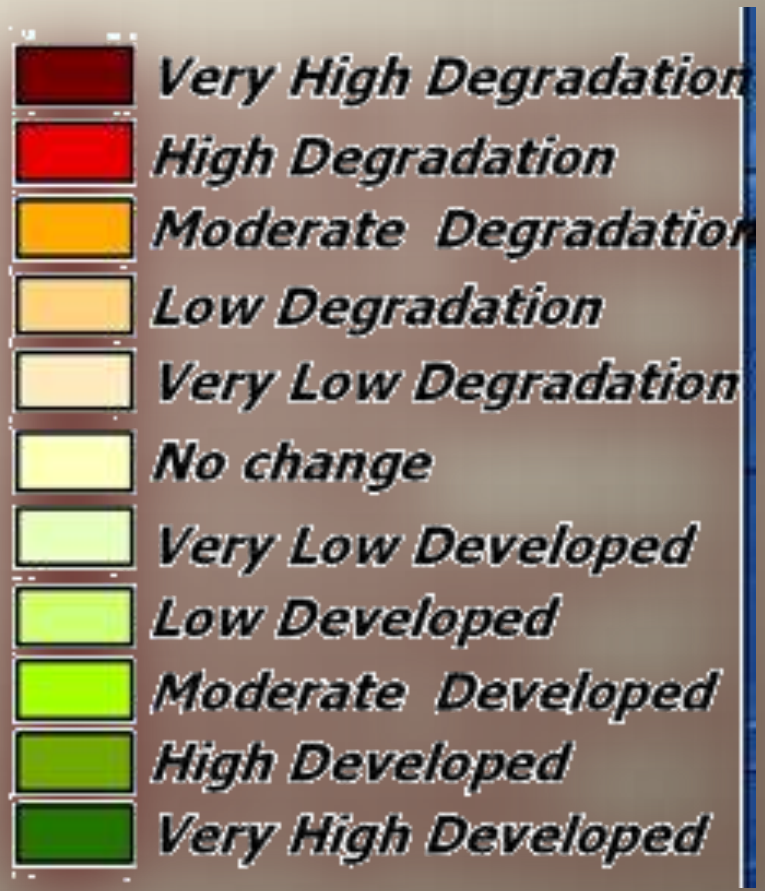


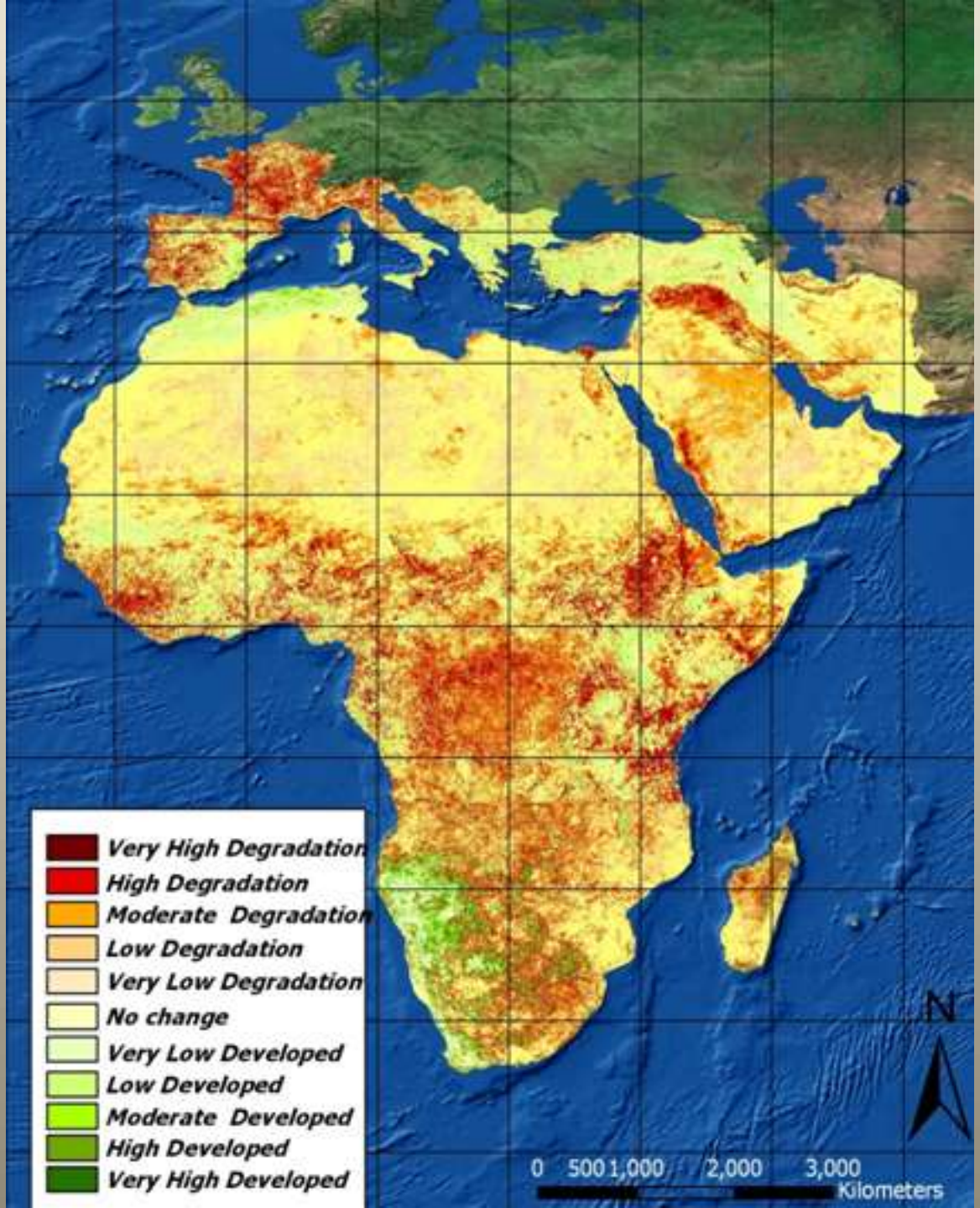
$$P(\lambda) = \tan^{-1}\left[\Im\{F(\lambda)\}/\Re\{F(\lambda)\}\right]$$

Phase of the annual cycle from Pathfinder data.

Monitoring Vegetation Change 2000 - 2011





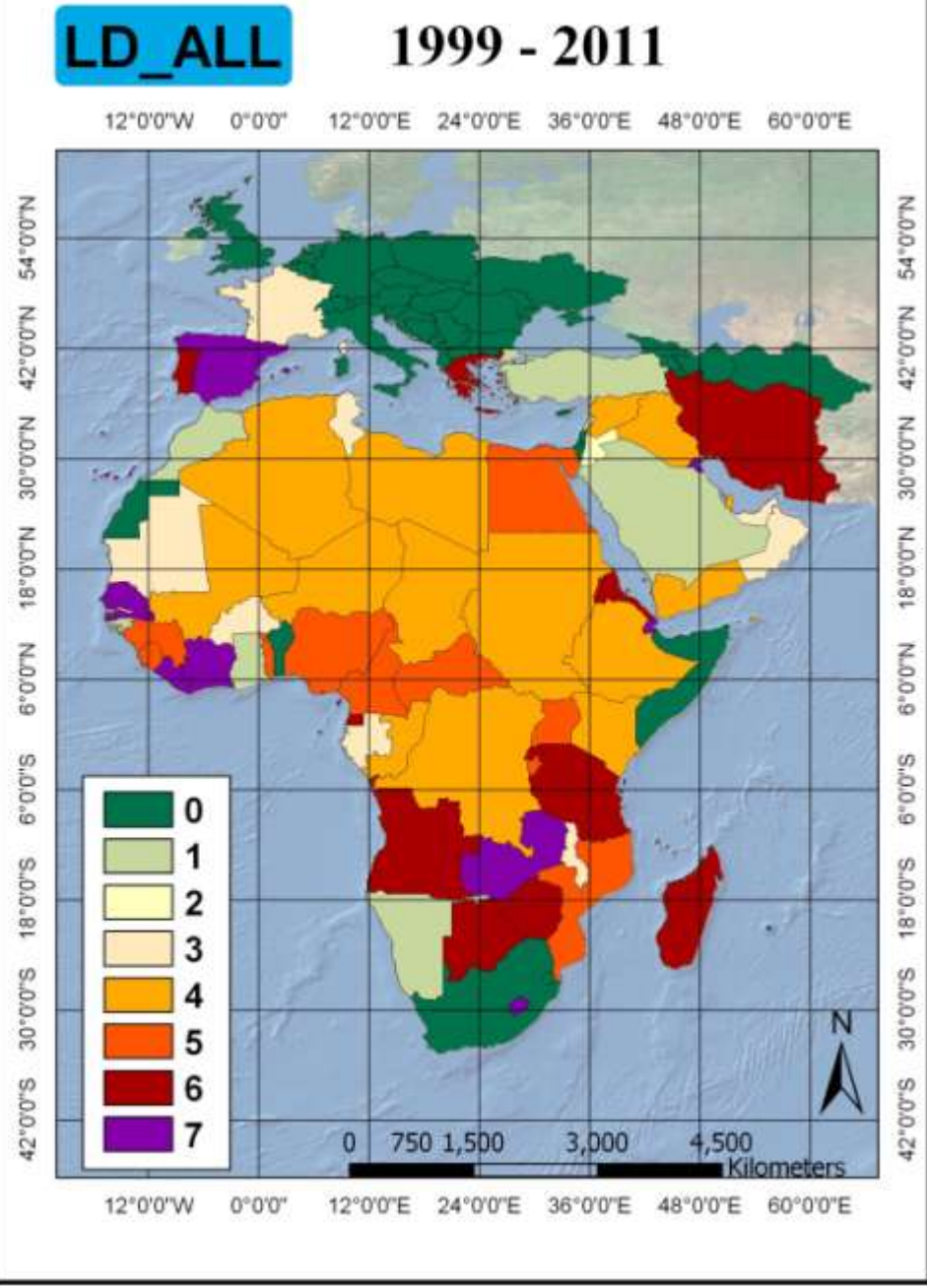

Very High Degradation
High Degradation
Moderate Degradation
Low Degradation
Very Low Degradation
No change
Very Low Developed
Low Developed
Moderate Developed
High Developed
Very High Developed
N
0 500 1,000 2,000 3,000
Kilometers

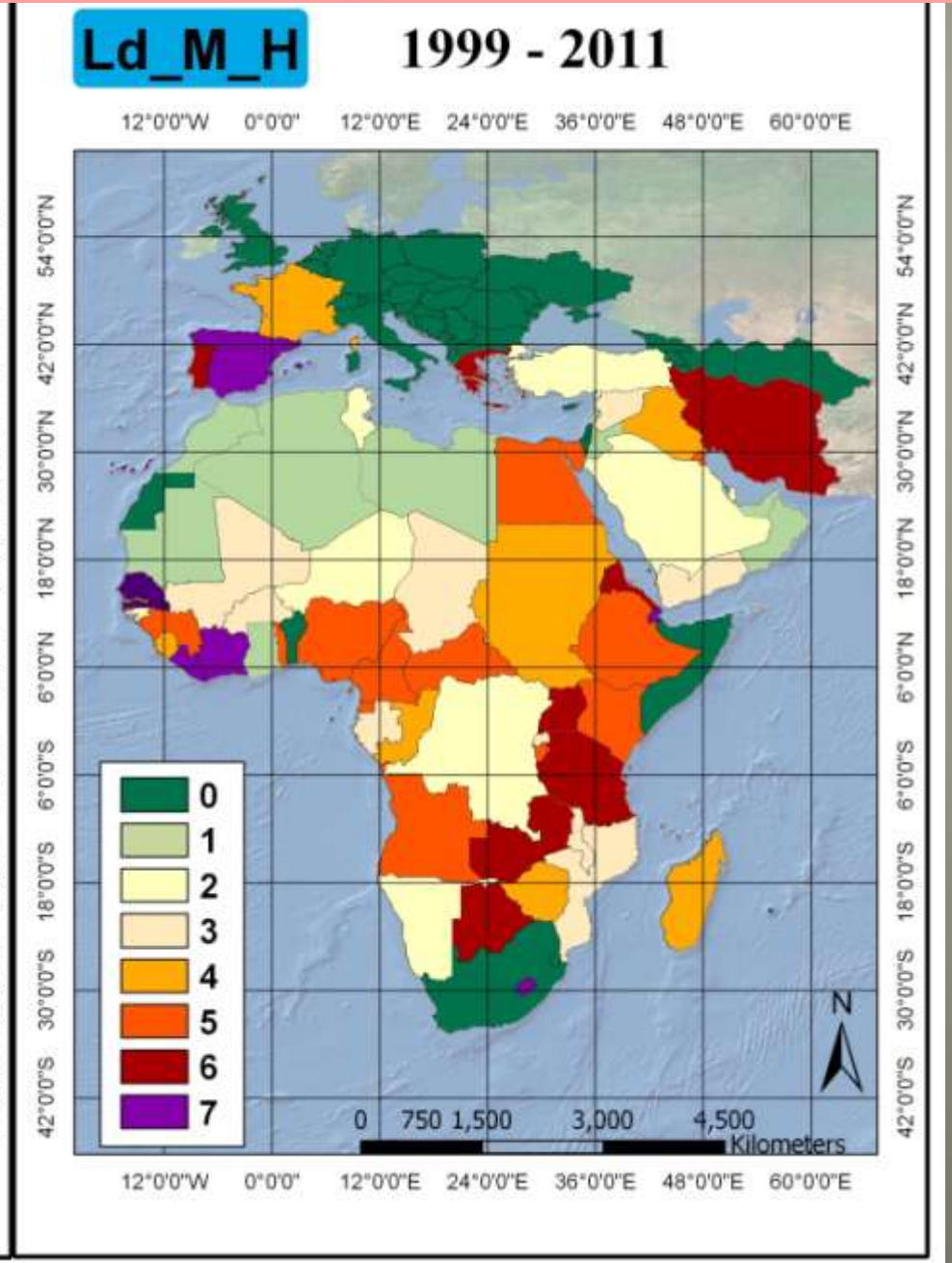
hot spots (1-3)	Deg Total	Country	vh_deg (1) %	h_deg (2) %	m_deg (3) %	hot spots (1-3) %	l_deg (4) %	vl_deg (5) %	Deg Total %	n %	vh_dev %	h_dev %	m_dev %	l_dev %	vl_dev %	Dev Total %
8	7	Sierra Leone	38.5	24.1	11.9	74.5	4.3	1.3	80.1	15.6	0	0	0	1	3.2	4.2
8	7	Andorra	35.2	28.4	9.9	73.5	2.8	1.6	77.9	14.6	0	0	0	2	5.4	7.4
7	7	D R Congo	14.7	35.8	19.1	69.6	6.5	2	78.1	15.9	0.3	0.2	0.1	1.8	3.6	6
7	7	South France	33.1	25.5	11	69.6	3.8	1.2	74.6	15.8	0	0	0.1	4.3	5.2	9.6
7	7	Djibouti	2.9	30.6	35.8	69.3	10.4	2.5	82.2	16.1	0	0	0.1	0.6	1.1	1.8
7	7	San Marino	35.7	13.4	16.3	65.4	1.9	0	67.3	16.2	0	0	0	6	10.5	16.5
7	7	R Congo	19.4	28.4	14.2	62	5.1	1.5	68.6	16.4	0	0.1	0.3	7.6	7	15
7	7	Liberia	32.5	19.5	9.7	61.7	3.7	1.2	66.6	17	0	0.1	0.3	8.5	7.5	16.4
7	7	Lesotho	11	17.6	32.4	61	26.7	5	92.7	2.2	3	1.6	0.4	0.1	0.1	5.2
6	6	Ethiopia	21.8	23.2	14.4	59.4	5.2	1.7	66.3	18.7	0.1	0.1	0.3	7.9	6.8	15.2
6	6	Guinea	21.7	23.1	14.3	59.1	5.7	1.9	66.7	22.1	0	0	0	3.7	7.5	11.2
6	6	Gaza Strip	18	22.7	16	56.7	9.6	2.9	69.2	23.7	0.5	0	0	2.4	4.2	7.1
6	7	Zambia	14.5	19.5	22.6	56.6	16.5	5.9	79	11.8	4.1	2.3	0.9	0.7	1.4	9.4
6	6	Portugal	29.2	17.6	9.5	56.3	3.8	1.2	61.3	21.4	0.3	0.3	0.7	8.4	7.6	17.3
6	5	Uganda	24.4	18.9	10.5	53.8	4.1	1.3	59.2	17.1	9.2	0.2	0.7	13.5	9.2	32.8
6	6	Syria	15.8	20.2	15.6	51.6	8.6	2.9	63.1	28.2	0	0.1	0.2	3.7	4.7	8.7
6	7	Swaziland	14.3	17.8	19.3	51.4	15.7	6.6	73.7	16.9	4.2	2.5	1	0.4	1.3	9.4
6	6	Iraq	13.2	15.9	21.9	51	10.1	3	64.1	26.1	0.2	0.2	0.3	5.1	4	9.8
6	6	Botswana	19.1	16.2	15.2	50.5	10.8	4	65.3	6.5	9.1	8.3	4.8	1.7	4.2	28.1
6	6	Comoros	20	14.9	15.3	50.2	9	5	64.2	9.2	9.1	8.9	5.5	1.3	1.8	26.6
5	5	Cameroon	15	20.9	13.8	49.7	5.5	1.8	57	23.2	0	0.1	0.3	9.3	10	19.7
5	5	Rwanda	23.7	16.4	9.4	49.5	4	1.4	54.9	18.7	0.1	0.2	0.8	14.3	10.9	26.3
5	5	Nigeria	15.7	19.1	14.4	49.2	6.2	2	57.4	25.5	0	0	0.2	7.6	9.3	17.1
5	5	Equatorial Guinea	26.3	14.5	8.4	49.2	3.3	1	53.5	17	0	0.1	1	17.6	10.6	29.3
5	6	Eritrea	7.3	18.5	23.3	49.1	11.5	3.6	64.2	31.1	0	0	0	1	3.6	4.6
5	5	C A Republic	6.6	23.3	18.1	48	7.6	2.5	58.1	29.4	0	0	0	3.5	8.9	12.4
5	5	Croatia	12.2	21.2	13.6	47	5.2	1.7	53.9	29.3	0.1	0.3	0.1	7.2	9.2	16.9
5	6	South Africa	15.7	15.4	15.3	46.4	11.1	4.6	62.1	13.4	6.7	5.7	3.6	1.7	6.8	24.5
5	6	Angola	12.5	16.6	16.7	45.8	11.7	4.6	62.1	16.5	4.2	4.2	3.3	3.1	6.6	21.4
5	6	Mauritius	17.7	13.2	14.9	45.8	9.4	4.8	60	8.4	8.9	8.3	6.2	2.7	5.6	31.7
5	7	Kuwait	1.9	13.2	29.6	44.7	31.8	6.5	83	15.8	0	0	0	0.7	0.6	1.3
5	5	Burundi	15.1	17.7	11.9	44.7	4.8	1.6	51.1	23.5	0.3	0.3	0.6	10.9	13.2	25.3
5	5	Tanzania	18	14.6	11.4	44	6.7	2.6	53.3	23.2	0.3	0.2	0.3	11	11.7	23.5
5	5	Benin	14.5	17.2	11.7	43.4	5	1.7	50.1	25.8	0	0	0	9.8	14.3	24.1
5	4	Kenya	17.1	15.2	10.5	42.8	4.5	1.6	48.9	23.7	0.1	0.2	0.8	13.9	12.3	27.3
5	5	Guinea-Bissau	10.6	18	13.9	42.5	8.5	2	53	29.7	0	0	0.2	8.5	11	19.7
5	4	Gabon	18.6	14.4	9.3	42.3	3.8	1.3	47.4	19	0.1	0.4	1.5	19.9	11.8	33.7
5	4	Bosnia and Herzegovina	7.4	17.8	15.1	40.3	6.8	2.2	49.3	31.6	0	0	0.2	6.9	11.8	18.9

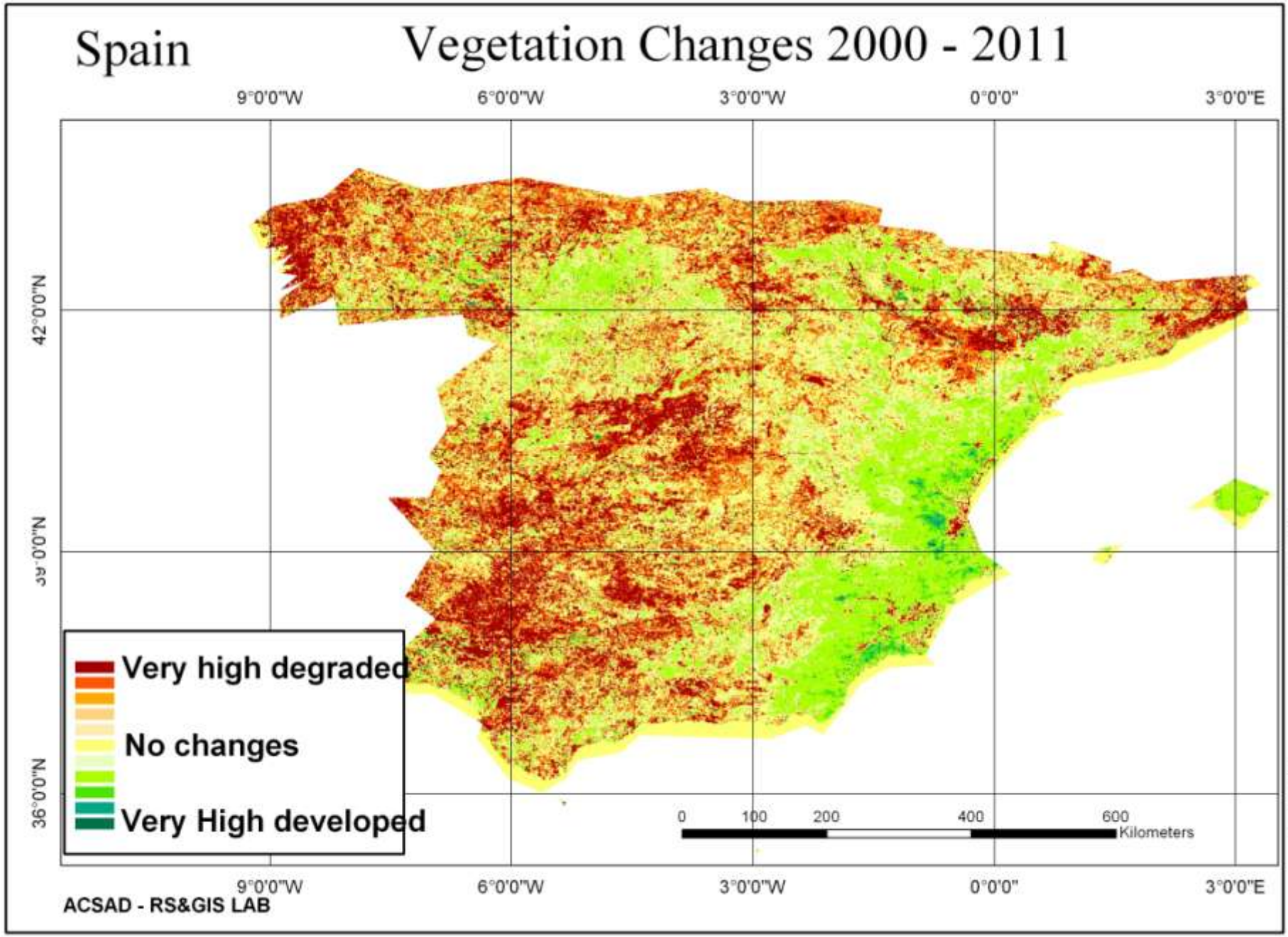
hot spots (1-3)	Deg Total	Country	vh_deg (1) %	h_deg (2) %	m_deg (3) %	hot spots (1-3) %	l_deg (4) %	vl_deg (5) %	Deg Total %	n %	vh_dev %	h_dev %	m_dev %	l_dev %	vl_dev %	Dev Total %
4	5	Somalia	9	14.1	16	39.1	8.1	3	50.2	35.3	0	0.1	0.2	6.3	7.9	14.5
4	6	Mayotte	11	12.1	15.5	38.6	12.7	11.6	62.9	19.5	6.1	5.9	3.6	1.9	0	17.5
4	4	Spain	15.8	13.5	9	38.3	3.8	1.3	43.4	24	0.1	0.4	1.3	18.5	12.3	32.6
4	4	Italy	14.4	15	8.2	37.6	3.3	1.1	42	25.5	0.1	0.1	0.7	20.6	11	32.5
4	6	Madagascar	9.3	11.7	16.2	37.2	16.5	8	61.7	29.4	3.3	2.6	16.2	0.5	1.1	23.7
4	6	Zimbabwe	7.2	11.3	18.2	36.7	20.5	10.3	67.5	28.5	0.3	1.1	0.5	0.1	0.3	2.3
4	4	Cote d'Ivoire	13.1	13.3	9	35.4	4	1.4	40.8	21.2	0	0.1	0.6	22.5	14.9	38.1
4	5	Reunion	13.9	10.2	10.9	35	11.1	6.3	52.4	15.5	5.7	8.9	6.8	3.1	5.7	30.2
4	3	Sao Tome & Principe	18.8	9.9	6.2	34.9	1.8	0.2	36.9	14.2	2.4	4.7	6.8	28	7.1	49
4	4	Togo	8.7	13.6	11.3	33.6	5.7	2	41.3	32.5	16.7	0	0.1	9.4	16.7	42.9
4	3	Ghana	10.9	12.3	10.1	33.3	4.9	1.7	39.9	28.2	0	0.1	0.3	15	16.4	31.8
4	3	Gambia	8.6	12.7	10.9	32.2	4.8	1.8	38.8	33.3	0	0	0.1	11.3	16.5	27.9
4	3	Cyprus	8	14	9.9	31.9	4.6	1.4	37.9	49.2	0	0	0.1	4.5	8.3	12.9
4	4	pls	9.7	11.1	10.6	31.4	8.6	3.8	43.8	49.2	0	0	0.1	2.5	4.4	7
3	6	Saudi Arabia	1.5	4.3	23.1	28.9	28.5	11.3	68.7	30.3	0.1	0	0.1	0.4	0.4	1
3	3	Burkina Faso	5.1	11.4	11.9	28.4	6.2	2.3	36.9	39	0	0	0	7.5	16.6	24.1
3	3	Malawi	5.6	8.1	14.5	28.2	2.8	7.4	38.4	21	2.6	3.1	3.5	2.8	7.4	19.4
3	4	Chad	6.2	9.3	11.5	27	10.9	7.7	45.6	49	0.1	0	0.1	1.6	3.7	5.5
3	4	Sudan & s. Sudan	5.2	9.8	11.7	26.7	12.6	8.1	47.4	42.3	0	0	0.2	4.4	5.7	10.3
3	3	West Bank	3.8	8.7	13.7	26.2	7.9	3.4	37.5	47.4	0	0.2	0.2	5.8	8.9	15.1
3	3	Georgia	1.5	14.3	10.3	26.1	4.3	1.5	31.9	27.9	5.2	0.1	0.4	20.9	15.2	41.8
3	4	Bahrain	0.9	3.1	20.2	24.2	16.1	0.8	41.1	53.5	0	0.3	0	0.7	0.8	1.8
3	4	Yugoslavia	5.2	9	9.8	24	5.2	1.9	31.1	32.4	0.1	0.1	0.5	18.7	17.3	36.7
3	5	Mozambique	3	6.1	12.9	22	19.4	12	53.4	44.2	0.7	0.5	0.4	0.2	0.6	2.4
3	4	Mali	1.3	6.5	13.9	21.7	16.1	8.5	46.3	39.6	0	0	0	5.3	8.7	14
3	4	Yemen	2.5	6.7	11.2	20.4	17.4	8.5	46.3	51.2	0	0	0	0.7	1.7	2.4

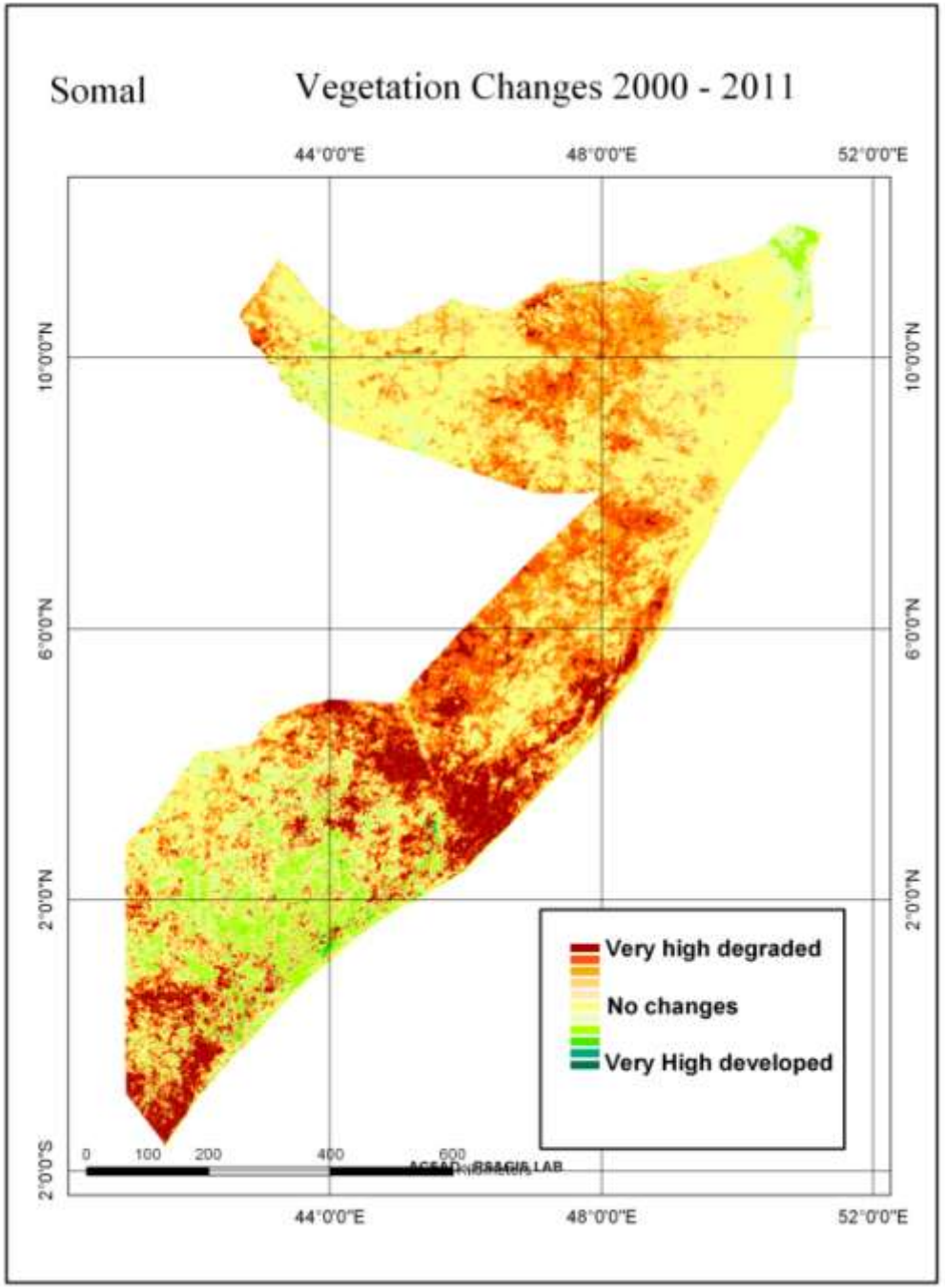
hot spots (1-3)	Deg Total	Country	vh_deg (1) %	h_deg (2) %	m_deg (3) %	hot spots (1-3) %	l_deg (4) %	vl_deg (5) %	Deg Total %	n %	vh_dev %	h_dev %	m_dev %	l_dev %	vl_dev %	Dev Total %
2	1	**Namibia**	9.9	5.5	4.1	19.5	2.8	1.2	23.5	5.5	8	12.3	13.3	7.5	30	71.1
2	4	**Niger**	1.5	6.4	10	17.9	16.8	14	48.7	49.3	0	0	0	0.4	1.6	2
2	1	**Senegal**	2.1	7.1	8.7	17.9	4.7	1.7	24.3	32.9	0	0	0.2	23	19.6	42.8
2	1	**Iran**	2.3	5.6	9.9	17.8	8.3	3.5	29.6	49.5	0.1	0.1	0.2	7.4	13.3	21.1
2	4	**Qatar**	0.4	1.9	11	13.3	21.1	11.5	45.9	51.7	0	0	0.1	1.1	1.1	2.3
2	3	**Tunisia**	0.7	2	10.3	13	9.2	5.1	27.3	41.3	0	0.1	0.2	12.6	18.5	31.4
2	1	**Turkey**	3.4	4.3	4.2	11.9	2.4	1	15.3	26.2	0.2	0.3	1.1	35.1	21.9	58.6
2	4	**Egypt**	1.4	2.3	7	10.7	19.6	17	47.3	50.7	0.1	0.1	0.2	1	0.7	2.1
2	1	**Albania**	4.7	2.9	2.7	10.3	1.4	0.5	12.2	16.2	0.1	0.2	1.9	57.5	12	71.7
2	1	**Bulgaria**	2	3.8	4.3	10.1	2.3	0.9	13.3	18.2	0.4	1	4.3	47.5	15.1	68.3
1	3	**Oman**	0.3	1.1	8.1	9.5	19.1	9.4	38	60	1.2	0	0	0.2	1.2	2.6
1	1	**Greece**	3.5	3.1	2.8	9.4	1.6	0.5	11.5	32	0.1	0.2	1.2	39.8	15.1	56.4
1	2	**Jordan**	0.3	1.5	7.5	9.3	13.1	6.7	29.1	69	0	0	0	0.5	1.5	2
1	3	**Mauritania**	0	0.8	8.1	8.9	17.2	10.8	36.9	57.4	0	0	0	1.2	4.4	5.6
1	1	**Lebanon**	1.6	2.8	2.7	7.1	1.6	0.8	9.5	30.5	0	0	0.3	29.1	30.5	59.9
1	4	**Libya**	0.1	0.7	5.4	6.2	21.9	17.7	45.8	53.7	0	0	0	0.1	0.4	0.5
1	1	**Armenia**	2.3	1.8	2	6.1	1.3	0.5	7.9	14.8	0.2	0.6	2.6	55.7	18.1	77.2
1	3	**U A Emirates**	0.8	1.3	3.9	6	13.2	16.1	35.3	63	0	0	0	0.6	1.1	1.7
1	1	**Macedonia**	1.9	1.9	1.9	5.7	1.2	0.6	7.5	12.7	0.5	0.4	2.1	58.3	18.6	79.9
1	1	**Morocco**	0.5	0.6	2.5	3.6	6.8	4.1	14.5	53.2	0	0	0.2	14.8	17.2	32.2
1	1	**Seychelles**	2.3	0.9	0	3.2	0.1	0.6	3.9	81	7.2	0.6	1.6	4.4	1.4	15.2
1	4	**Algeria**	0.1	0.2	2.6	2.9	22.1	15.5	40.5	48.8	0	0.2	0.7	6.4	3.5	10.8
1	1	**Azerbaijan**	0.6	0.6	0.8	2	0.4	0.1	2.5	17	0.8	0.9	2.4	45.4	31.1	80.6

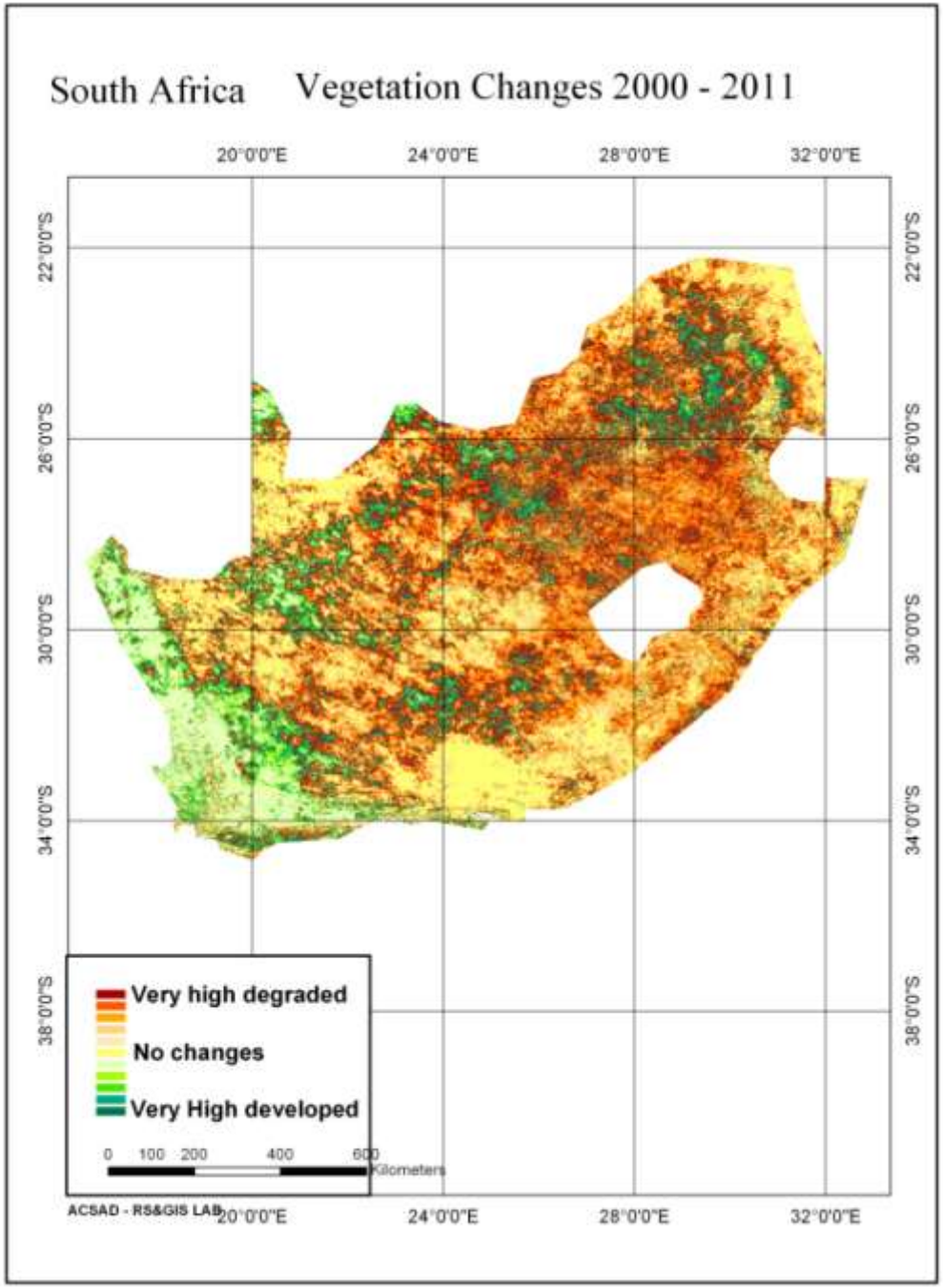
Monitoring Vegetation Change 2000 - 2011

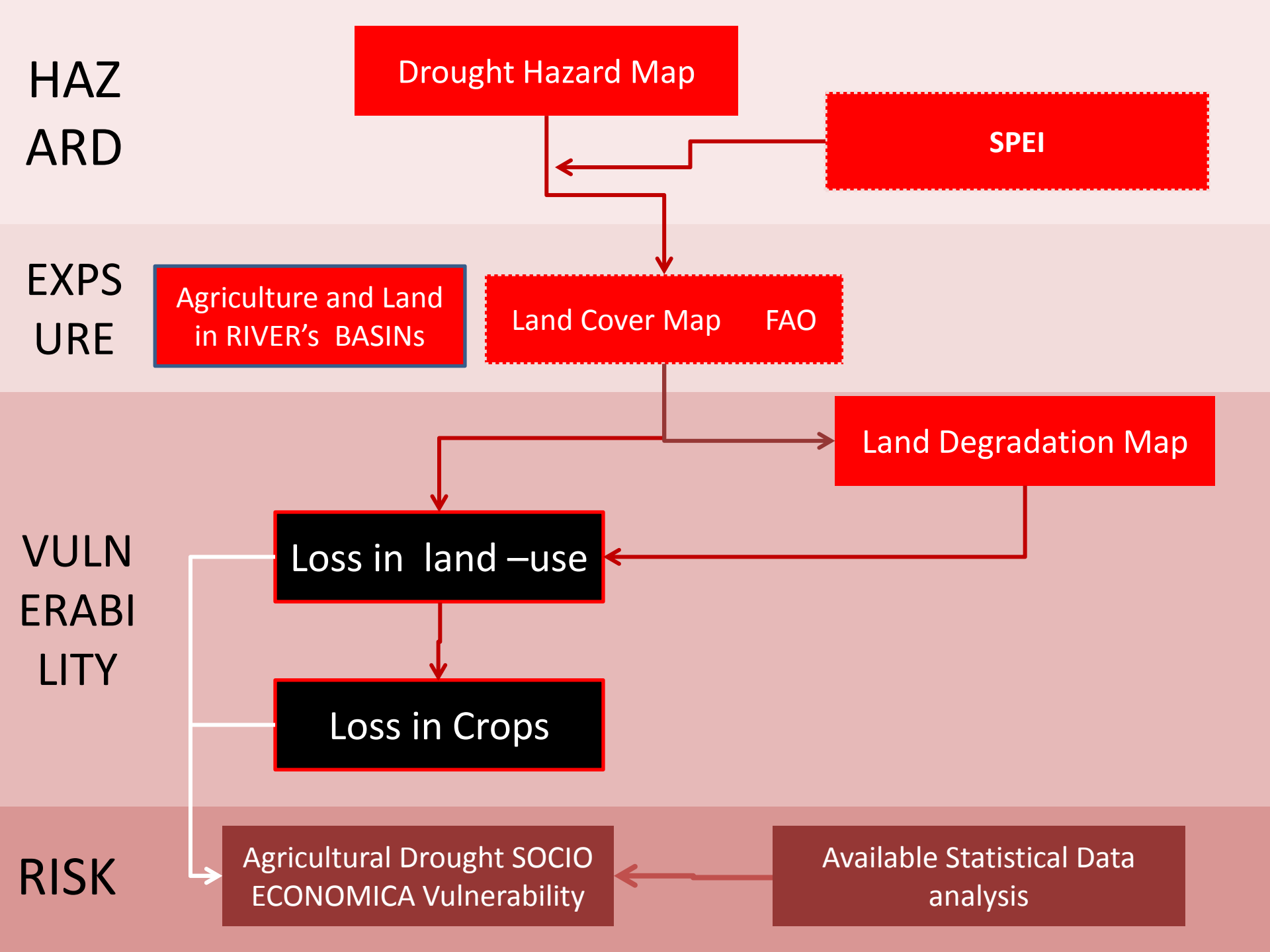




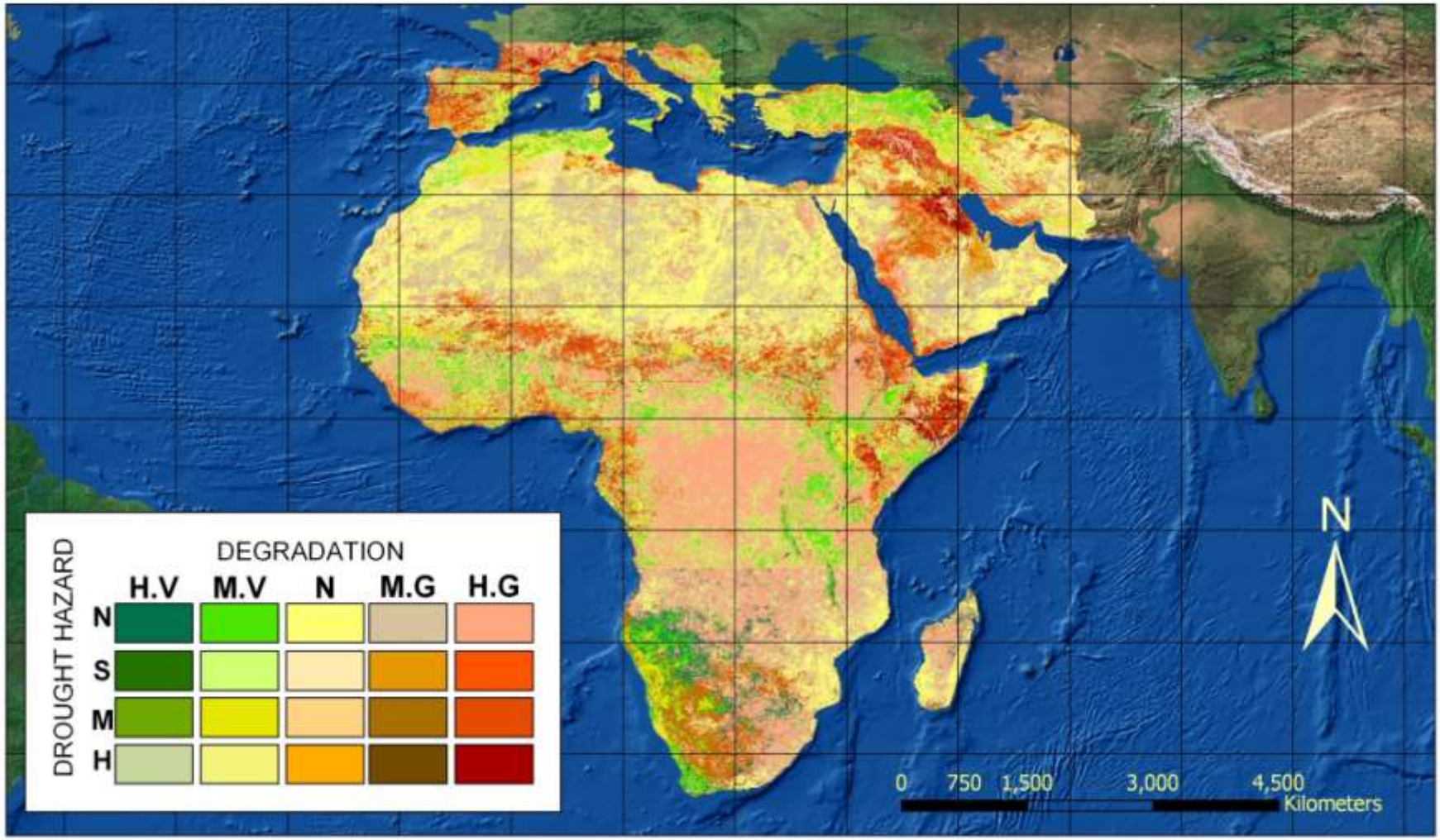

Spain
Vegetation Changes 2000 - 2011
9°0'0"W
6°0'0"W
3°0'0"W
0°0'0"
3°0'0"E
42°0'0"N
39°0'0"N
36°0'0"N
Very high degraded
No changes
Very High developed
0
100
200
400
600
Kilometers
ACSAD - RS&GIS LAB

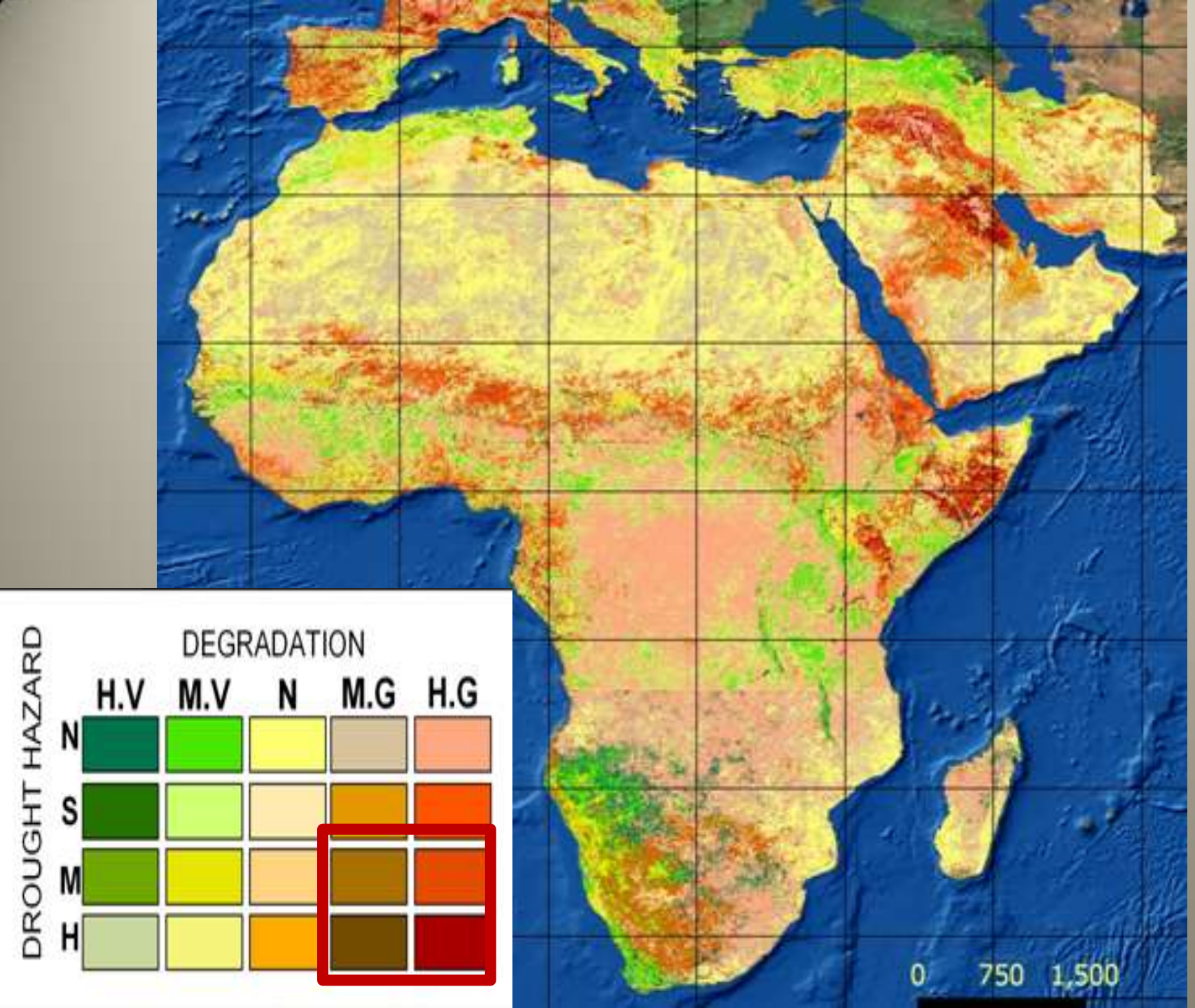

Somal
Vegetation Changes 2000 - 2011
44°0'0"E
48°0'0"E
52°0'0"E
10°0'0"N
6°0'0"N
2°0'0"N
2°0'0"S
Very high degraded
No changes
Very High developed
0
100
200
400
600

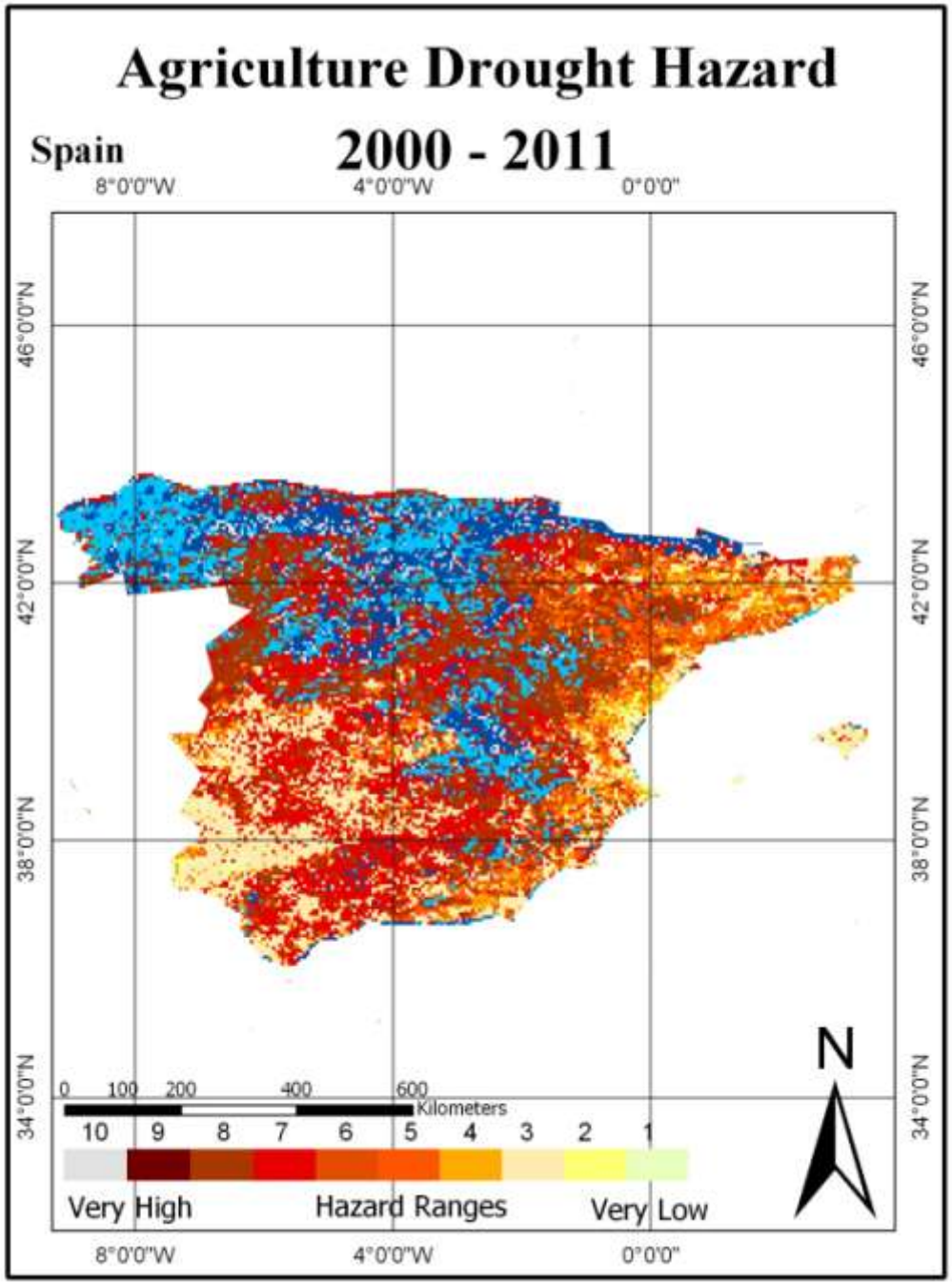

South Africa Vegetation Changes 2000 - 2011
20°0'0"E
24°0'0"E
28°0'0"E
32°0'0"E
22°0'0"S
26°0'0"S
30°0'0"S
34°0'0"S
38°0'0"S
Very high degraded
No changes
Very High developed
0 100 200 400 600
Kilometers
ACSAD - RS&GIS LAB


HAZ
ARD
Drought Hazard Map
SPEI
EXPS
URE
Agriculture and Land in RIVER's BASINs
Land Cover Map FAO
Land Degradation Map
VULN
ERABI
LITY
Loss in land –use
Loss in Crops
RISK
Agricultural Drought SOCIO ECONOMICA Vulnerability
Available Statistical Data analysis

DROUGHT HAZARD & DEGRADATION

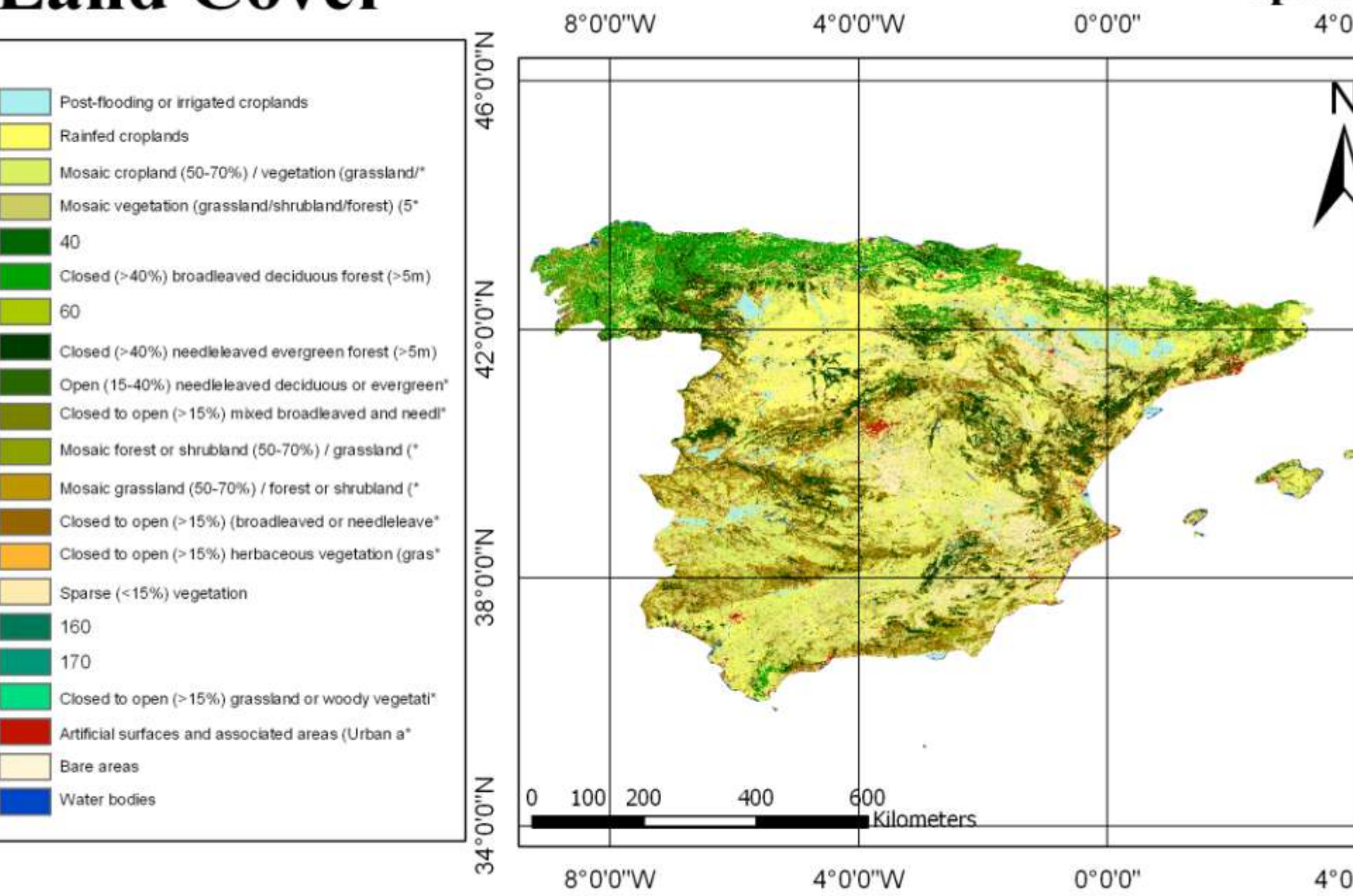



DEGRADATION
H.V
M.V
N
M.G
H.G
DROUGHT HAZARD
N
S
M
H
0
750
1,500


Agriculture Drought Hazard
Spain
2000 - 2011
8°0'0"W
4°0'0"W
0°0'0"
46°0'0"N
42°0'0"N
38°0'0"N
34°0'0"N
0 100 200 400 600
Kilometers
10 9 8 7 6 5 4 3 2 1
Very High
Hazard Ranges
Very Low
N

Land Cover

Spain



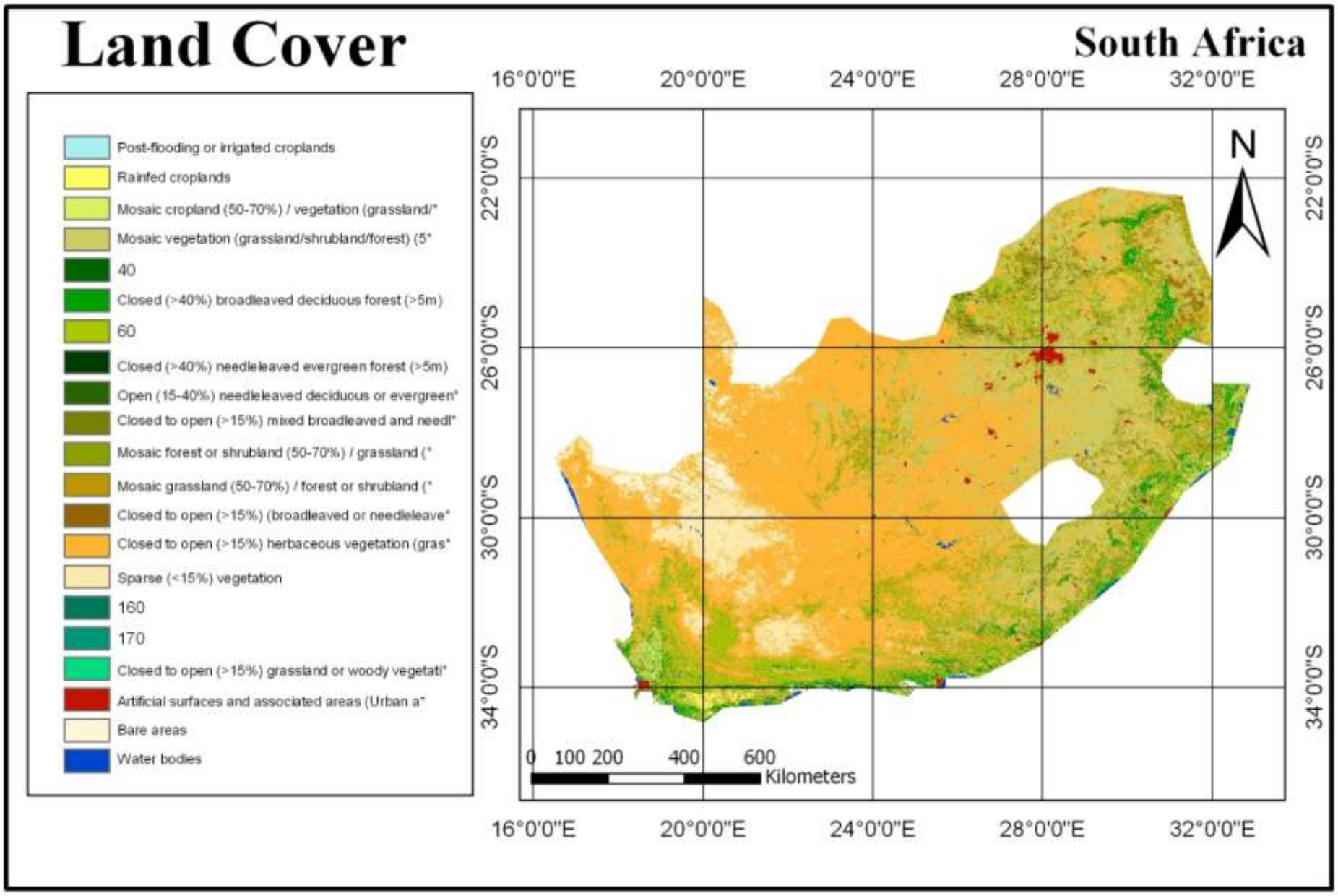
SPAIN

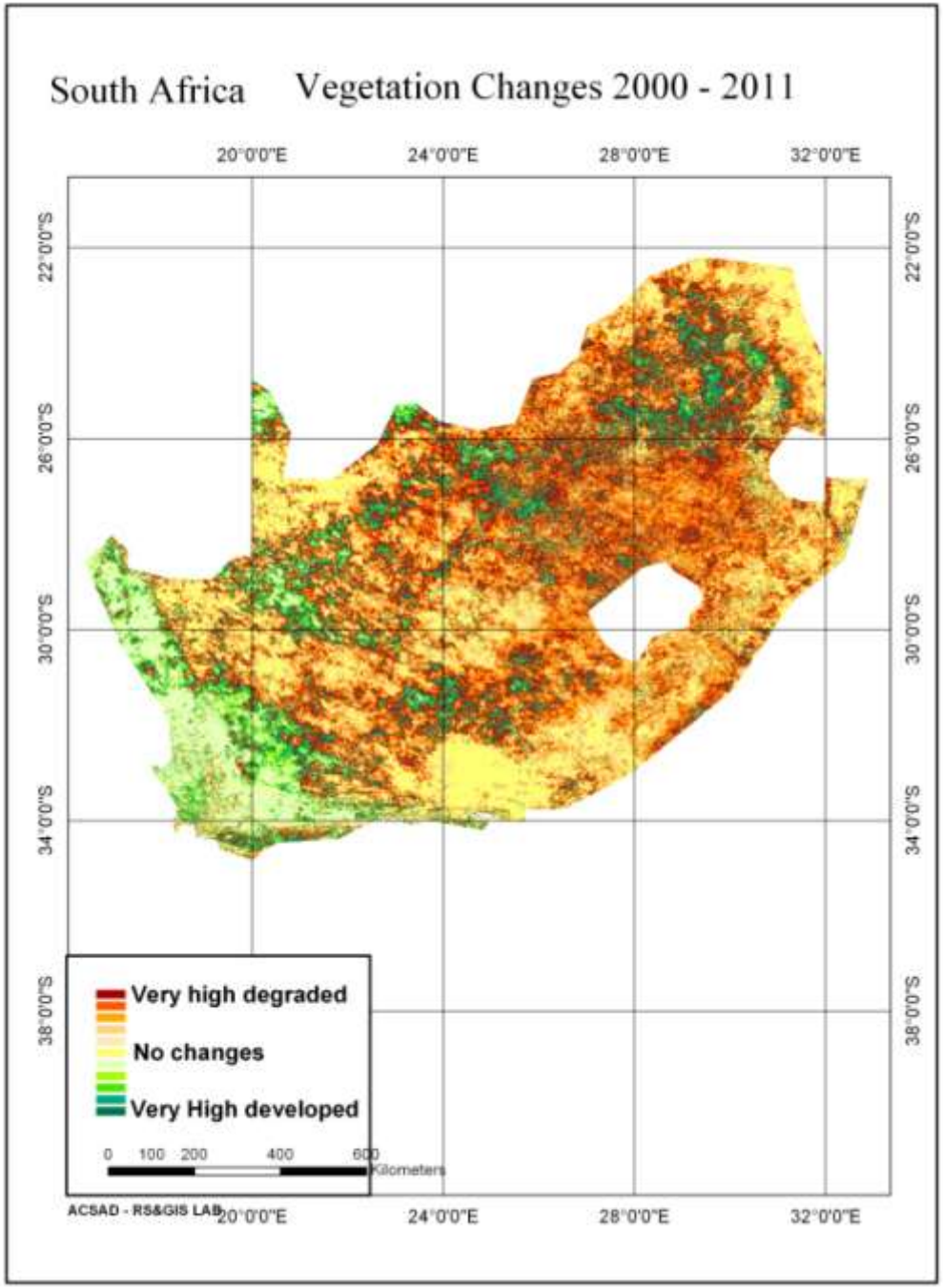
ADH and LC

Land Cover	Hazard	%	Total %
Irrigated croplands	S	0.62%	
	M	1.93%	
	H	2.78%	
			7.04%
Rainfed croplands	S	0.18%	
	M	1.10%	
	H	2.62%	
			4.76%
Mosaic Croplands/Vegetation	S	0.43%	
	M	3.35%	
	H	4.05%	
			10.41%
Forest	S	2.54%	
	M	5.57%	
	H	12.73%	
			26.44%
Rangelands	S	1.08%	
	M	2.30%	
	H	6.40%	
			12.60%
Artificial areas		6.26%	6.26%
Bare areas		8.35%	8.35%
Water bodies		6.48%	6.48%
Permanent snow and ice		0.14%	0.14%

Land Cover

South Africa



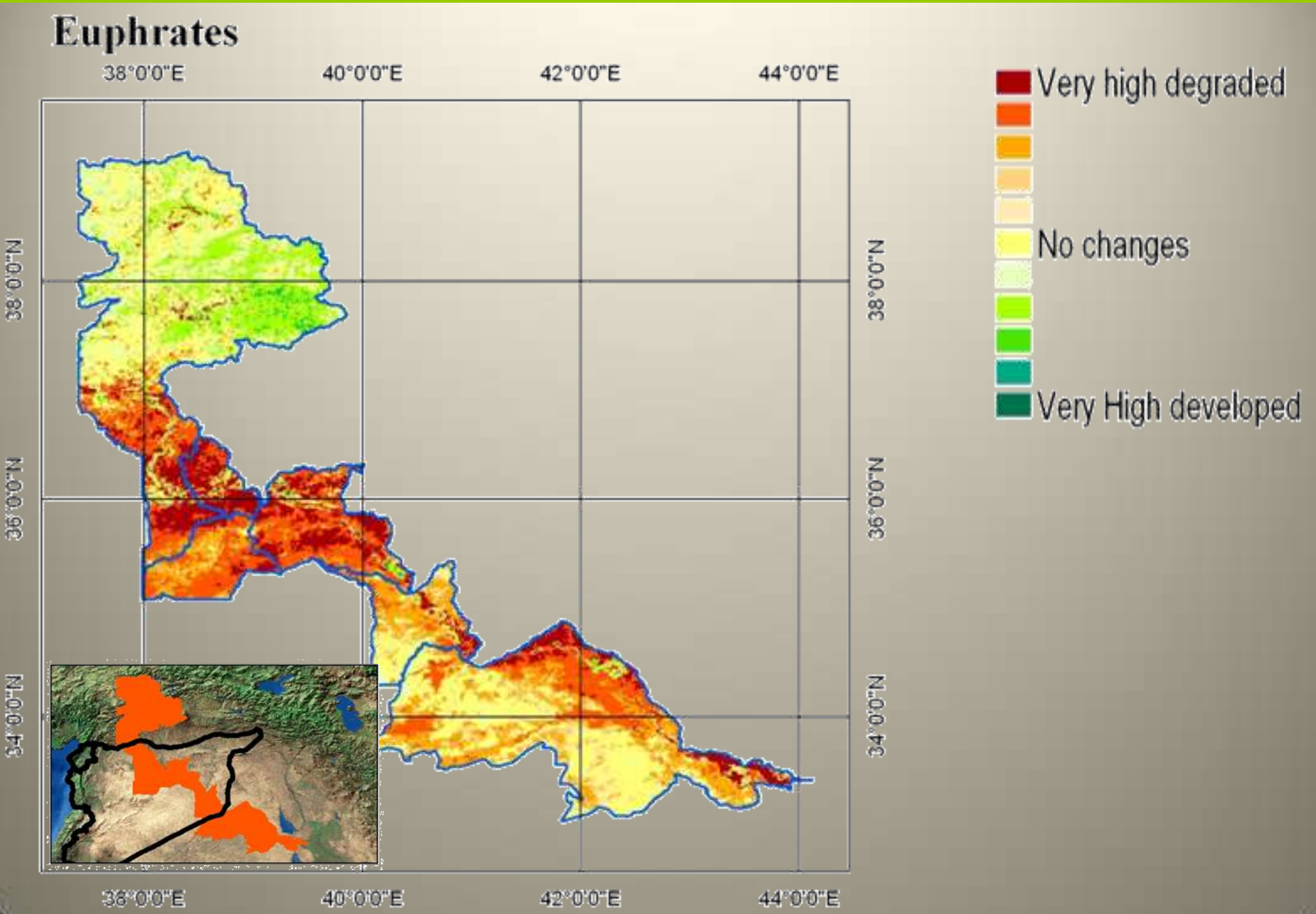

South Africa Vegetation Changes 2000 - 2011
20°0'0"E
24°0'0"E
28°0'0"E
32°0'0"E
22°0'0"S
26°0'0"S
30°0'0"S
34°0'0"S
38°0'0"S
Very high degraded
No changes
Very High developed
0 100 200 400 600
Kilometers
ACSAD - RS&GIS LAB

Degradation in Land Cover SOUTH AFRICA

Land Cover	Degradation	%
Rainfed croplands	vh_deg	0.05%
	h_deg	0.01%
	m_deg	0.06%
	l_deg	1.32%
	vl_deg	0.14%
	n	0.01%
	vl_dev	0.26%
	l_dev	2.69%
	m_dev	0.06%
	h_dev	0.00%
	vh_dev	0.17%
		4.78%
Mosaic Croplands/Vegetation	vh_deg	0.89%
	h_deg	2.69%
	m_deg	0.51%
	l_deg	4.21%
	vl_deg	8.95%
	n	3.44%
	vl_dev	0.85%
	l_dev	0.86%
	m_dev	1.25%
	h_dev	0.31%
	vh_dev	0.07%
		24.03%

Land Cover	Degradation	%
forest	vh_deg	0.70%
	h_deg	0.62%
	m_deg	0.73%
	l_deg	0.33%
	vl_deg	1.00%
	n	4.14%
	vl_dev	3.54%
	l_dev	1.68%
	m_dev	1.01%
	h_dev	2.47%
	vh_dev	5.34%
		20.27%
Mosaic Forest-Shrubland/Grassland	vh_deg	1.79%
	h_deg	0.41%
	m_deg	0.61%
	l_deg	0.41%
	vl_deg	0.07%
	n	2.80%
	vl_dev	2.48%
	l_dev	0.84%
	m_dev	0.39%
	h_dev	4.79%
	vh_dev	2.34%
		16.93%
Rangelands	vh_deg	1.23%
	h_deg	3.95%
	m_deg	4.19%
	l_deg	1.71%
	vl_deg	0.60%
	n	1.50%
	vl_dev	2.34%
	l_dev	0.21%
	m_dev	0.04%
	h_dev	0.86%
	vh_dev	0.84%
		17.47%

Euphrates River Basin



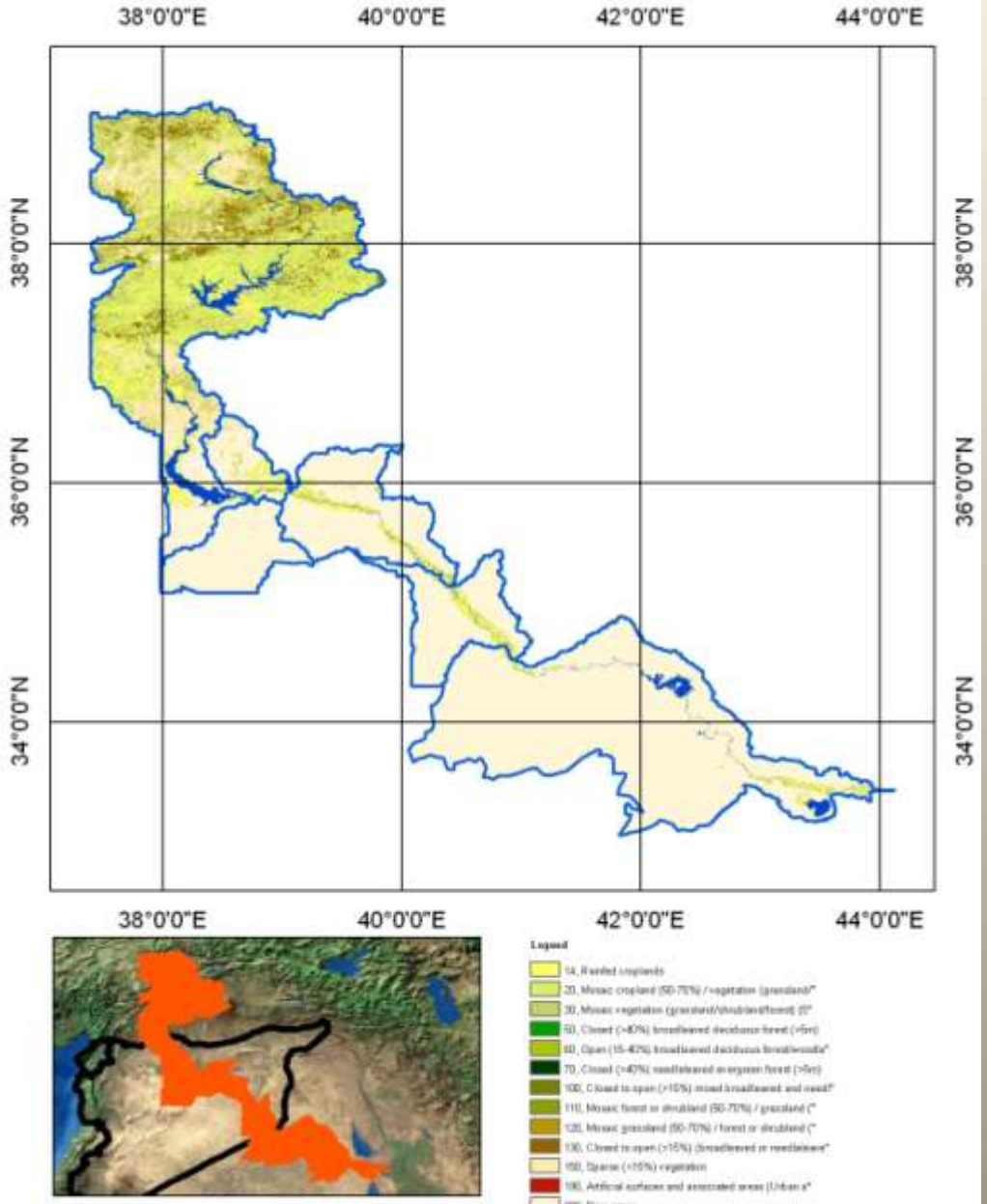
Euphrates River Basin

Country	AREA	vh_deg (1)	h_deg (2)	m_deg (3)	l_deg (4)	vl_deg (5)	Deg Total
Turkey	3577959.7	63689.39	121024.01	156829.75	92642.18	42128.38	476313.71
	35.2	0.63	1.19	1.54	0.91	0.41	4.68
Syria	3500899.7	927200.01	1249017.65	634992.63	167688.04	46201.83	3025100.16
	34.4	9.13	12.29	6.25	1.65	0.45	29.77
Iraq	3081594.9	239532.62	565116.22	759911.58	396848.96	123761.11	2085170.49
	30.3	2.36	5.56	7.48	3.91	1.22	20.53
TOTAL	10160454.2	1230422.02	1935157.88	1551733.96	657179.18	212091.32	5586584.36
		12.12	19.04	15.27	6.47	2.08	54.98

Country	n	vh_dev	h_dev	m_dev	l_dev	vl_dev	Dev Total
Turkey	1132841.63	4977.62	22009.64	79274.24	989846.02	872696.83	1968804.35
	11.15	0.05	0.22	0.78	9.74	8.59	19.38
Syria	335664.39	1846.71	4529.76	6187.37	51892.27	75679.04	140135.15
	3.3	0.02	0.04	0.06	0.51	0.74	1.37
Iraq	935805.63	0	553.55	3009.71	17385.93	39669.54	60618.73
	9.21	0	0.01	0.03	0.17	0.39	0.6
TOTAL	2404311.65	6824.33	27092.95	88471.32	1059124.22	988045.41	2169558.23
	23.66	0.07	0.27	0.87	10.42	9.72	21.35

Land Cover map

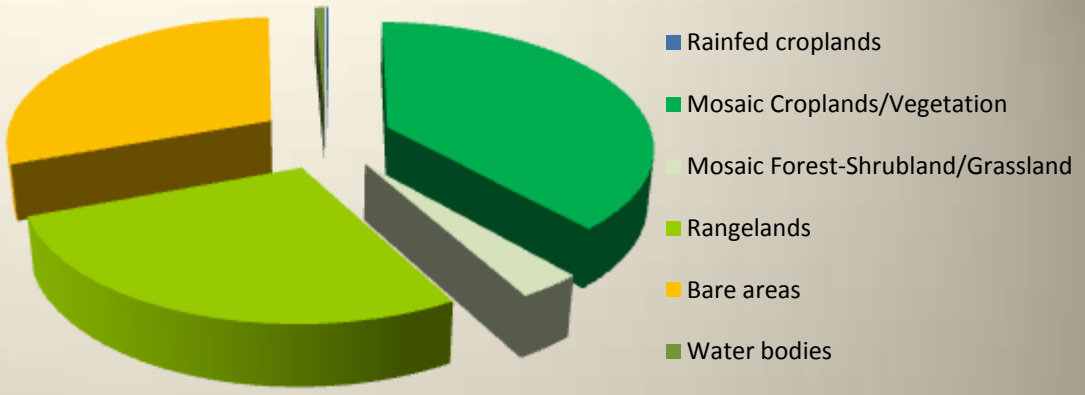
Euphrates



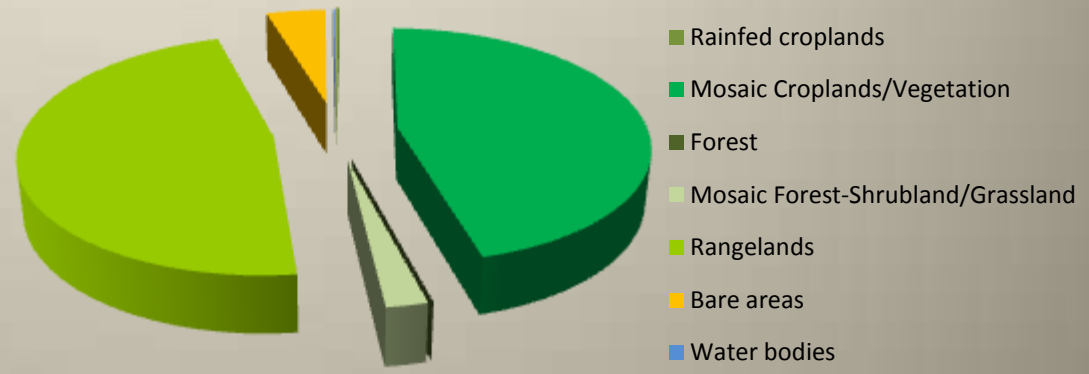
Land Cover Description in Euphrates River Basin	Area in Ha	Area in %	Country	Area in Ha	Area in %
Rainfed croplands	751653.02	4.86%	Iraq	28330.68	0.18%
			Syria	238827.69	1.54%
			Turkey	484494.66	3.13%
Mosaic Croplands/Vegetation	2121239.95	13.71%	Iraq	31036.99	0.20%
			Syria	215024.55	1.39%
			Turkey	1875178.41	12.12%
Mosaic Vegetation/Croplands	1882089.78	12.16%	Iraq	23426.76	0.15%
			Syria	194108.70	1.25%
			Turkey	1664554.31	10.76%
Closed broadleaved deciduous forest			Turkey	860.39	0.01%
Closed needleleaved evergreen forest	2822.93	0.02%	Syria	333.41	0.00%
			Turkey	2489.52	0.02%
Closed to open mixed broadleaved and needleleaved forest	190.45	0.00%	Syria	94.41	0.00%
			Turkey	96.04	0.00%
Mosaic Forest-Shrubland/Grassland	311160.85	2.01%	Iraq	4929.33	0.03%
			Syria	18120.45	0.12%
			Turkey	288111.06	1.86%
Mosaic Grassland/Forest-Shrubland	97819.75	0.63%	Iraq	57.24	0.00%
			Syria	1952.00	0.01%
			Turkey	95810.51	0.62%
Closed to open shrubland	308427.38	1.99%	Iraq	886.37	0.01%
			Syria	2075.68	0.01%
			Turkey	305465.33	1.97%
Sparse vegetation	1209753.38	7.82%	Iraq	38376.40	0.25%
			Syria	419885.38	2.71%
			Turkey	751491.59	4.86%
Closed to open vegetation regularly flooded			Iraq	63.14	0.00%
Bare areas	8381217.09	54.17%	Iraq	4232263.91	27.35%
			Syria	4043863.56	26.13%
			Turkey	105089.62	0.68%
Water bodies	405744.20	2.62%	Iraq	92982.39	0.60%
			Syria	141477.09	0.91%
			Turkey	171284.72	1.11%
TOTAL				15473042.30	

Land Cover Description	Country	Area_ha	%
Rainfed croplands	Iraq	28330.68	0.18%
	Syria	238827.69	1.54%
	Turkey	484494.66	3.13%
Mosaic Croplands/Vegetation	Iraq	54463.76	0.35
	Syria	409133.25	2.64
	Turkey	3539732.72	22.88
Closed to open mixed broadleaved and needleleaved forest	Syria	427.82	0
	Turkey	3445.95	0.02
Mosaic Forest-Shrubland/Grassland	Iraq	4986.57	0.03
	Syria	20072.46	0.13
	Turkey	383921.57	2.48
Closed to open shrubland	Iraq	39262.77	0.25
	Syria	421961.06	2.73
	Turkey	1056956.93	6.83
Bare areas	Iraq	4232263.91	27.35%
	Syria	4043863.56	26.13%
	Turkey	105089.62	0.68%
Water bodies	Iraq	92982.39	0.60%
	Syria	141477.09	0.91%
	Turkey	171284.72	1.11%

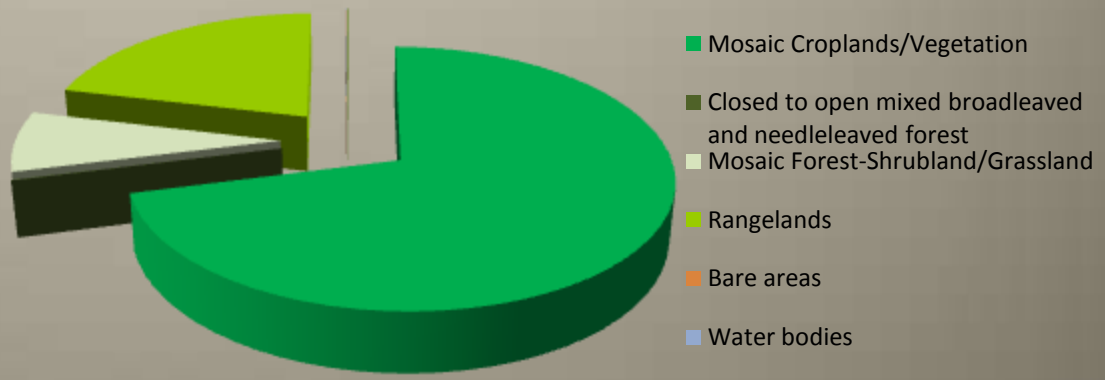
LAND USE IN EUPHRATE RIVER BASIN - IRAQ



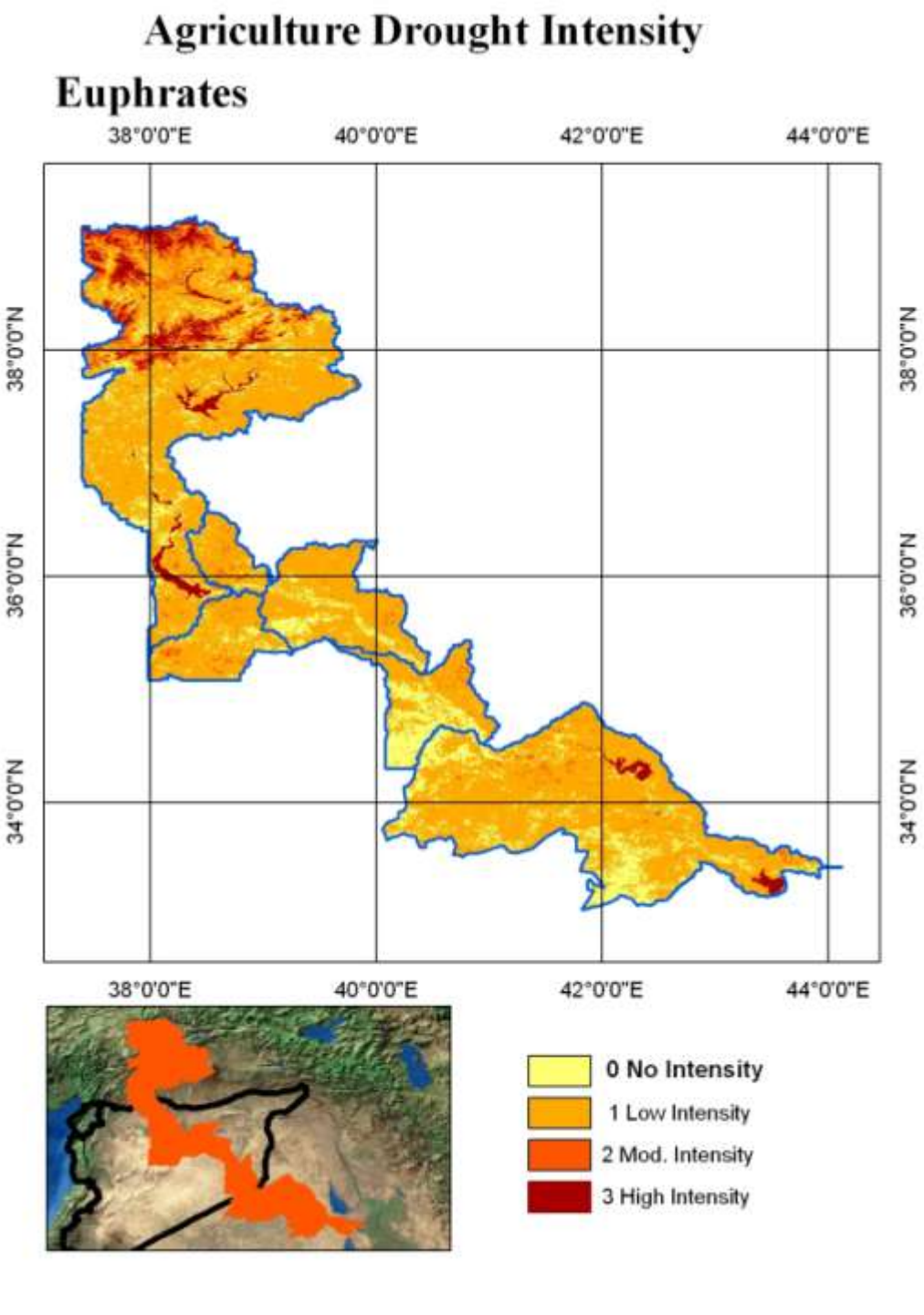
LAND USE IN EUPHRATE RIVER BASIN - SYRIA



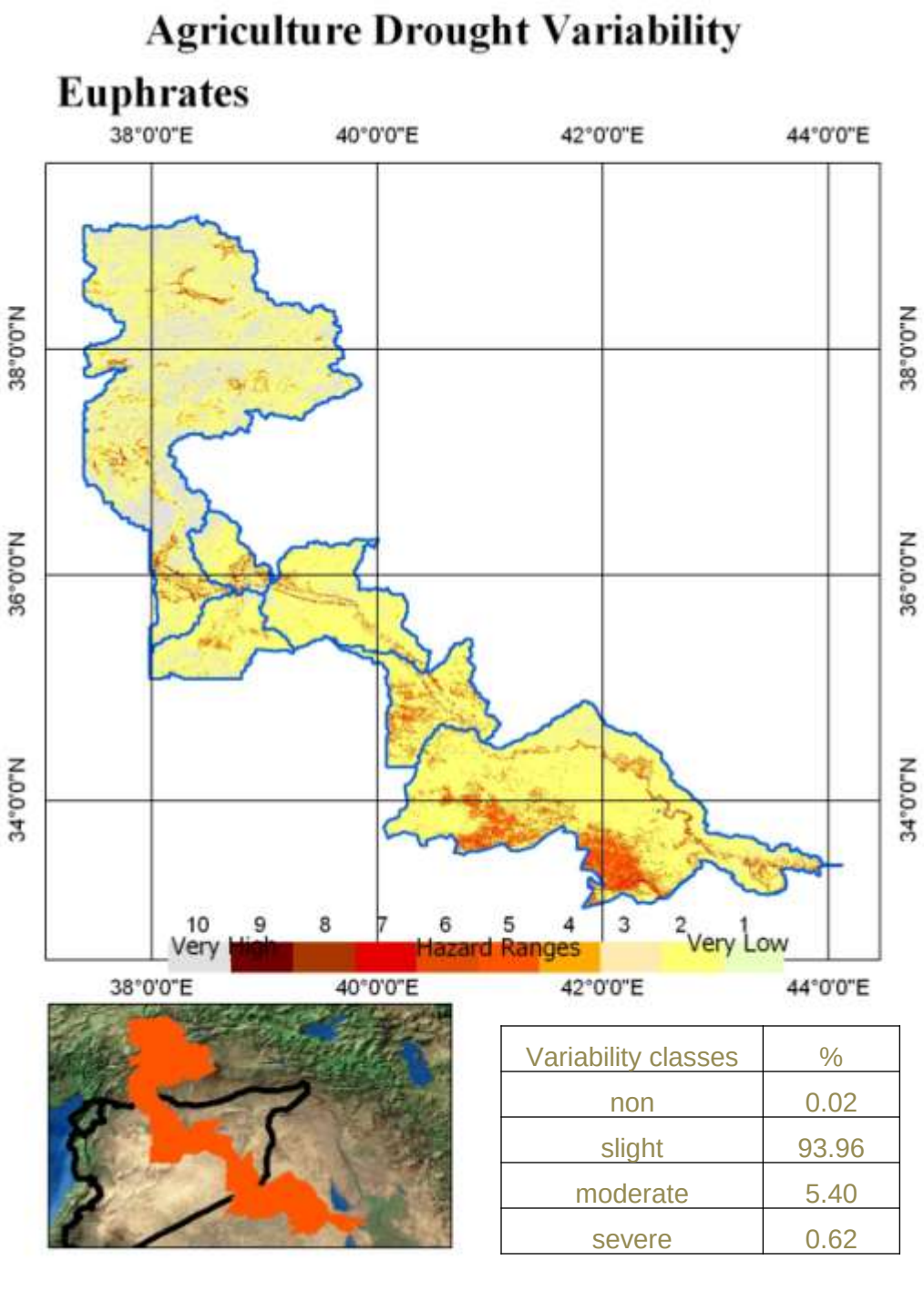
LAND USE IN EUPHRATE RIVER BASIN -TURKEY



Country	class	Area_Ha	%
Iraq	0	542424.34	5.34%
Iraq	1	2419435.91	23.81%
Iraq	2	57915.16	0.57%
Iraq	3	61819.27	0.61%
Syria	0	759470.77	7.47%
Syria	1	2595100.63	25.54%
Syria	2	83912.62	0.83%
Syria	3	62419.99	0.61%
Turkey	0	368438.82	3.63%
Turkey	1	2382394.62	23.45%
Turkey	2	448168.44	4.41%
Turkey	3	378959.15	3.73%
		10160459.72	

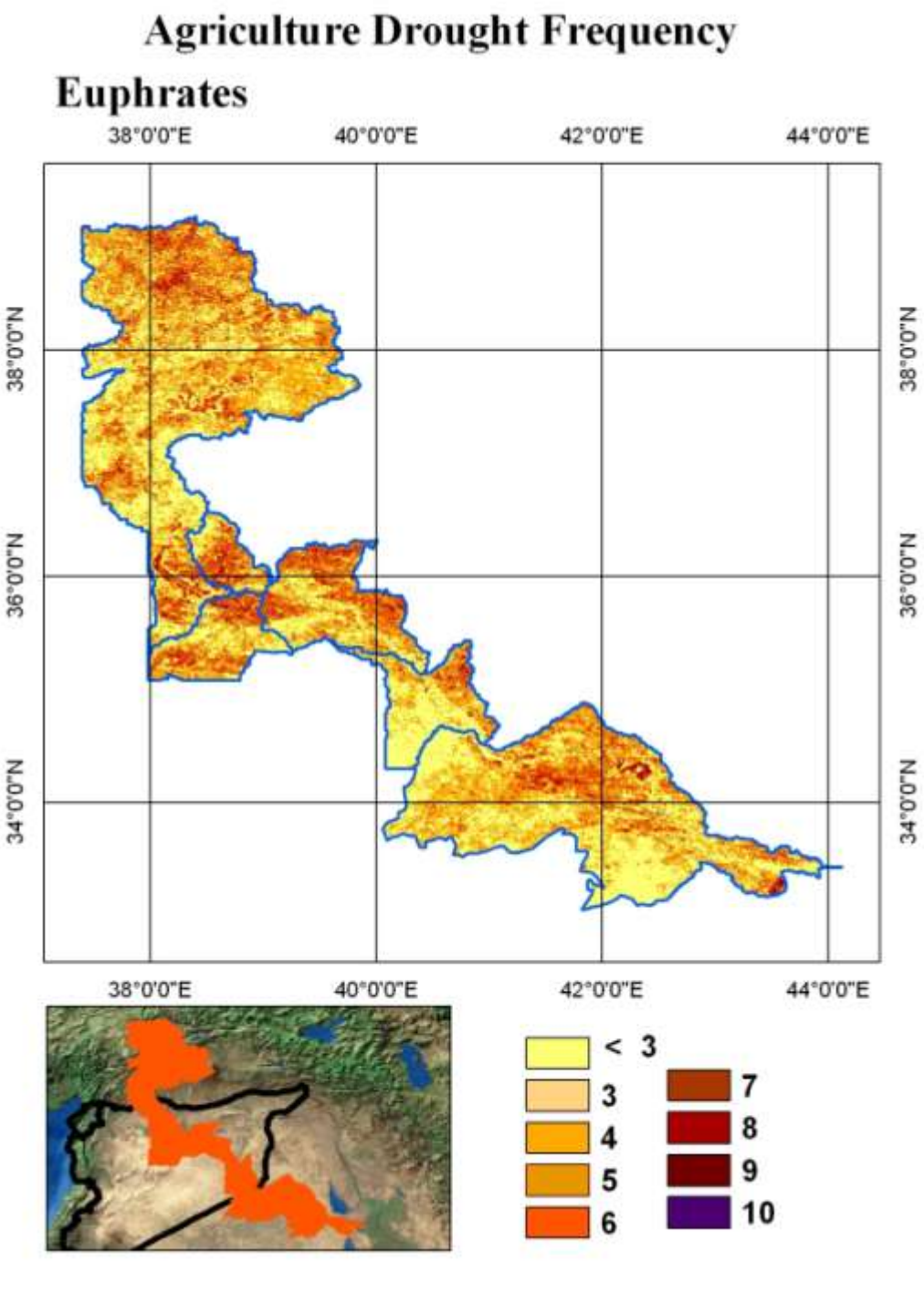


Variability classes	Country	Area inha	%
0	Iraq	111.10	0.00
0	Syria	654.45	0.01
0	Turkey	1480.35	0.01
1	Iraq	2718951.90	26.76
1	Syria	3342909.16	32.90
1	Turkey	3484442.76	34.29
2	Iraq	340584.77	3.35
2	Syria	129179.40	1.27
2	Turkey	78669.11	0.77
3	Iraq	21946.99	0.22
3	Syria	28161.03	0.28
3	Turkey	13368.83	0.13
		10160459.86	100

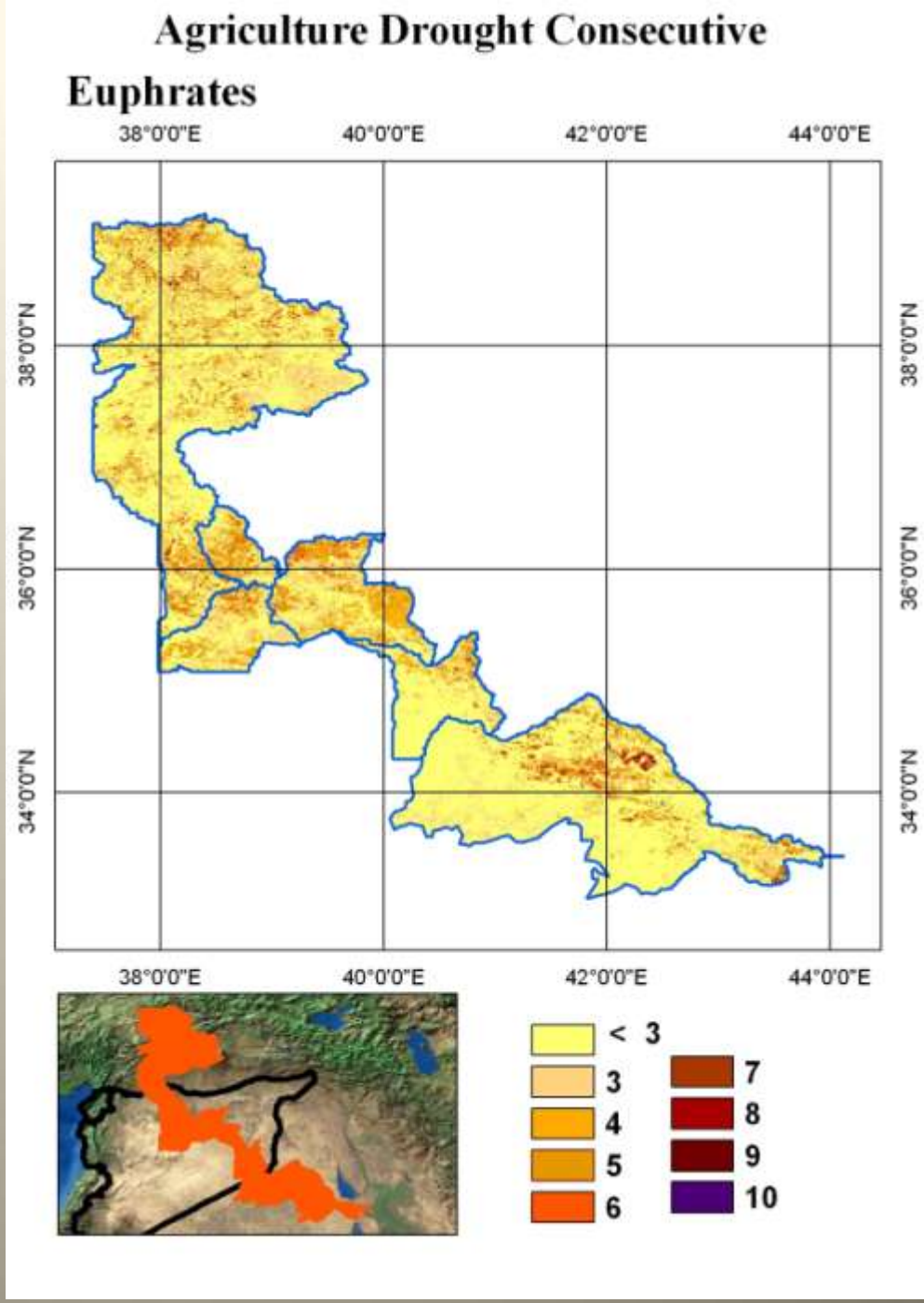


Variability classes	%
non	0.02
slight	93.96
moderate	5.40
severe	0.62

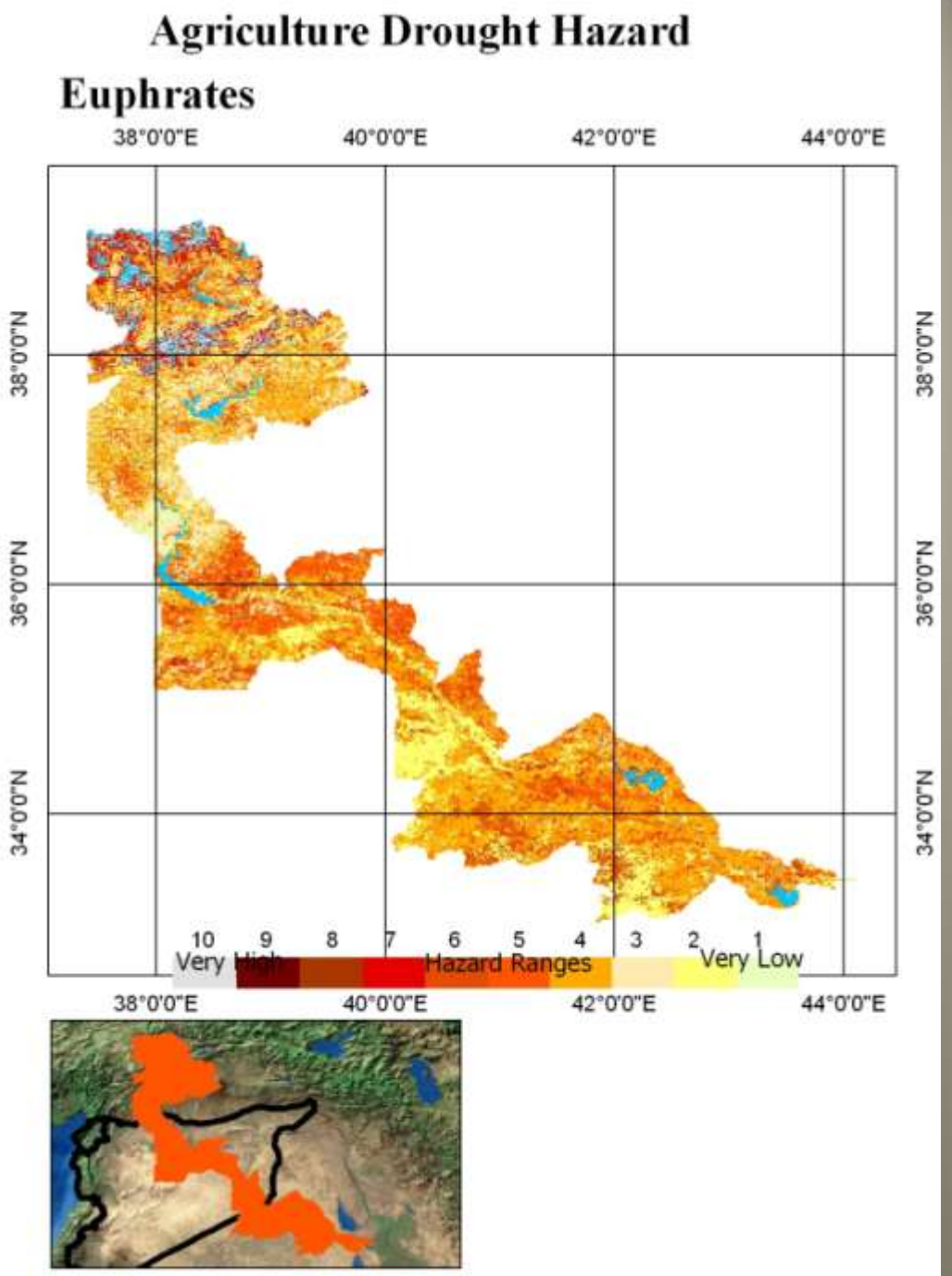
Year	Country	Area in Ha	Area in %
0	Iraq	24305.92	0.24%
0	Syria	42548.55	0.42%
0	Turkey	26682.03	0.26%
1	Iraq	205471.84	2.02%
1	Syria	237828.38	2.34%
1	Turkey	184303.54	1.81%
2	Iraq	430367.86	4.24%
2	Syria	498434.75	4.91%
2	Turkey	431243.00	4.24%
3	Iraq	649620.76	6.39%
3	Syria	683918.58	6.73%
3	Turkey	650707.69	6.40%
4	Iraq	670333.29	6.60%
4	Syria	586060.06	5.77%
4	Turkey	773732.24	7.62%
5	Iraq	528217.22	5.20%
5	Syria	501008.65	4.93%
5	Turkey	649561.94	6.39%
6	Iraq	329230.44	3.24%
6	Syria	445102.10	4.38%
6	Turkey	449197.79	4.42%
7	Iraq	170023.62	1.67%
7	Syria	323204.41	3.18%
7	Turkey	266575.55	2.62%
8	Iraq	56350.82	0.55%
8	Syria	148552.45	1.46%
8	Turkey	114161.60	1.12%
9	Iraq	12201.08	0.12%
9	Syria	32239.01	0.32%
9	Turkey	30507.63	0.30%
10	Iraq	5471.56	0.05%
10	Syria	2006.48	0.02%
10	Turkey	1287.99	0.01%
		10160458.85	



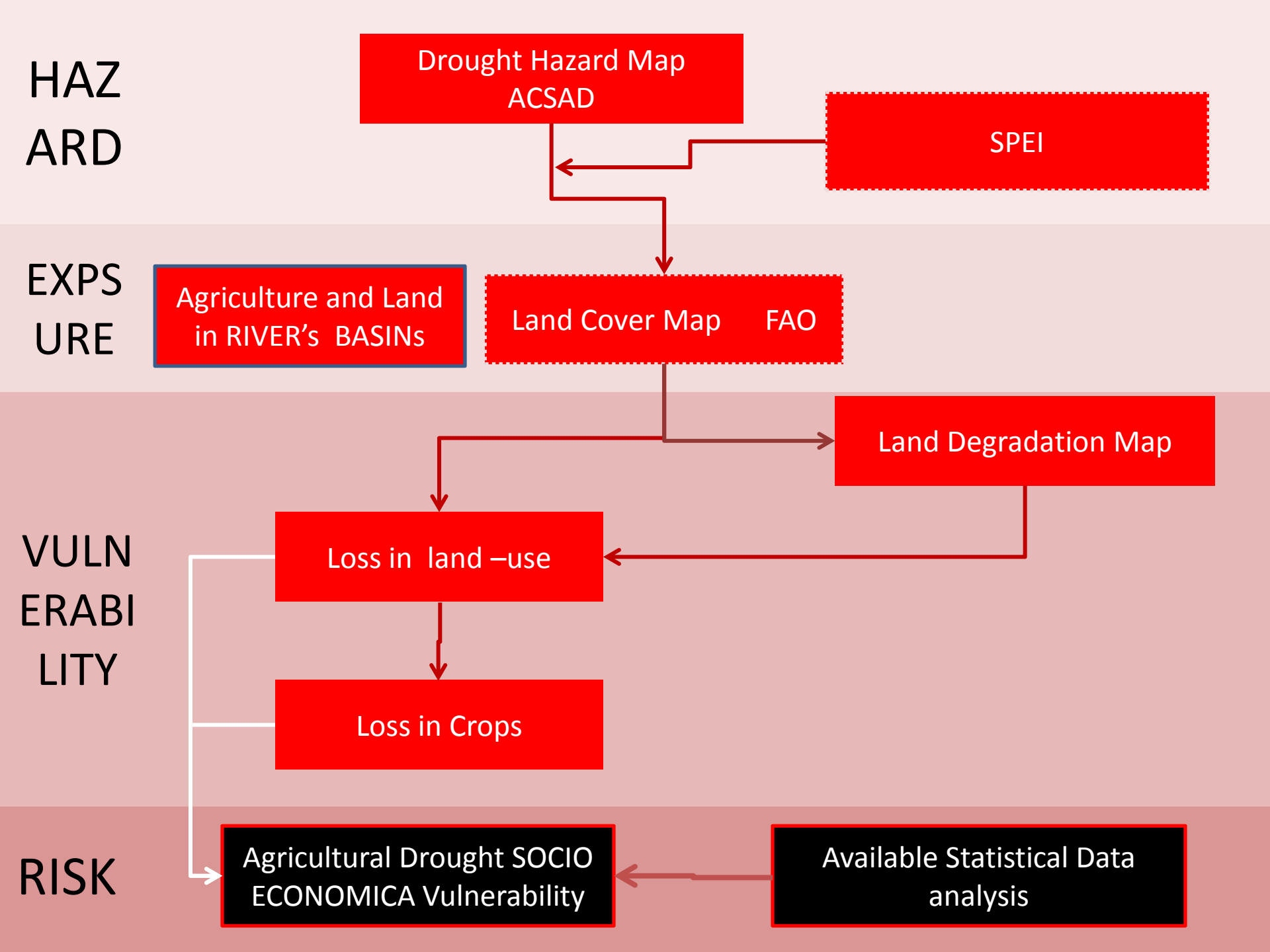
number_yr	Country	Area inHa	%
0	Iraq	24863.37	0.24
1	Iraq	727095.31	7.16
2	Iraq	1362231.38	13.41
3	Iraq	509919.59	5.02
4	Iraq	163812.20	1.61
5	Iraq	159771.63	1.57
6	Iraq	61508.39	0.61
7	Iraq	16437.88	0.16
8	Iraq	45332.94	0.45
9	Iraq	5114.28	0.05
10	Iraq	5507.42	0.05
0	Syria	43454.69	0.43
1	Syria	666478.00	6.56
2	Syria	1085108.61	10.68
3	Syria	794131.42	7.82
4	Syria	417540.86	4.11
5	Syria	373927.20	3.68
6	Syria	100420.72	0.99
7	Syria	6546.07	0.06
8	Syria	6311.73	0.06
9	Syria	4977.85	0.05
10	Syria	2006.48	0.02
0	Turkey	26795.67	0.26
1	Turkey	795131.95	7.83
2	Turkey	1144010.76	11.26
3	Turkey	932218.94	9.17
4	Turkey	333675.73	3.28
5	Turkey	198889.38	1.96
6	Turkey	49717.69	0.49
7	Turkey	32167.97	0.32
8	Turkey	38570.04	0.38
9	Turkey	25494.89	0.25
10	Turkey	1287.99	0.01
		10160459.03	100.00



HAZARD Classes ADH	Area_ha	%
1	326167.73	2.11
2	2149051.76	13.89
3	2062734.96	13.33
4	5714836.02	36.93
5	2497874.28	16.14
6	981703.62	6.34
7	610905.57	3.95
8	323254.14	2.09
9	4022.18	0.03
10	264452.30	1.71
Water	538039.83	0.03
	15473042.38	



Land Cover	Level of Hazard	Area in Ha	%
Rainfed croplands	Non	144578.94	0.93
	Slight	435585.57	2.82
	Moderate	151012.13	0.98
	Severe	12466.21	0.08
Mosaic Croplands/Vegetation	Non	480390.99	3.10
	Slight	2285100.40	14.77
	Moderate	801695.97	5.18
	Severe	253914.94	1.64
Forest	Non	1185.46	0.01
	Slight	1830.97	0.01
	Moderate	780.59	0.01
	Severe	59.34	0.00
Mosaic Forest-Shrubland/Grassland	Non	51912.27	0.34
	Slight	170054.00	1.10
	Moderate	109694.13	0.71
	Severe	43378.62	0.28
Rangelands	Non	212340.83	1.37
	Slight	737023.70	4.76
	Moderate	362344.36	2.34
	Severe	124332.37	0.80


HAZ
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Drought Hazard Map
ACSAD
SPEI
EXPS
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Agriculture and Land
in RIVER's BASINs
Land Cover Map FAO
Land Degradation Map
VULN
ERABI
LITY
Loss in land –use
Loss in Crops
RISK
Agricultural Drought SOCIO
ECONOMICA Vulnerability
Available Statistical Data
analysis

ECONOMICAL INDICATOR

EcA – A. Change in GDP Million US$

EcB - B. GNI/person %

EcC - C. Annual Change in Share of Agriculture value added in total GDP (% GDP)Agriculture

EcD - D. Agriculture, Value Added per Agricultural Worker

EcE - E. Evaluation of the value of total agriculture production and food production value (million of 2004-2006 in US $)

EcA
Change in GDP Million US$

1	GDP more than 1000 Million US$
2	750 - 1000
3	500 – 750 Million US$
4	250 - 500 Million US$
5	100 - 250 Million US$
6	50 - 100 Million US$
7	less than 50

EcB
GNI/person %

1	>500%
2	250 – 500%
3	100 – 250 %
4	50 – 100%
5	0 – 50 %
6	0 – (10)
7	(10) – (20)

EcC -
Annual Change in Share of Agriculture value added in total GDP (% GDP)Agriculture

1	>500%
2	250 – 500%
3	100 – 250 %
4	50 – 100%
5	0 – 50 %
6	0 – (10)
7	(10) – (20)

EcD -
Agriculture, Value Added per Agricultural Worker

1	>100%
2	50 – 100%
3	25 – 50 %
4	0 – 25%
5	No change
6	0 - (25%)
7	< (25)

EcE –
Evaluation of the value of total agriculture production and food production value (million of 2004-2006 in US $)

1	>100%
2	50 – 100%
3	25 – 50 %
4	0 – 25%
5	0 - (25%)
6	(25) – (50)
7	➢ (50)

POPULATION

PoA - Total population Change %

PoB - Females % of labour force in Agriculture

PoC - Annual Agriculture Population %

PoD –Change in Rural Population % of total population %

PoE – Population dependent on Agri. [ratio/ha/capita, 2009]

PoF – Population economically active in Agri. [ratio/ha/capita, 2009]

PoA –
Total population Change %

1	>10
2	5 - 10
3	4 - 5
4	3 - 4
5	2 - 3
6	1 – 2
7	less than 1

PoB –
Females % of labour force in Agriculture

1	>10
2	5 - 10
3	0 - 5
4	No change
5	<0 - (1) %
6	(1) – (2)
7	less than (2)

PoC
Annual Agriculture Population %

1	➢ 10
2	5 - 10
3	0 – 5 %
4	No change
5	<0 - (5) %
6	(5) – (10)
7	< (10)

PoD –
POPULATION D. Change in Rural Population % of total population %

1	➢ 0
2	0 – (2)
3	(2) – (4)
4	(4) – (6)
5	(6) – (8)
6	(8) – (10)
7	➢ (10)

PoE –
Population dependent on Agri. [ratio/ha/capita, 2009]

1	➢ 30
2	25 - 30
3	20 - 25
4	15 - 20
5	10 – 15
6	5 - 10 %
7	<5

PoF –
Population economically active in Agri. [ratio/ha/capita, 2009]

1	➢ 30
2	25 - 30
3	20 - 25
4	15 - 20
5	10 – 15
6	5 - 10 %
7	<5

LAND USE

LuA
LAND USE A. change in Arable land %

LuB
LAND USE change in Forest cover %

LuC
LAND USE Change in Permanent crops Cover %

LuD
Change in Crop Production %

LuE
Evaluation of Crop Production Value Per Ha. Value 2004-2006 in ($)
Crop Production Per Ha. of Land Use for the year 2009 US$

LuA

LAND USE A. change in Arable land %

1	>100%
2	50 – 100%
3	0 – 50 %
4	No change
5	0 - (25%)
6	(25) – (50)
7	➢ (50)

LuB

LAND USE change in Forest cover %

1	➢ 25
2	10 – 25%
3	0 - 10
4	No change
5	0 - (25%)
6	(25) – (50)
7	>(50)

LuC

LAND USE Change in

Permanent crops Cover %

1	>100%
2	50 – 100%
3	0 – 50 %
4	No change
5	0 - (25%)
6	(25) – (50)
7	➢ (50)

LuD

Change in Crop Production %

1	>100%
2	50 – 100%
3	0 – 50 %
4	No change
5	0 - (25%)
6	(25) – (50)
7	➢ (50)

LuE

Evaluation of Crop Production Value Per Ha. Value 2004-2006 in ($)

Crop Production Per Ha. of Land Use for the year 2009 US$

1	more than 2500 US$ per Ha
2	2000 – 2500 US$ per Ha
3	1500 – 2000 US$ per Ha
4	1000- 1500 US$ per Ha
5	500-1000 US$ per Ha
6	250 - 500 US$ per Ha
7	less than 250 US$ per Ha

WATER AVAILABILITY

WaA

WATER AVAILABILITY A.

Freshwater availability per capita %

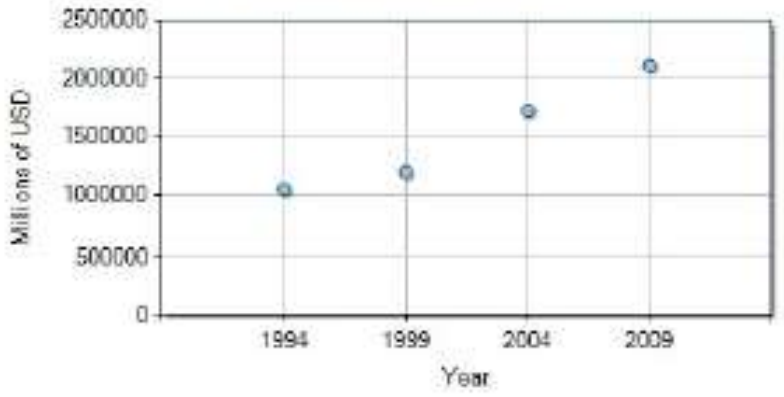
1	No change
2	(1) – (10)
3	(10) – 20)
4	(20 – 30)
5	(30 – 40)
6	(40) – (50)
7	➢ (50)

Italy

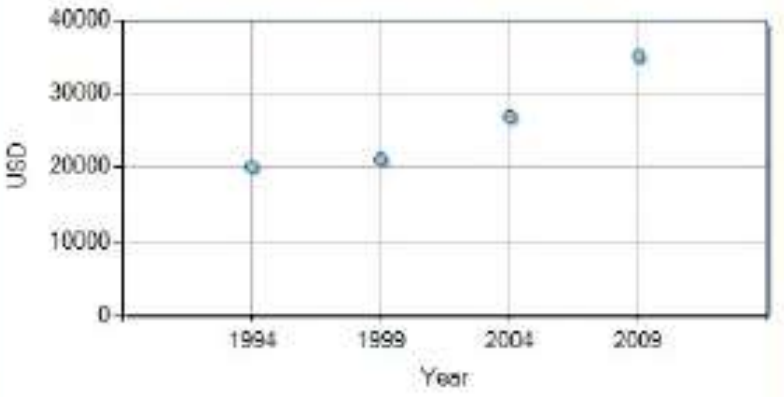
FAOSTAT

ECONOMIC INDICATORS

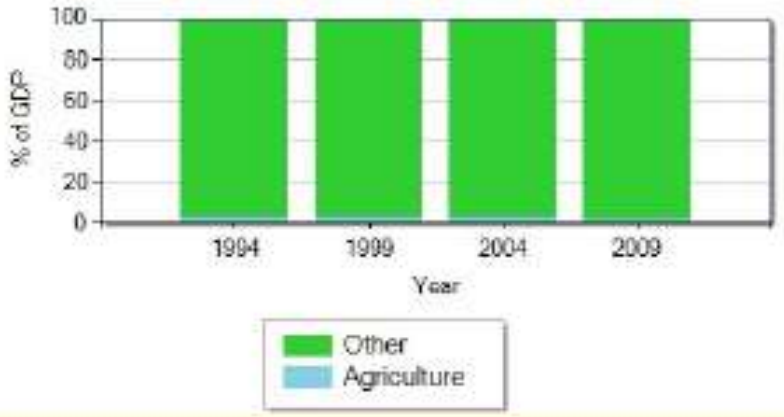
Gross domestic product



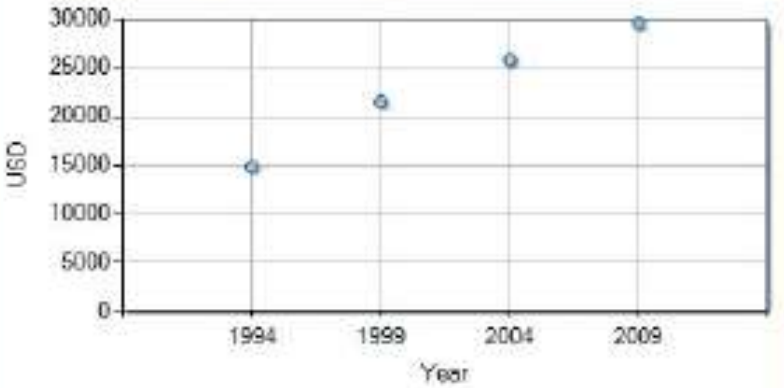
Gross national income per capita



Share of Agriculture value added in total GDP



Agriculture, value added per agricultural worker



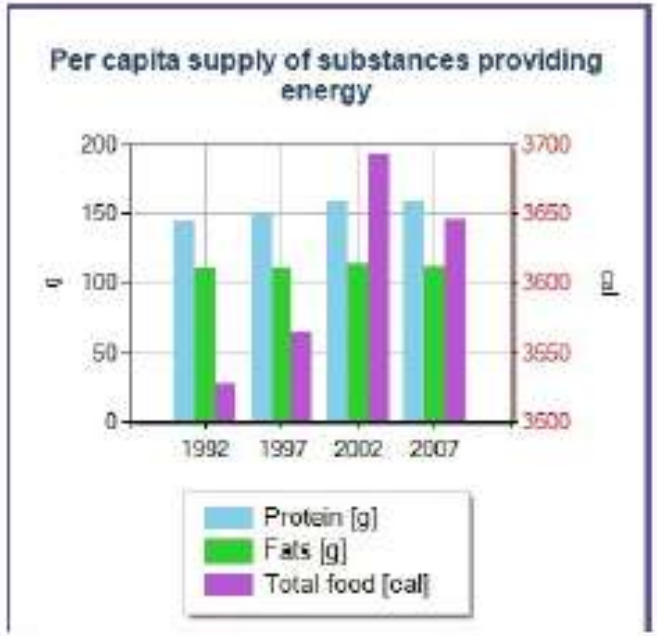
FOOD, NUTRITION AND FOOD SECURITY

Per capita food supply				
	Quantity [kcal/capita/day]			
	1992	1997	2002	2007
Food Supply	3541	3577	3699	3634

Food Aid shipments				
	Quantity [1000 t]			
	--	--	--	--
Cereals	n.a.	n.a.	n.a.	n.a.

Prevalence of undernutrition				
	Prevalence [%]			
	--	--	--	--
Undernutrition	n.a.	n.a.	n.a.	n.a.

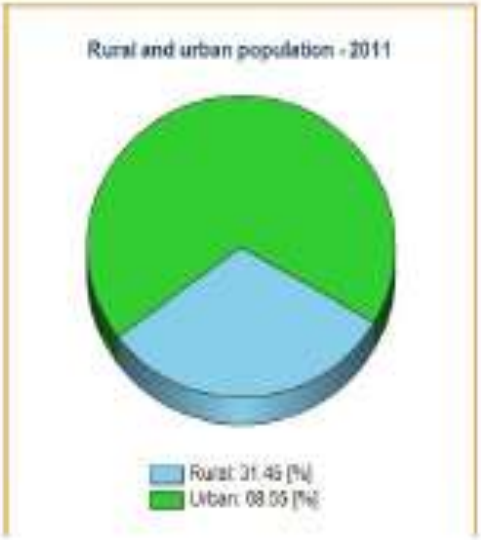
Top Ten commodities Availability for consumption 2007		
	Commodity	Quantity [kcal/capita/day]
1	Wheat	1036
2	Olive Oil	339
3	Sugar (Raw Equivalent)	289
4	Pigmeat	193
5	Bovine Meat	132
6	Soyabean Oil	109
7	Sunflowerseed Oil	103
8	Fats, Animals, Raw	87
9	Wine	82
10	Potatoes	69



POPULATION

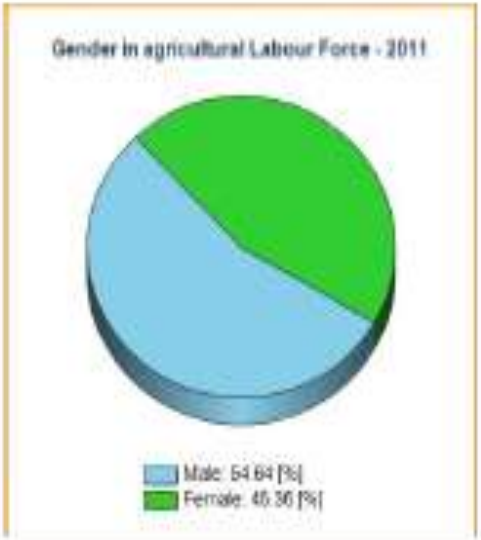
Evolution of population and labour force size

	Size [Millions]				Annual growth rate [%]		
	1996	2001	2006	2011	1996-2001	2001-2006	2006-2011
Total population	56.94	57.20	59.08	60.79	0.09	0.65	0.57
Agricultural population	3.67	2.90	2.34	1.86	-4.6	-4.2	-4.28
Total labour force	23.00	23.73	24.87	26.16	0.63	0.94	1.02
Labour force in agriculture	1.48	1.20	0.96	0.81	-4.11	-3.97	-3.74



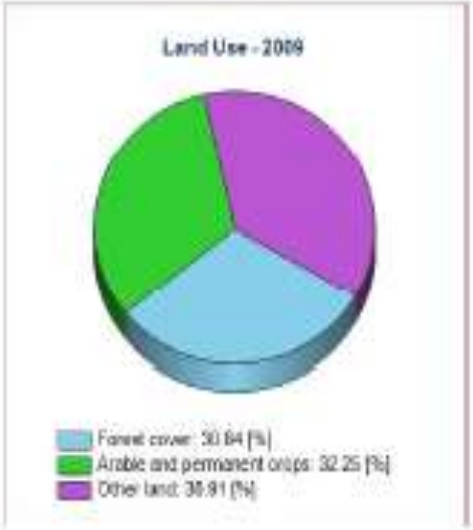
Evolution of population and labour force composition

	Share [%]				Annual growth rate [%]		
	1996	2001	2006	2011	1996-2001	2001-2006	2006-2011
Rural population [% of total population]	33.02	32.71	32.27	31.45	-0.19	-0.27	-0.51
Labour force in agriculture [% of total labour force]	6.45	5.06	3.96	3.09	-4.74	-4.78	-4.84
Females [% of labour force in agriculture]	39.35	41.43	42.94	45.49	1.04	0.72	1.16



LAND USE AND AGRICULTURAL INPUTS

Evolution of land use							
	Area [Millions of ha]				Annual growth rate [%]		
	1994	1999	2004	2009	1994-1999	1999-2004	2004-2009
Total area	29.41	29.41	29.41	29.41	0	0	0
Arable land	8.33	8.54	7.98	6.68	0.5	-1.35	-2.92
Permanent crops	2.81	2.88	2.55	2.61	0.49	-2.4	0.47
Forest cover	7.90	8.29	8.68	9.07	0.97	0.92	0.88



Arable land and land under permanent crops availability (ratio per person)				
	Ratio [ha]			
	1994	1999	2004	2009
Total population	0.20	0.20	0.18	0.16
Population dependent on agriculture	2.75	3.60	4.13	4.61
Population economically active in agriculture	6.80	6.77	9.77	10.77

AGRICULTURE DROUGHT and ECONOMICAL INDICATOR

EcA – A. Change in GDP Million US$

EcB - B. GNI/person %

EcC - C. Annual Change in Share of Agriculture value added in total GDP (% GDP)Agriculture

EcD - D. Agriculture, Value Added per Agricultural Worker

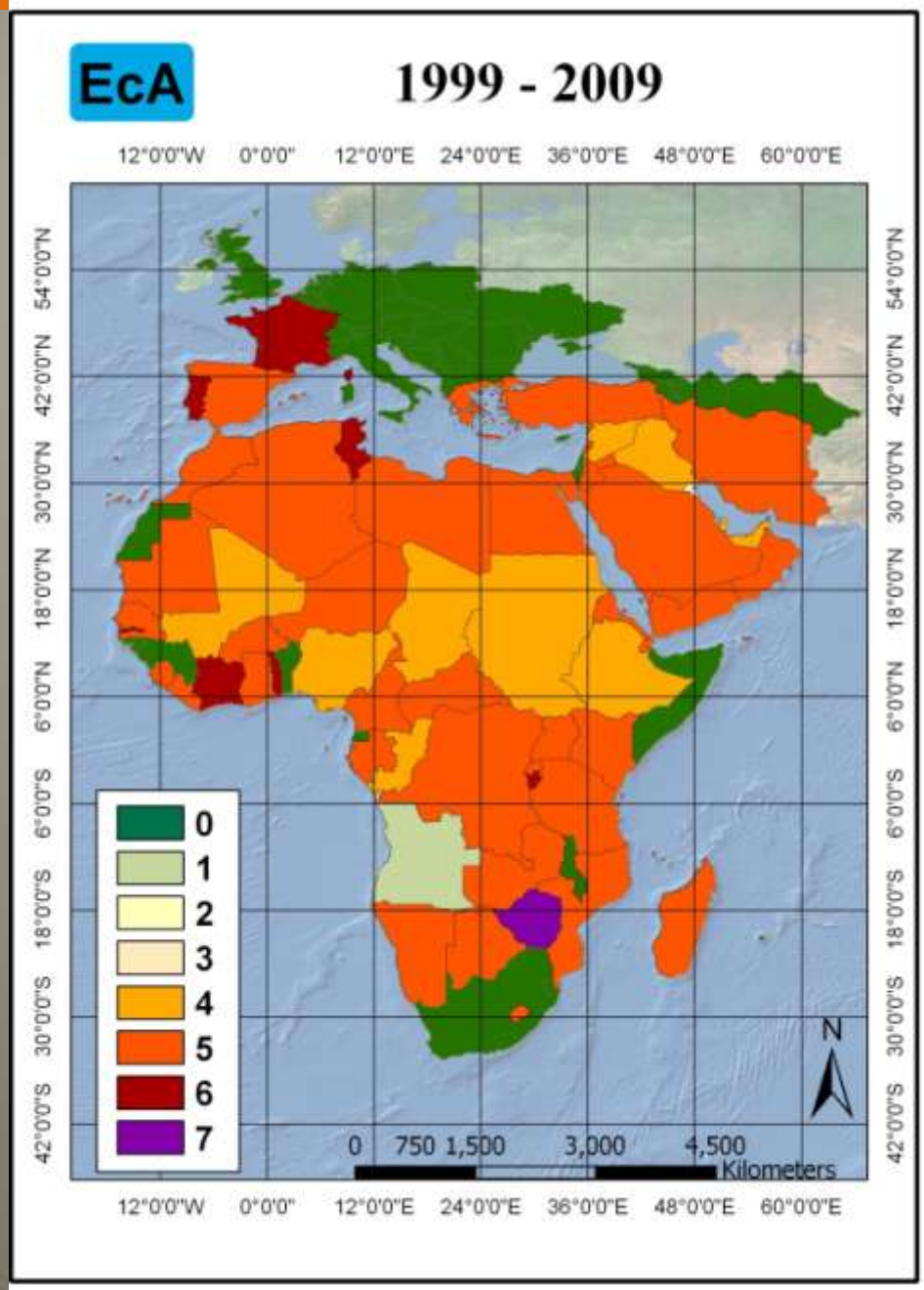
EcE - E. Evaluation of the value of total agriculture production and food production value (million of 2004-2006 in US $)

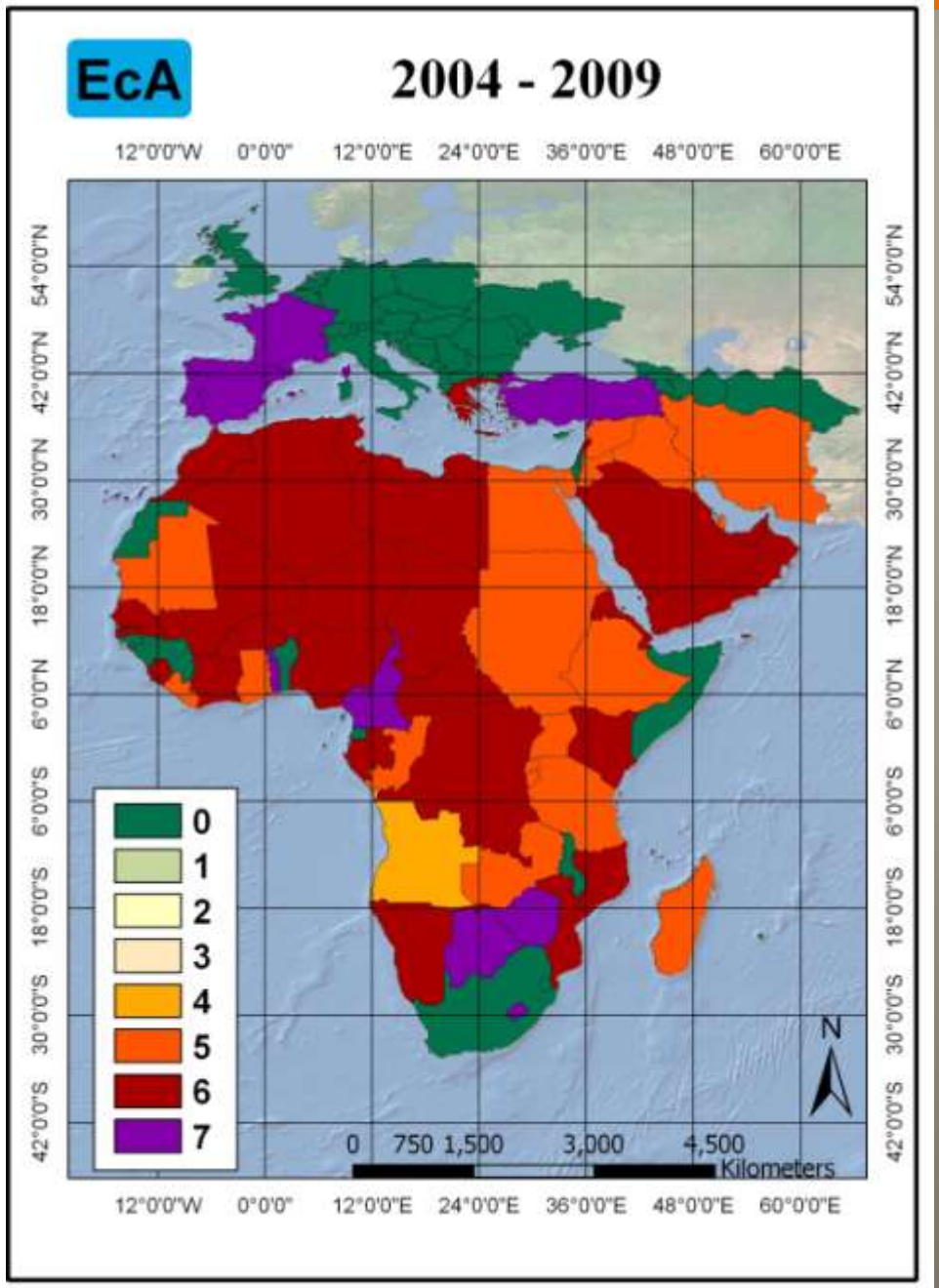
Countries	ADH M H	ADH ALL	Ld M H	LD ALL	EcA	EcA	EcB	EcB	EcC	EcC	EcD	EcD	EcE	EcE
	2000 - 2011	2000 - 2011	1999 - 2011	1999 - 2011	2009 - 1999	2009 - 2004	2009 - 2004	2009- 1999	2009 - 2004	2009 - 1999	2009 - 2004	2009- 1999	2010- 2005	2010- 2000
Equatorial Guinea	7	5	5	6										
Eritrea	7	5	6	6	5	6	4	4	5	3	6	7	5	3
Greece	7	6	6	6	5	6	4	3	6	5	4	4	5	5
Kuwait	7	6	5	7	3	5	3	3					4	3
Lebanon	7	5	1	1	5	6	5	4	5	4	3	1	4	4
Morocco	7	5	1	1	5	6	5	5	5	3	4	1	4	3
Portugal	7	6	6	6	6	7	5	4	5	5	4	4	4	5
Qatar	7	6	2	4	4	5	4	2					3	4
Syria	7	5	3	4	4	5	4	3	5	3	4	3	5	4
Cote d Ivoire	6	4	7	7	6	6	4	4	5	3	4	3	4	4
Djibouti	6	5	7	7	5	6	5	4	5	4	4	5	1	1
France (South)	6	5	4	3	6	7	5	4	5	5	4	2	5	5
Gabon	6	5	3	3	5	6	4	3	5	4	4	3	4	4
Iran	6	4	6	6	5	5	3	3	6	4	4	3	4	3
Iraq	6	5	4	4	4	5	3	3	7	6			5	4
Italy	6	6												
Liberia	6	3	7	7	5	5	5	5	6	1			5	4
Namibia	6	6	2	1	5	6	5	3	5	3	6	4	2	1
Nigeria	6	4	5	5	4	6	3	2					4	3
Senegal	6	5		7	5	6	4	4	5	3	4	6	3	3
Spain	6	6	7	7	5	7	5	3	5	4	3	3	4	4
Tunisia	6	5	2	3	6	6	4	4	6	5	5	4	4	4
turkey	6	5	2	1	5	7	4	3	6	6	6	3	4	4

Countries	ADH M H 2000 - 2011	ADH ALL 2000 - 2011	Ld M H 1999 - 2011	LD ALL 1999 - 2011	PoA 2011 - 2006	PoA 2011 - 2001	PoB 2011- 2006	PoB 2011 - 2001	PoC 2011 - 2006	PoC 2011 - 2001	PoD 2011- 2006	PoD 2011 - 2001	PoE 2009	PoF 2009
Equatorial Guinea	7	5	5	6										
Eritrea	7	5	6	6	3	5	3	5	3	2	3	2	7	7
Greece	7	6	6	6	7	7	5	3	5	5	3	2	7	6
Kuwait	7	6	5	7	3	4	3	4	4	1	4	2	7	7
Lebanon	7	5	1	1	6	7	3	4	6	6	4	2	7	6
Morocco	7	5	1	1	6	6	4	3	3	2	5	2	7	7
Portugal	7	6	6	6	7	7	3	2	5	5	5	2	7	7
Qatar	7	6	2	4	1	1	6	4	4	4	6	2	7	7
Syria	7	5	3	4	5	5	6	1	4	3	4	2	7	7
Cote d lvoire	6	4	7	7	6	5	3	5	5	5	5	2	7	7
Djibouti	6	5	7	7	4	5	3	3	3	3	4	2	7	7
France (South)	6	5	4	3	7	7	4	6	5	6	7	3	5	1
Gabon	6	5	3	3	6	6	4	7	5	5	7	3	7	7
Iran	6	4	6	6	6	6	3	2	5	5	6	2	7	7
Iraq	6	5	4	4	4	4	3	1	5	5	1	1	7	5
Italy	6	6												
Liberia	6	3	7	7	3	3	5	6	3	2	3	2	7	7
Namibia	6	6	2	1	5	6	3	7	4	4	4	2	7	7
Nigeria	6	4	5	5	5	5	3	3	4	5	5	2	7	7
Senegal	6	5		7	4	5	5	3	3	2	3	2	7	7
Spain	6	6	7	7	6	6	4	3	5	6	3	2	6	3
Tunisia	6	5	2	3	6	6	5	3	4	5	4	2	7	6
turkey	6	5	2	1	6	6	5	4	5	5	5	2	7	7

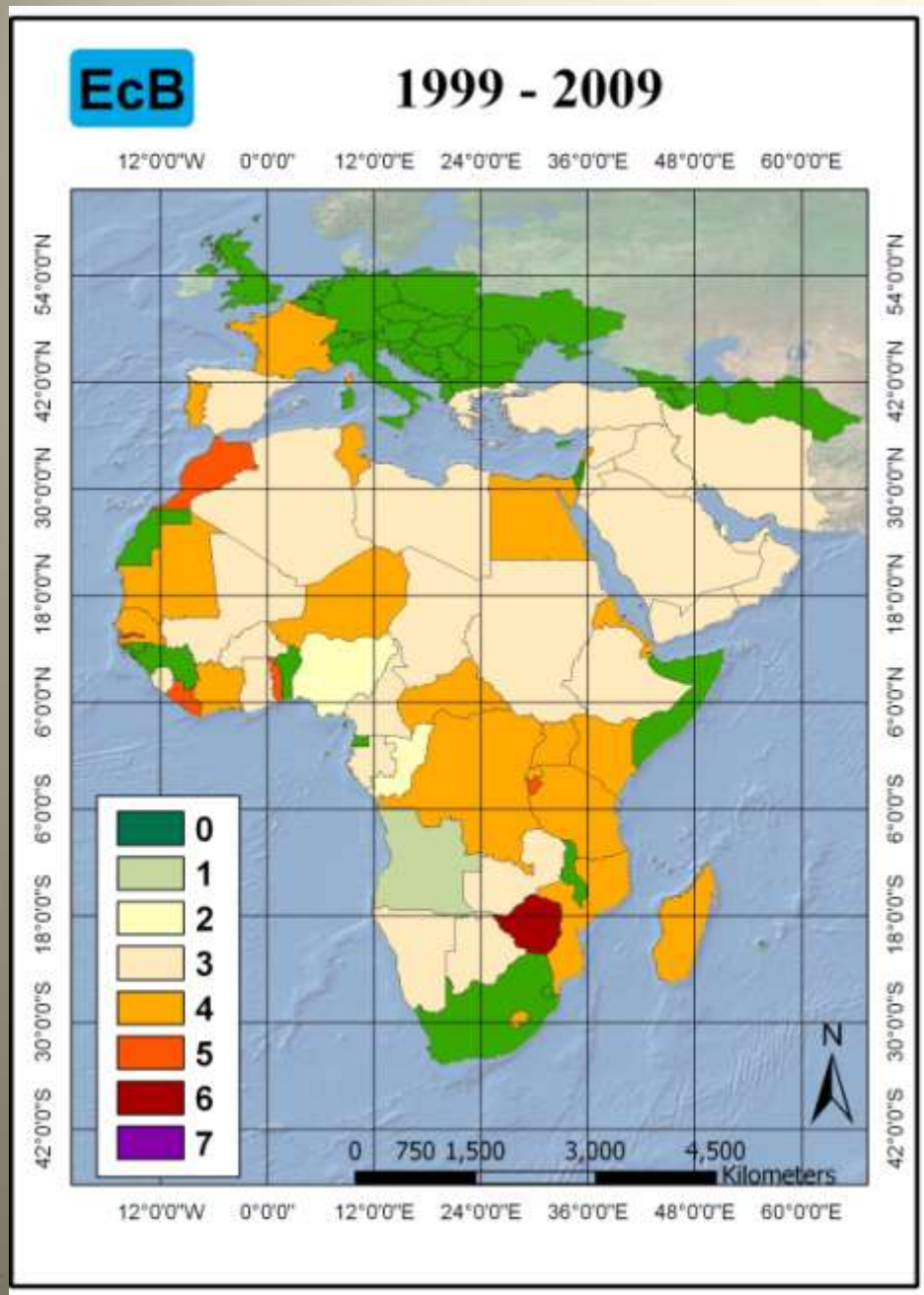
Countries	ADH M H	ADH ALL	Ld M H	LD ALL	LuA	LuA	LuB	LuB	LuC	LuC	LuD	LuD	LuE	WaA	WaA
	2000 - 2011	2000 - 2011	1999 - 2011	1999 - 2011	2009-2004	2009 - 1999	2009-2004	2009 - 1999	2009-2004	2009 - 1999	2009-2004	2009 - 1999	2009	2011-2006	2011-2001
Equatorial Guinea	7	5	5	6											
Eritrea	7	5	6	6	3	3	5	5	4	4	3	6	7	3	4
Greece	7	6	6	6	5	5	3	3	3	3	5	5	5	2	2
Kuwait	7	6	5	7	4	4	4		4	4			5		
Lebanon	7	5	1	1	4	3	4	3	4	4	5	5	1	2	3
Morocco	7	5	1	1	3	3	5	5	4	3	3	2	5	2	3
Portugal	7	6	6	6	6	6	3	3	3	3	3	3	4	2	2
Qatar	7	6	2	4	4	4			4	4	2	3	3	5	7
Syria	7	5	3	4	4	5	3	2	3	3	5	3	5	3	4
Cote d Ivoire	6	4	7	7	4	4	3	3	3	3	5	5	5	2	3
Djibouti	6	5	7	7			5	5	4	5	6	6	1	3	4
France (South)	6	5	4	3	5	5	3	3	5	5	5	5	7	2	2
Gabon	6	5	3	3	4	4	4	4	4	5	3	3	4	2	3
Iran	6	4	6	6	3	3	4	4	3	3	3	3	3	2	3
Iraq	6	5	4	4	5	5	7	7	5	5	3	3	5	3	4
Italy	6	6													
Liberia	6	3	7	7	3	3	5	5	5	3	5	5	5	3	4
Namibia	6	6	2	1	5	5	5	5	4	4	3	2	7	2	3
Nigeria	6	4	5	5	3	3	5	6	4	3	5	5	5	3	4
Senegal	6	5		7	3	3	5	5	3	4	3	3	6	3	4
Spain	6	6	7	7	5	5	3	3	5	5	3	3	4	2	3
Tunisia	6	5	2	3	5	5	3	2	3	3	3	3	5	2	2
turkey	6	5	2	1	5	5	3	2	3	3	3	3	4	3	3

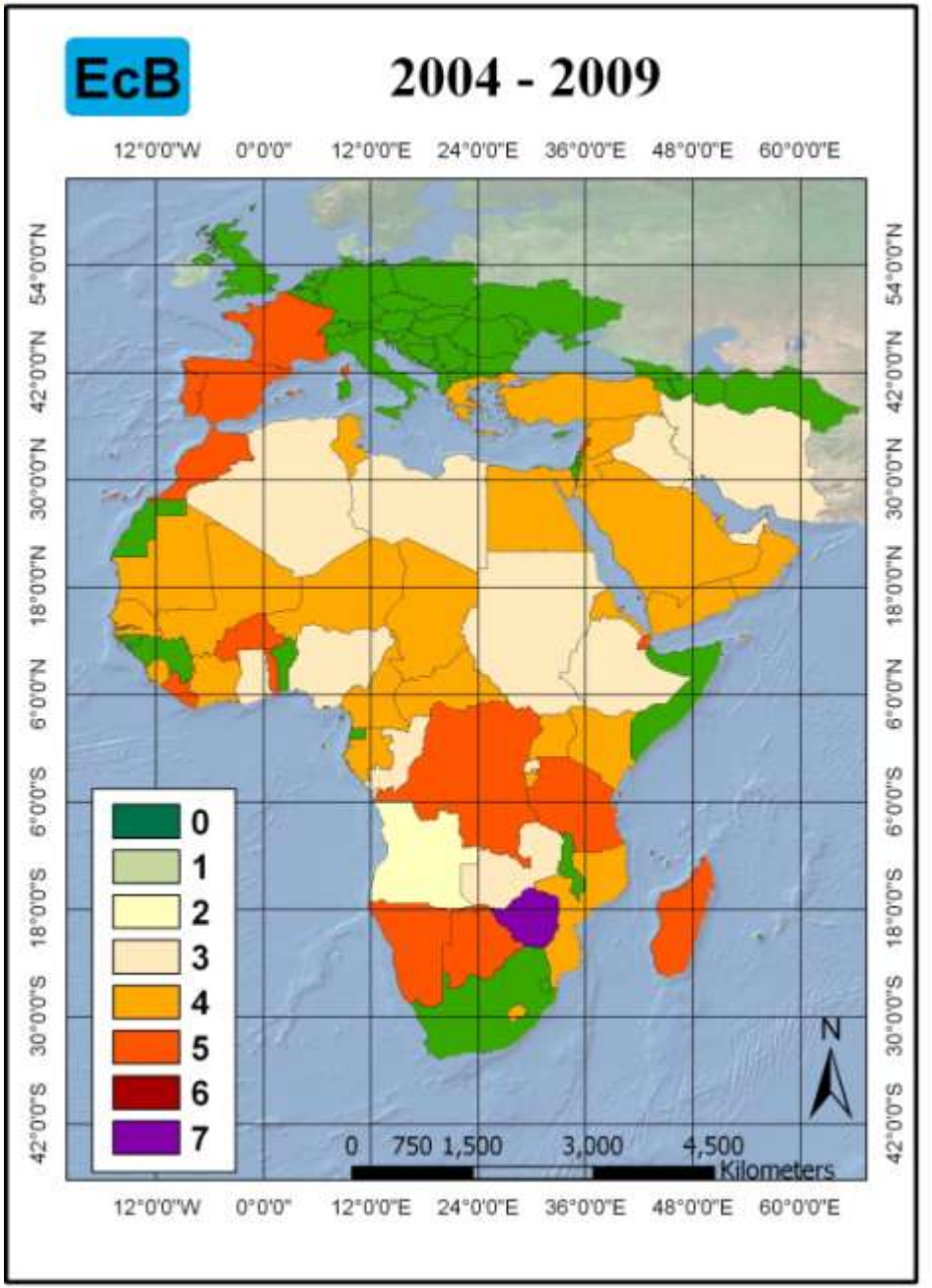
EcA – A. Change in GDP Million US$



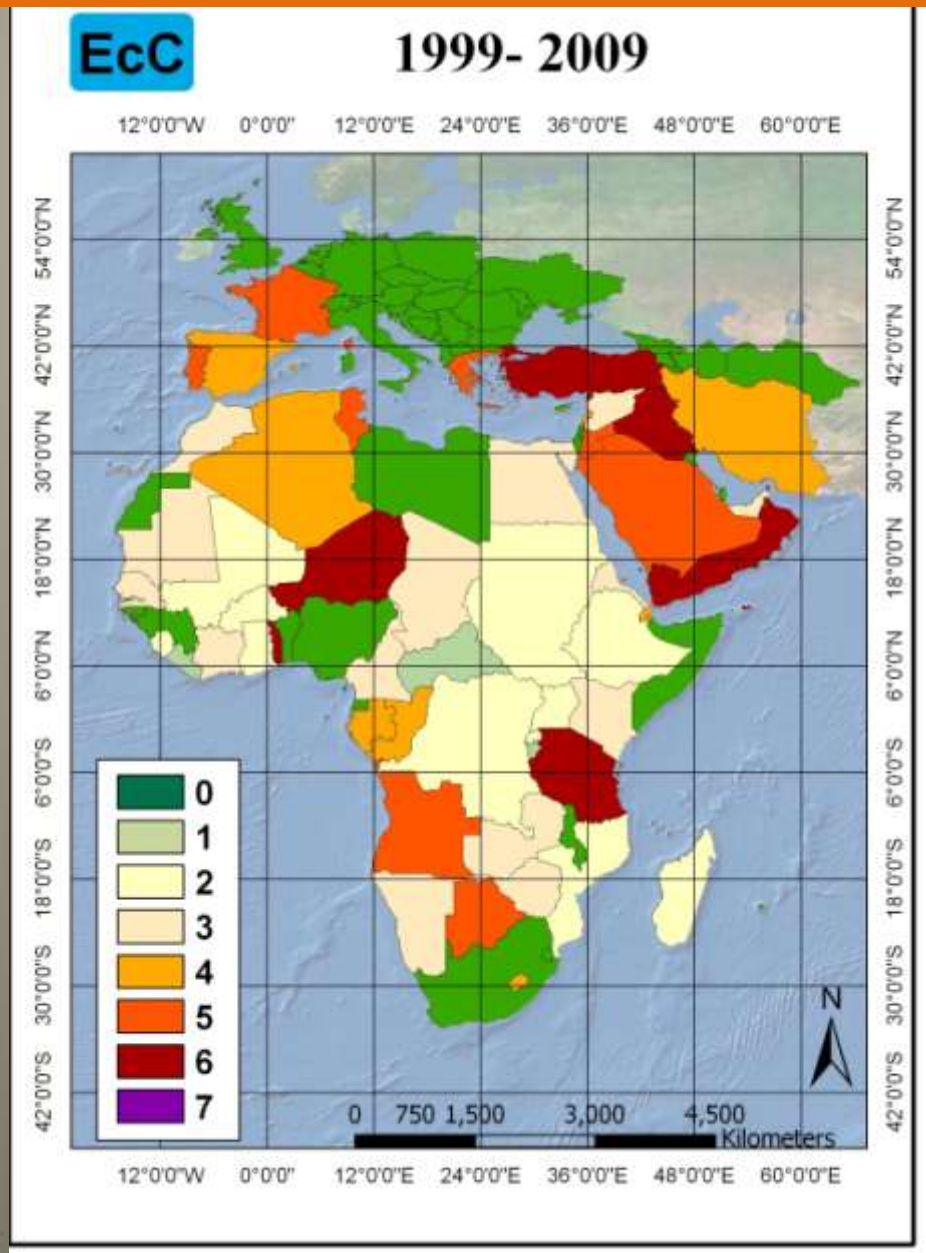


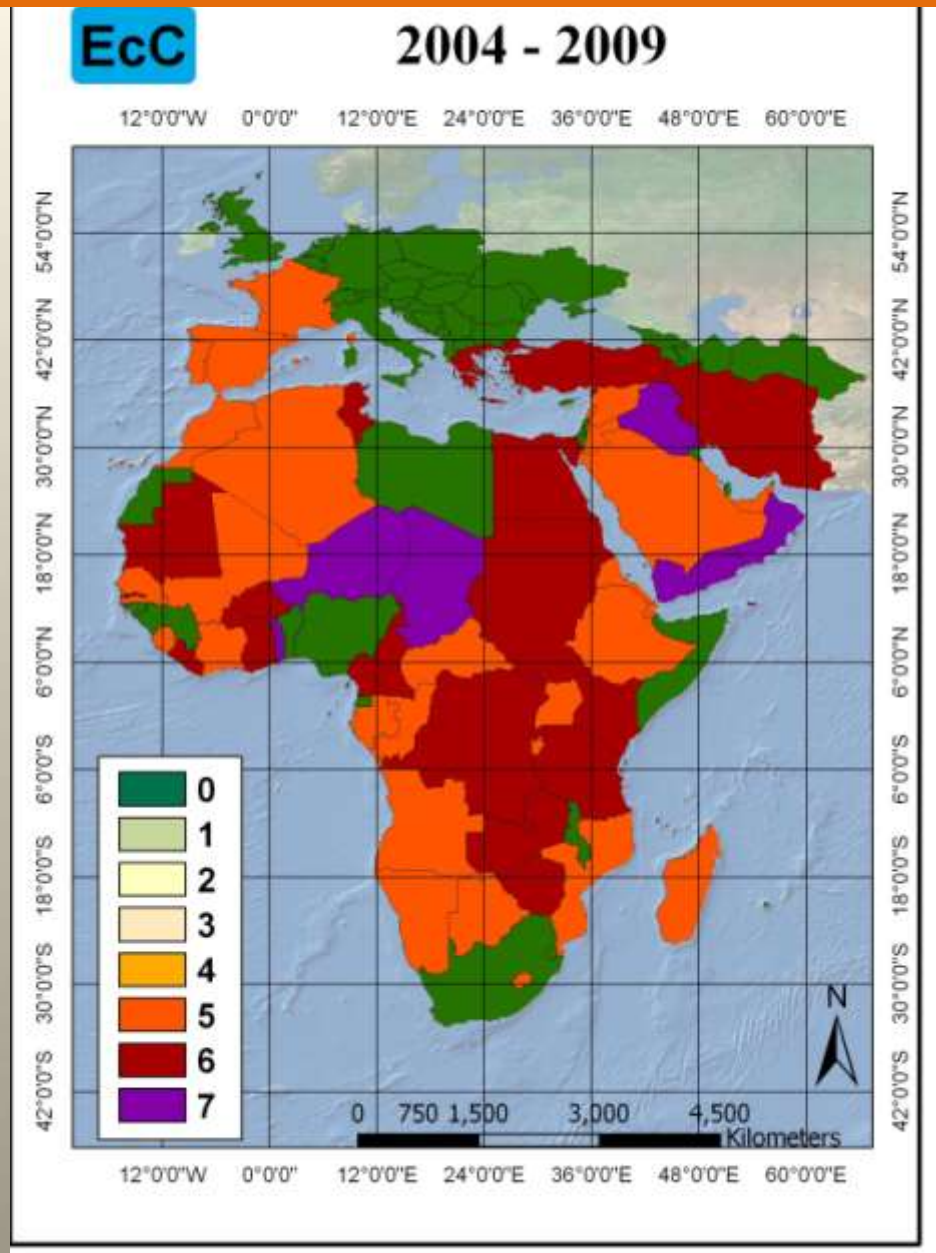
EcB - B. GNI/person %



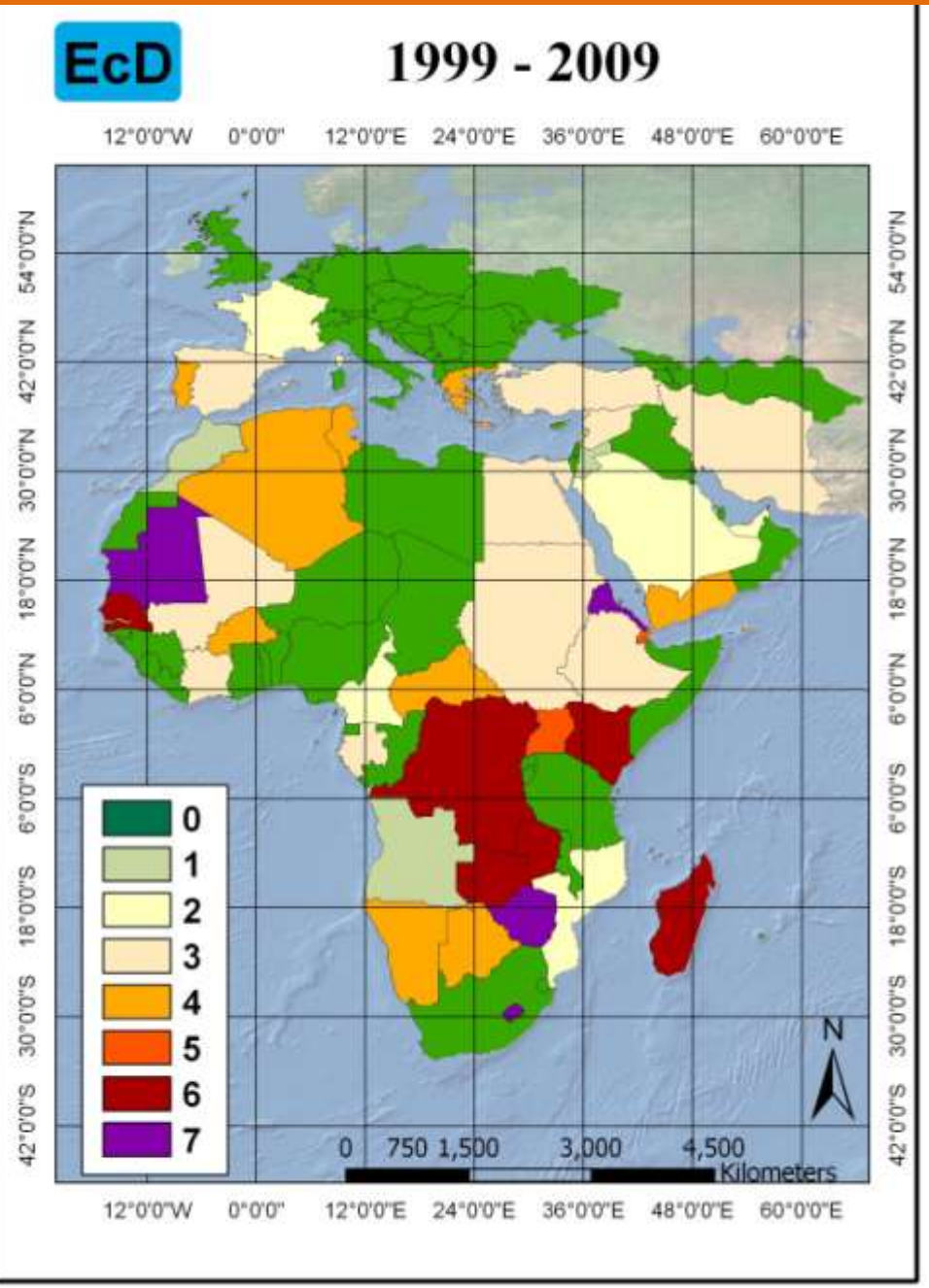


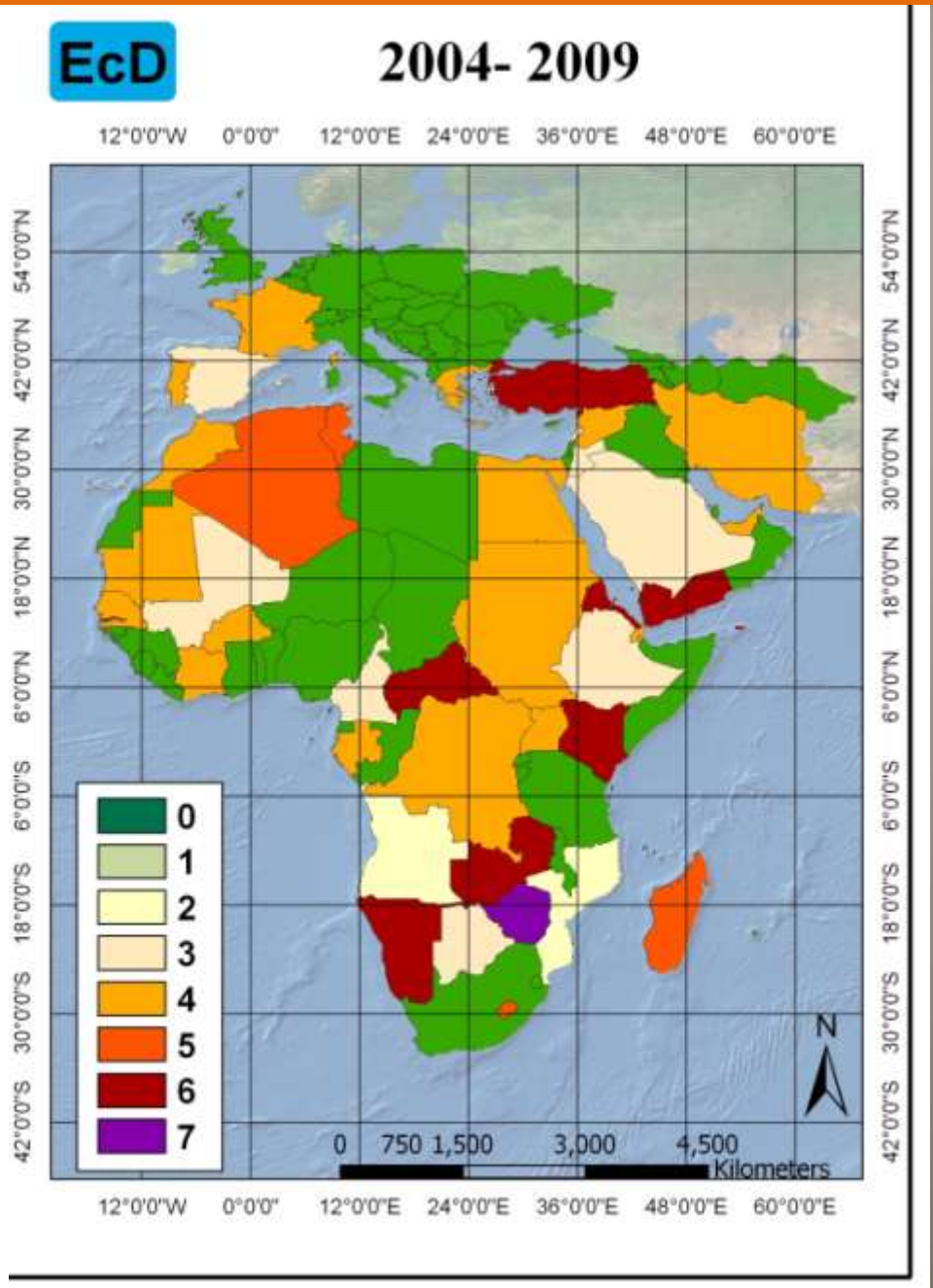
EcC - C. Annual Change in Share of Agriculture value added in total GDP (% GDP)Agriculture



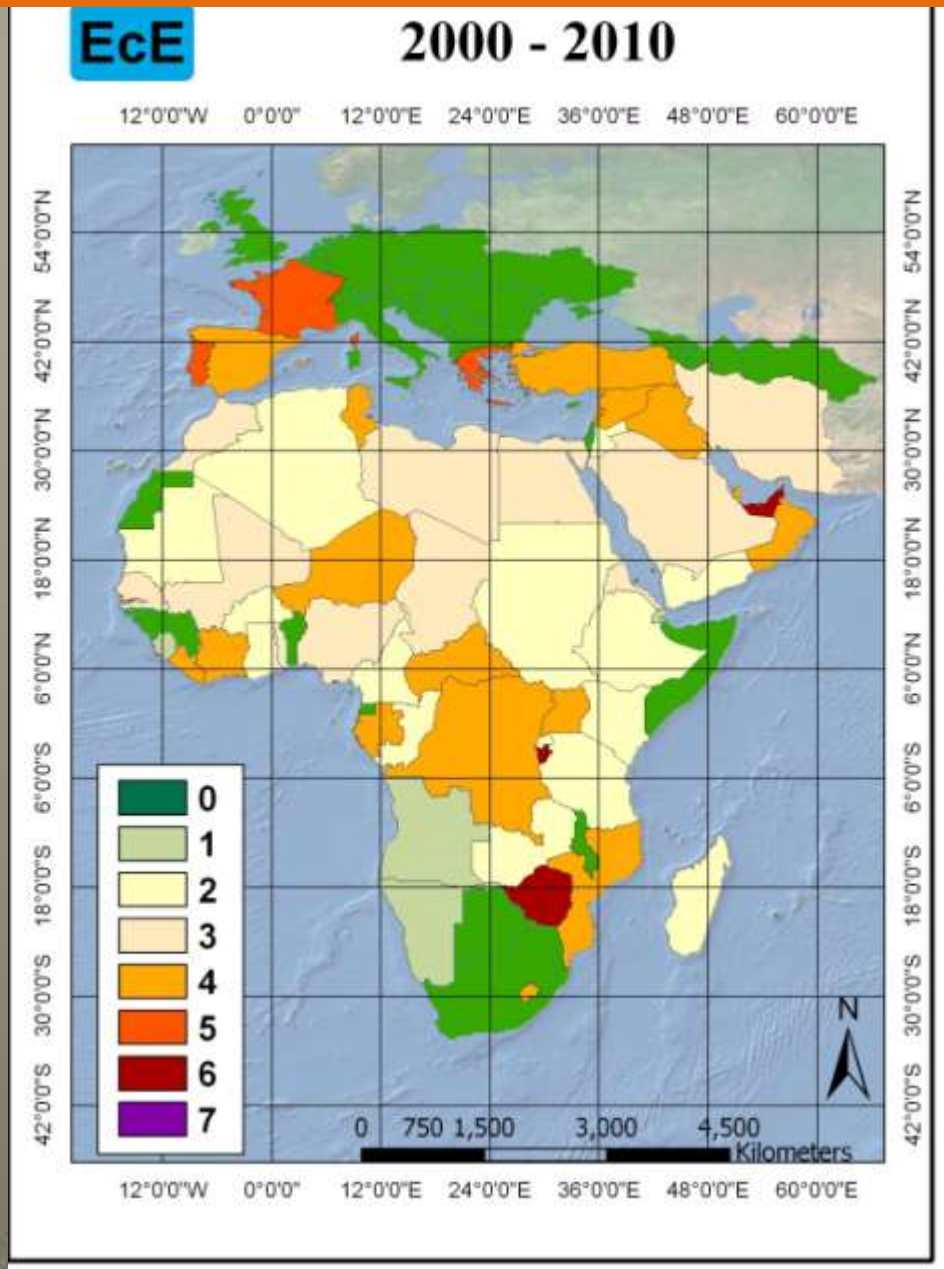


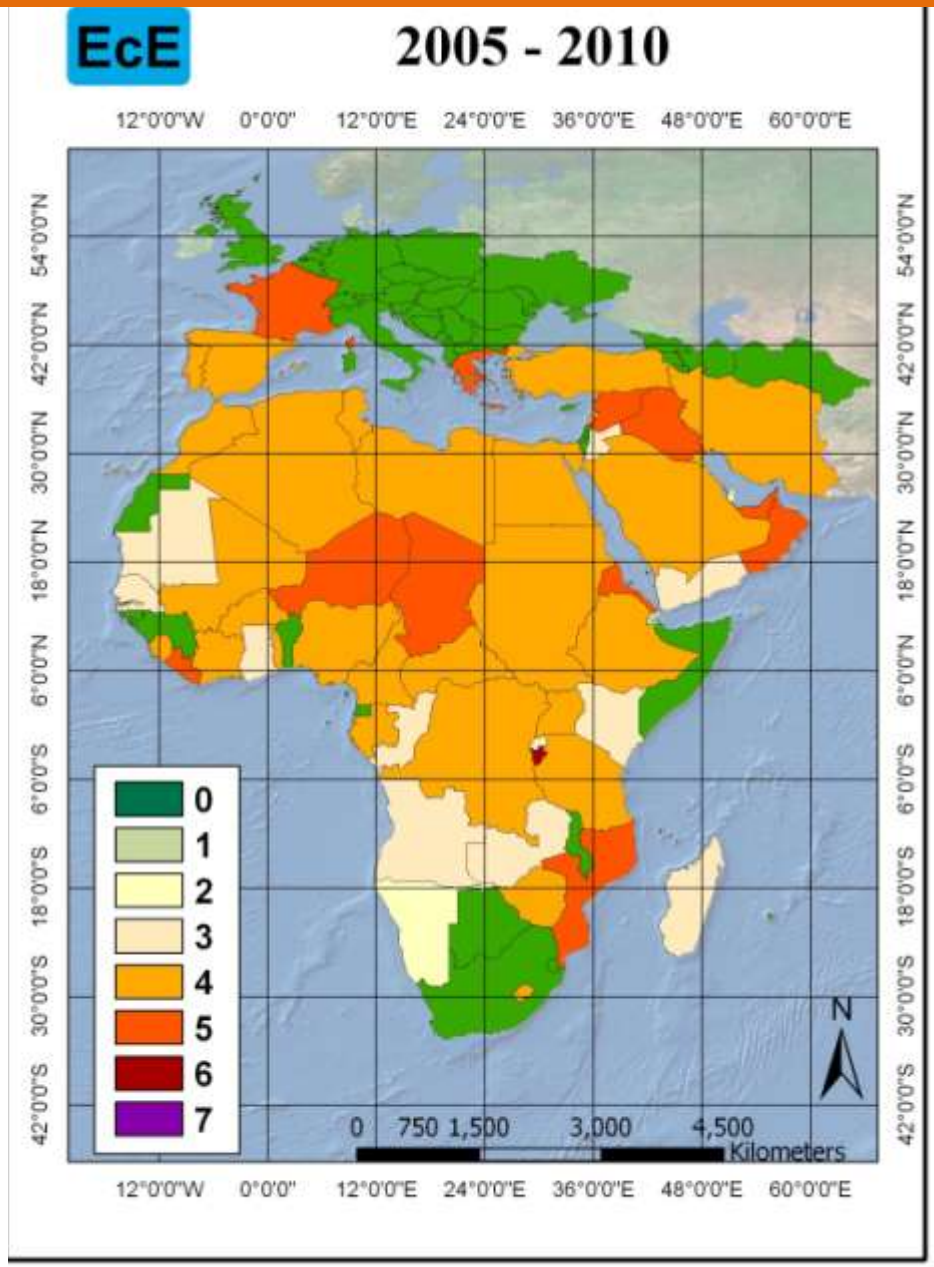
EcD - D. Agriculture, Value Added per Agricultural Worker





EcE - E. Evaluation of the value of total agriculture production and food production value (million of 2004-2006 in US $)





AGRICULTURE DROUGHT AND POPULATION INDICATORD

PoA - Total population Change %

PoB - Females % of labour force in Agriculture

PoC - Annual Agriculture Population %

PoD –Change in Rural Population % of total population %

PoE – Population dependent on Agri. [ratio/ha/capita, 2009]

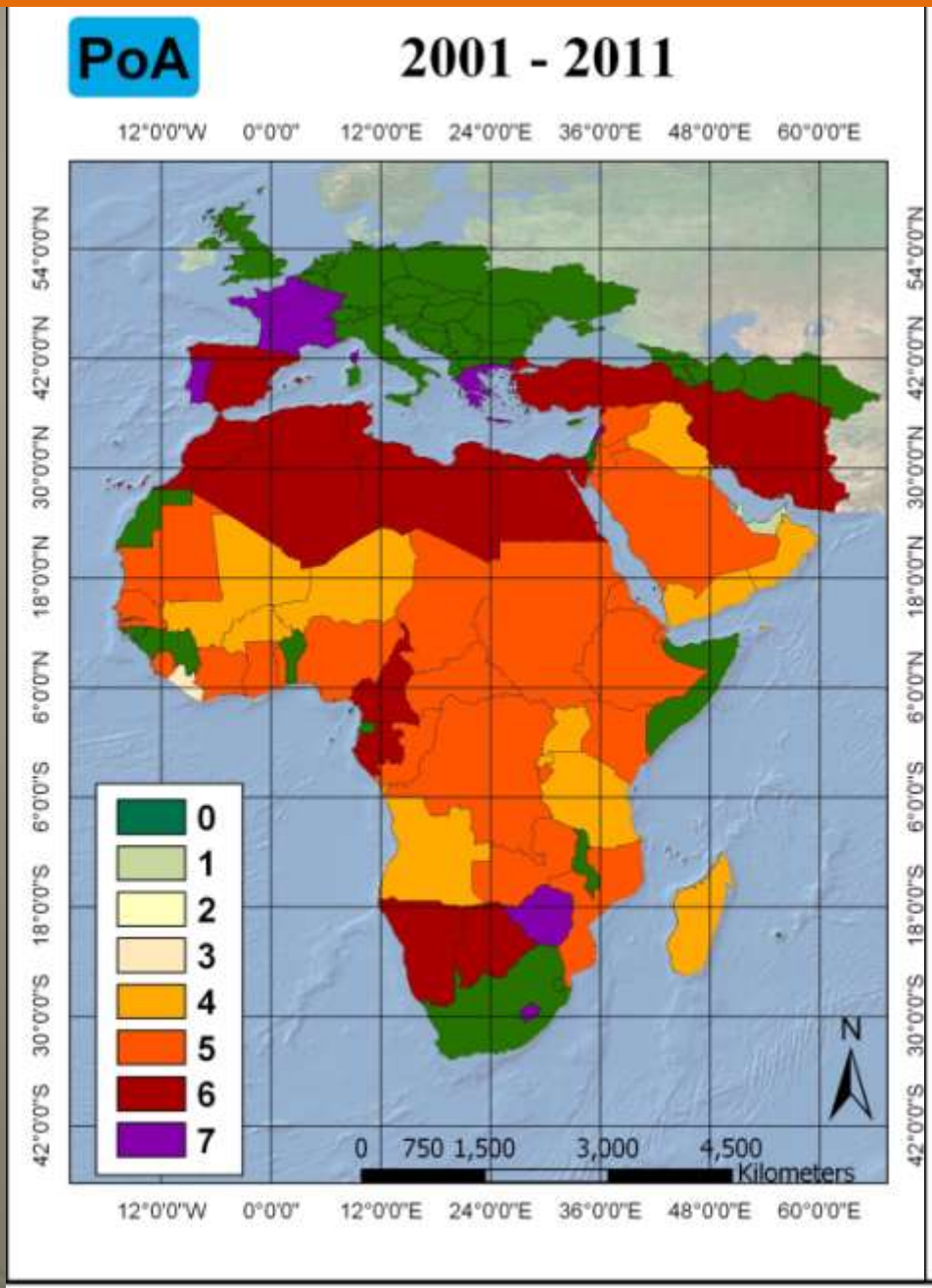
PoF – Population economically active in Agri. [ratio/ha/capita, 2009]

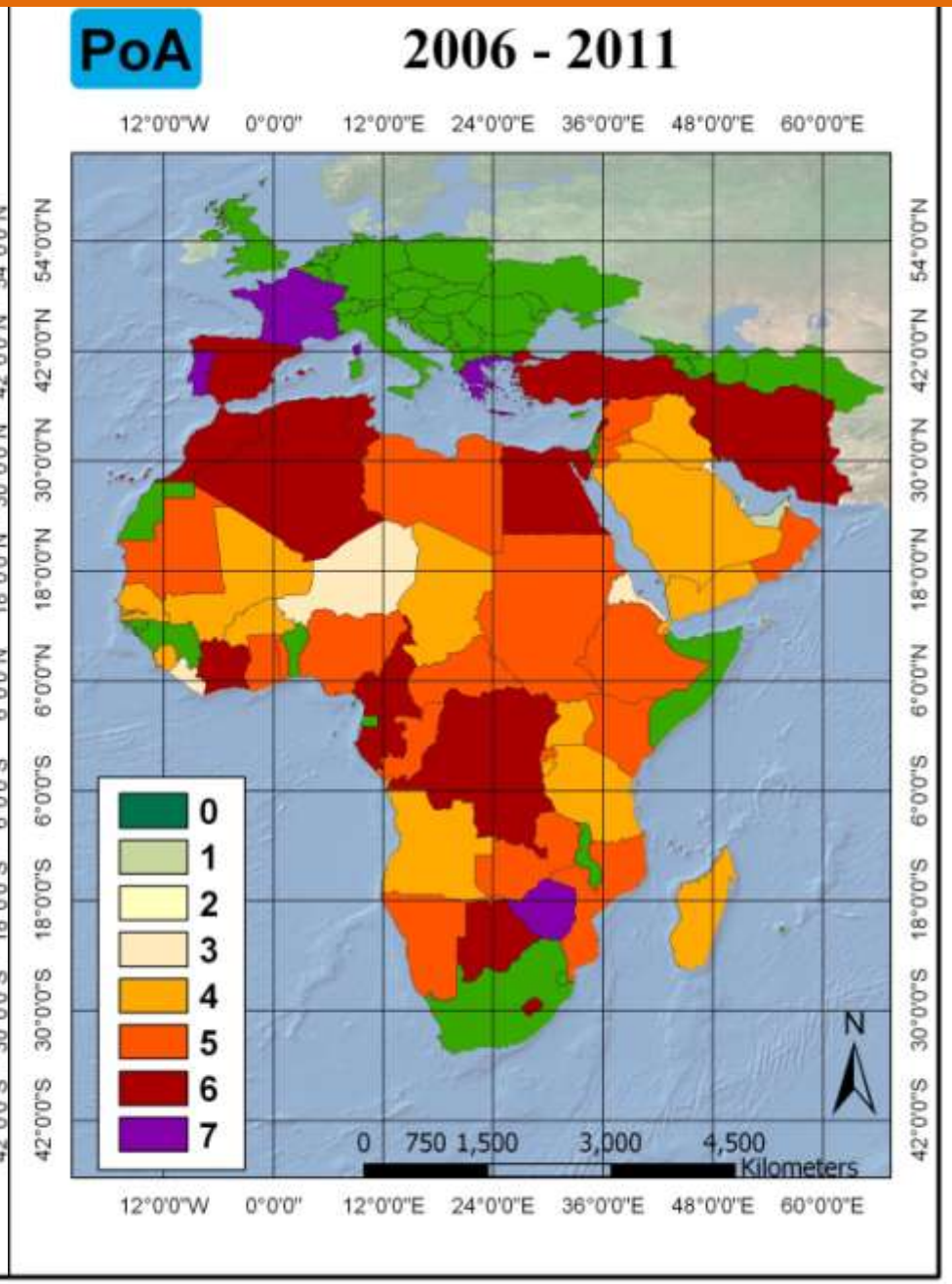
Countries	ADH M H	ADH ALL	Ld M H	LD ALL	EcA	EcA	EcB	EcB	EcC	EcC	EcD	EcD	EcE	EcE
	2000 - 2011	2000 - 2011	1999 - 2011	1999 - 2011	2009 - 1999	2009 - 2004	2009 - 2004	2009- 1999	2009 - 2004	2009 - 1999	2009 - 2004	2009- 1999	2010- 2005	2010- 2000
Botswan	5	4	6	6	5	7	5	3	5	5	3	4		
Burkina Faso	5	4	3	3	5	6	5	3	6	2	4	4	4	2
Cameroon	5	3	5	5	5	7	4	3	6	3	3	2	4	2
Chad	5	3	3	4	4	6	4	3	7	3			5	3
Ethiopia	5	4	5	4	4	5	3	3	5	2	3	3	4	2
Ghana	5	4	1	1	5	5	3	3	6	2			3	2
Kenya	5	5	5	4	5	6	4	4	6	3	6	6	3	2
Mali	5	4	3	4	4	6	4	3	5	2	3	3	4	3
Saudia	5	4	2	1	5	6	4	3	5	5	3	2	4	3
Sierra leane	5	3	4	5	5	6	4	3	5	2			4	1
South Africa	5	5												
Sudan	5	3	4	4	4	5	3	3	6	2	4	3	4	2
Togo	5	2	5	5	6	7	5	5	7	6			4	3
UAE	5	2	1	3	4	6	3	3	5	3	4	2	5	6
Algeria	**4**	3	1	4	5	6	3	3	5	4	5	4	4	2
Congo	**4**	4	4	4	4	5	3	2	5	4			3	2
Egypt	**4**	1	5	5	5	5	4	4	6	3	4	3	4	3
Jordan	**4**	3	1	2	5	5	4	3	5	5	3	1	3	2
Libya	**4**	1	1	4	5	6	3	3					4	3
Mauritania	**4**	3	1	3	5	5	4	4	6	3	4	7	3	2
Niger	**4**	3	2	4	5	6	4	4	7	6			5	4
Oman	**4**	1	1	3	5	6	4	3	7	6			5	4
Yemen	**4**	3	3	4	5	6	4	3	7	6	6	4	3	2

Countries	ADH M H	ADH ALL	Ld M H	LD ALL	PoA	PoA	PoB	PoB	PoC	PoC	PoD	PoD	PoE	PoF
	2000 - 2011	2000 - 2011	1999 - 2011	1999 - 2011	2011 - 2006	2011 - 2001	2011-2006	2011 - 2001	2011 - 2006	2011 - 2001	2011- 2006	2011 - 2001	2009	2009
Botswan	5	4	6	6	6	6	3	4	3	3			7	7
Burkina Faso	5	4	3	3	4	4	5	5	3	2	4	2	7	7
Cameroon	5	3	5	5	6	6	3	7	5	5	6	2	7	7
Chad	5	3	3	4	4	5	6	2	3	3	3	2	7	7
Ethiopia	5	4	5	4	5	5	5	3	3	3	2	2	7	7
Ghana	5	4	1	1	5	5	3	3	3	3	5	2	7	7
Kenya	5	5	5	4	5	5	3	5	3	3	2	2	7	7
Mali	5	4	3	4	4	4	6	5	3	2	4	2	7	7
Saudia	5	4	2	1	4	5	3	5	5	6	4	2	7	6
Sierra leane	5	3	4	5	4	5	3	3	3	2	3	2	7	7
South Africa	5	5												
Sudan	5	3	4	4	5	5	5	3	3	3	4	2	7	7
Togo	5	2	5	5	5	5	3	5	3	3	4	2	7	7
UAE	5	2	1	3	1	1	3	5	2	1	6	2	7	7
Algeria	**4**	3	1	4	6	6	5	3	4	4	6	2	7	7
Congo	**4**	4	4	4	5	5	2	7	4	4	4	2	7	7
Egypt	**4**	1	5	5	6	6	3	3	5	5	2	2	7	7
Jordan	**4**	3	1	2	5	5	7	1	5	7	2	2	7	7
Libya	**4**	1	1	4	5	6	2	1	5	6	4	2	5	2
Mauritania	**4**	3	1	3	5	5	6	2	5	5	5	2	7	7
Niger	**4**	3	2	4	3	4	3	3	3	2	2	2	7	7
Oman	**4**	1	1	3	5	4	3	5	3	4	4	2	7	7
Yemen	**4**	3	3	4	4	4	4	2	3	3	4	2	7	7

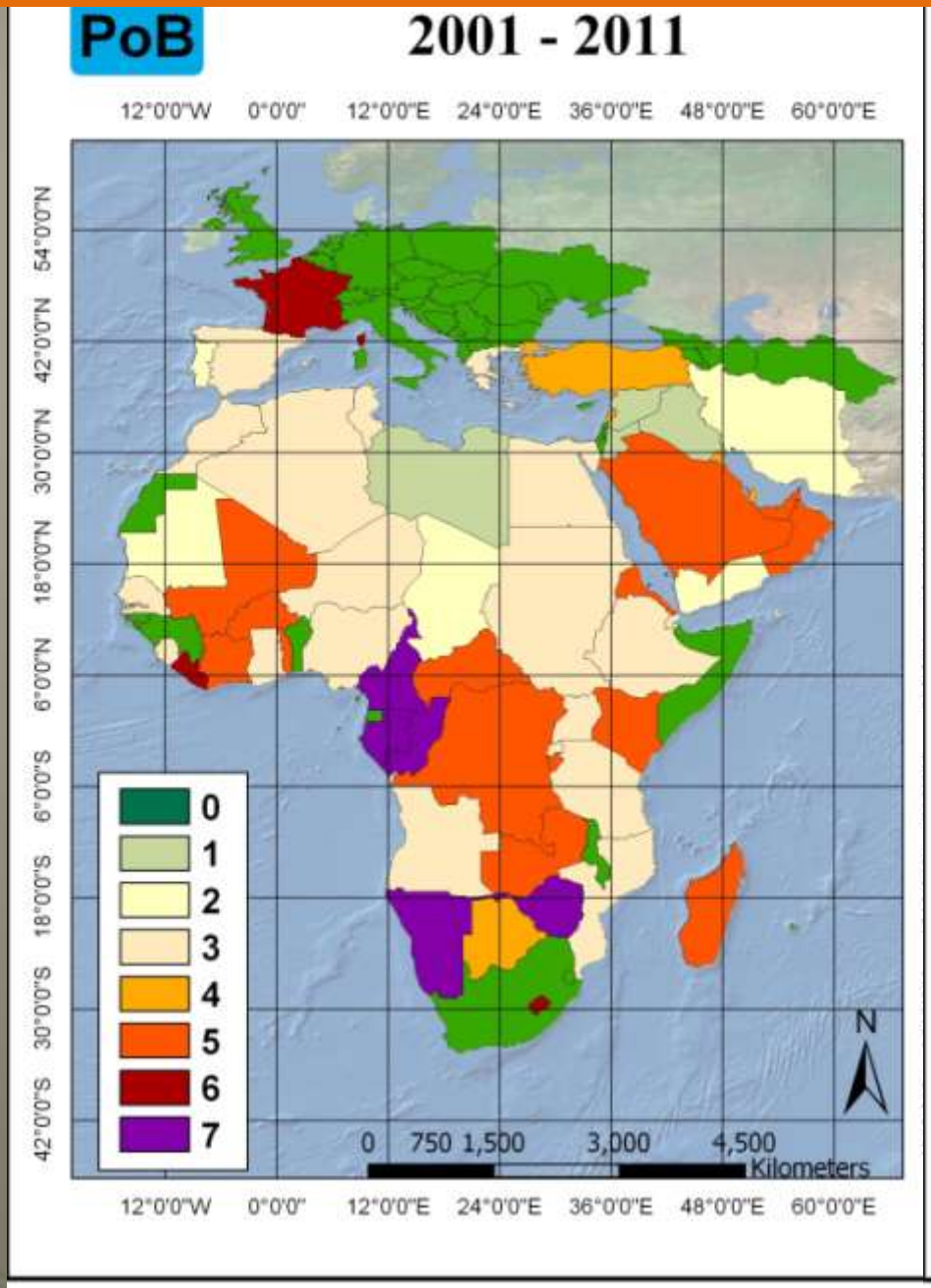
Countries	ADH M H	ADH ALL	Ld M H	LD ALL	LuA	LuA	LuB	LuB	LuC	LuC	LuD	LuD	LuE	WaA	WaA
	2000 - 2011	2000 - 2011	1999 - 2011	1999 - 2011	2009-2004	2009 - 1999	2009-2004	2009 - 1999	2009-2004	2009 - 1999	2009-2004	2009 - 1999	2009	2011-2006	2011-2001
Botswan	5	4	6	6	3	3	5	5	4	4					3
Burkina Faso	5	4	3	3	3	3	5	5	3	3	5	5	7	3	4
Cameroon	5	3	5	5	3	4	5	5	3	4	3	2	5	2	3
Chad	5	3	3	4	3	3	5	5	4	4	3	3	7	3	4
Ethiopia	5	4	5	4	3	3	5	5	3	2	3	3	6	3	4
Ghana	5	4	1	1	3	3	5	5	4	3	3	3	6	3	4
Kenya	5	5	5	4	3	3	5	5	2	3	3	3	2	3	4
Mali	5	4	3	4	3	3	5	5	4	3	3	3	6	3	4
Saudia	5	4	2	1	5	5	4	4	3	3	3	3	6	3	4
Sierra leane	5	3	4	5	4	1	5	5	4	3	3		6	3	4
South Africa	5	5													
Sudan	5	3	4	4	3	3	5	5	1	2	3	5	7	3	4
Togo	5	2	5	5	5	5	5	6	3	3	3	3	6	2	4
UAE	5	2	1	3	4	2	3	3	3	3	5	7	3	6	7
Algeria	4	3	1	4	3	5	5	5	3	2	3	2	6	2	3
Congo	4	4	4	4	3	4	5	5	3	3				3	4
Egypt	4	1	5	5	5	5	4	2	2	2	3	3	1	5	5
Jordan	4	3	1	2	5	3	4	4	5	5	3	2	6	3	4
Libya	4	1	1	4	4	5	4	4	5	5	3	3	6	2	3
Mauritania	4	3	1	3	5	5	3	3	3	3	3	3	7	3	4
Niger	4	3	2	4	3	3	5	5	2	1	3	3	7	3	4
Oman	4	1	1	3	1	1			4	4	6	6	3	2	4
Yemen	4	3	3	4	5	5	4	4	3	1	3	2	5	2	4

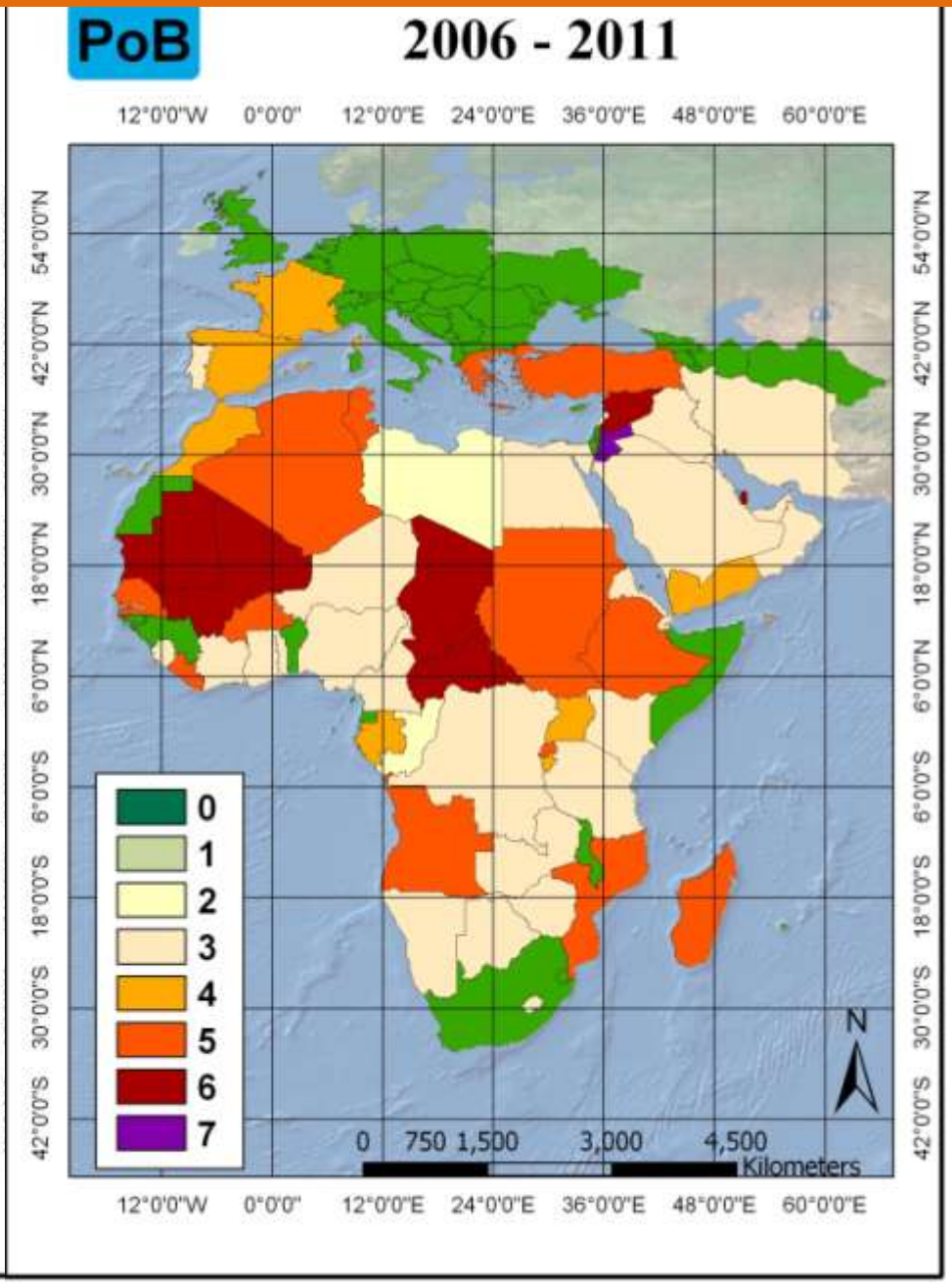
PoA - Total population Change %



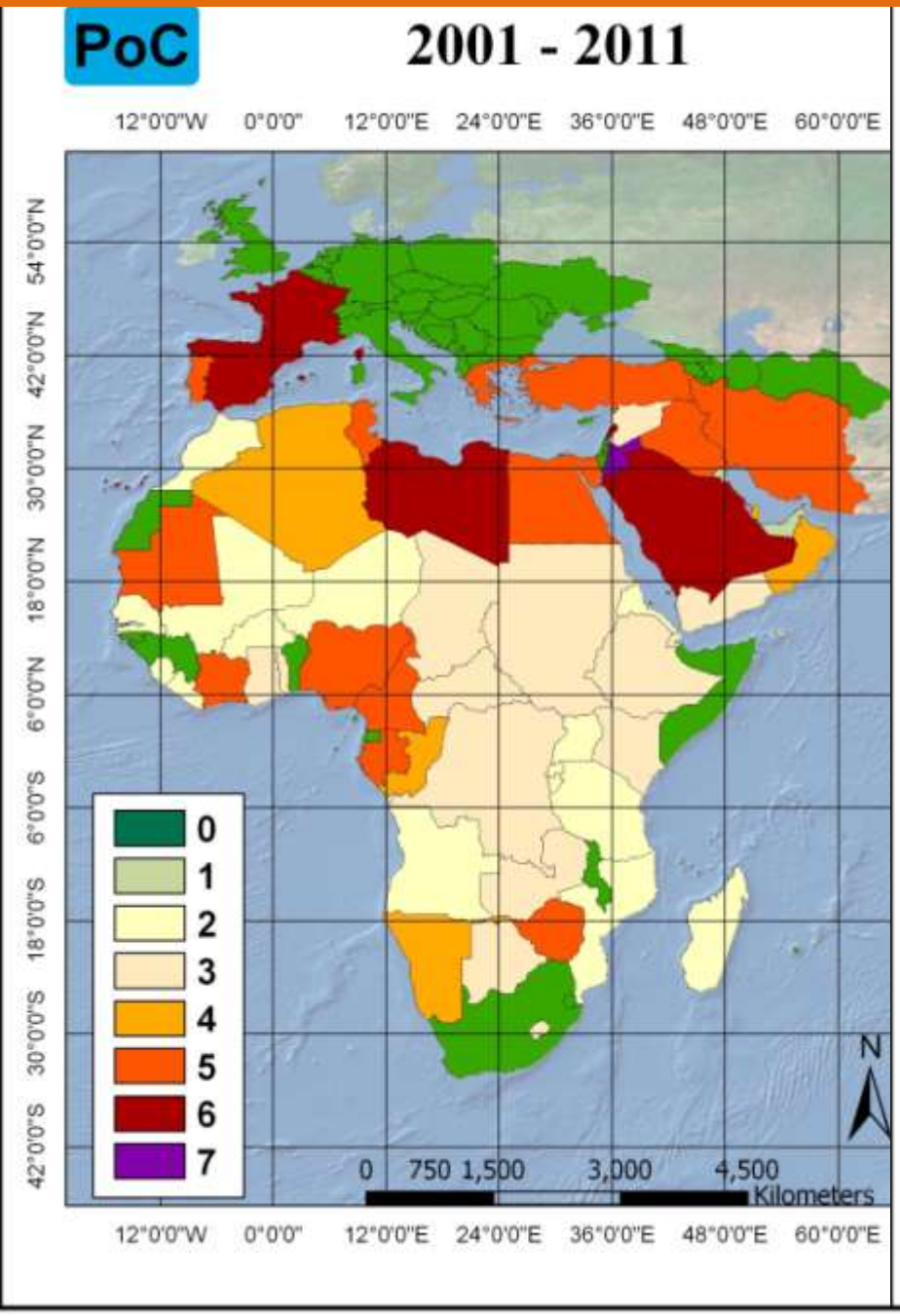


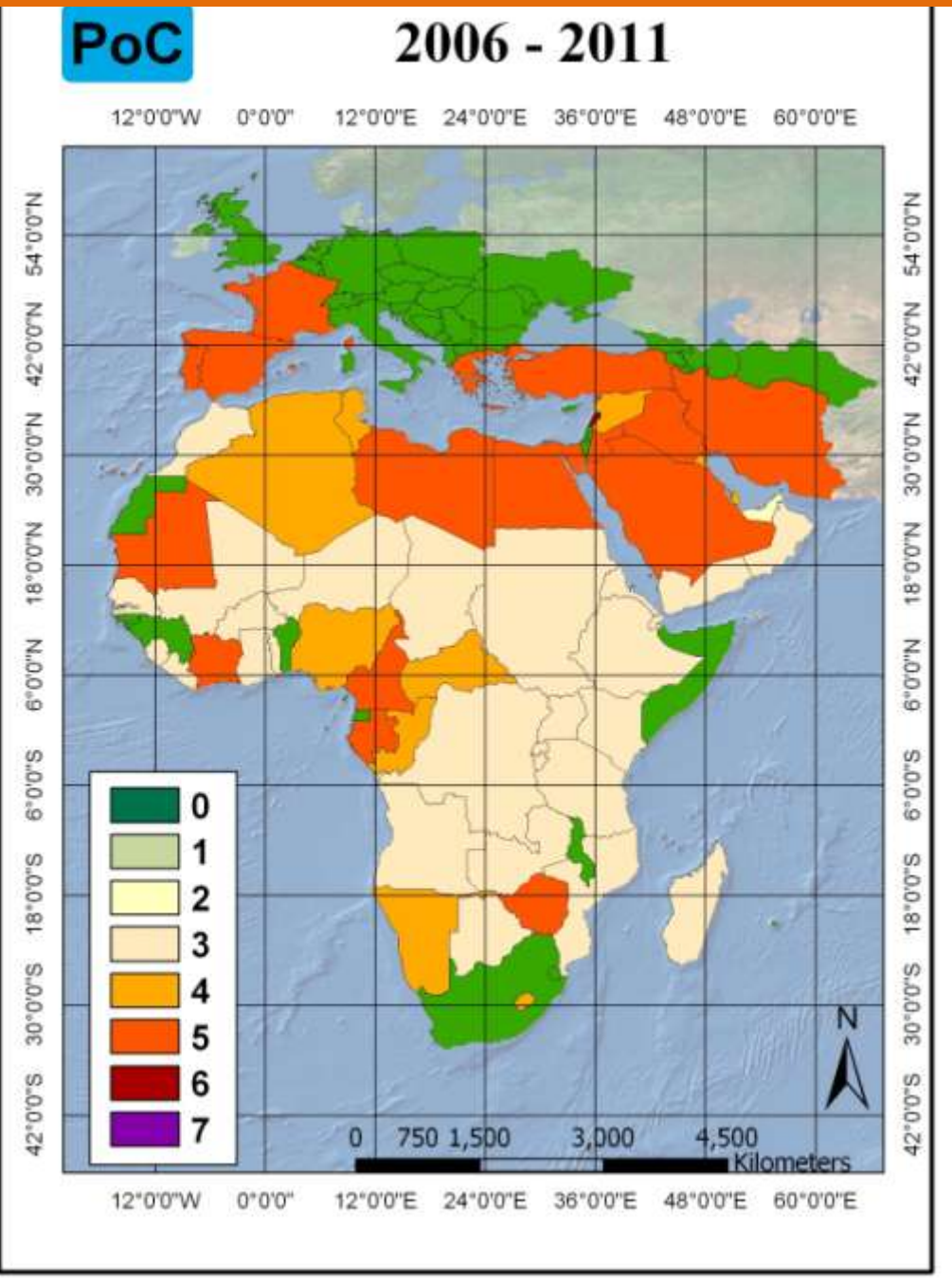
PoB - Females % of labour force in Agriculture



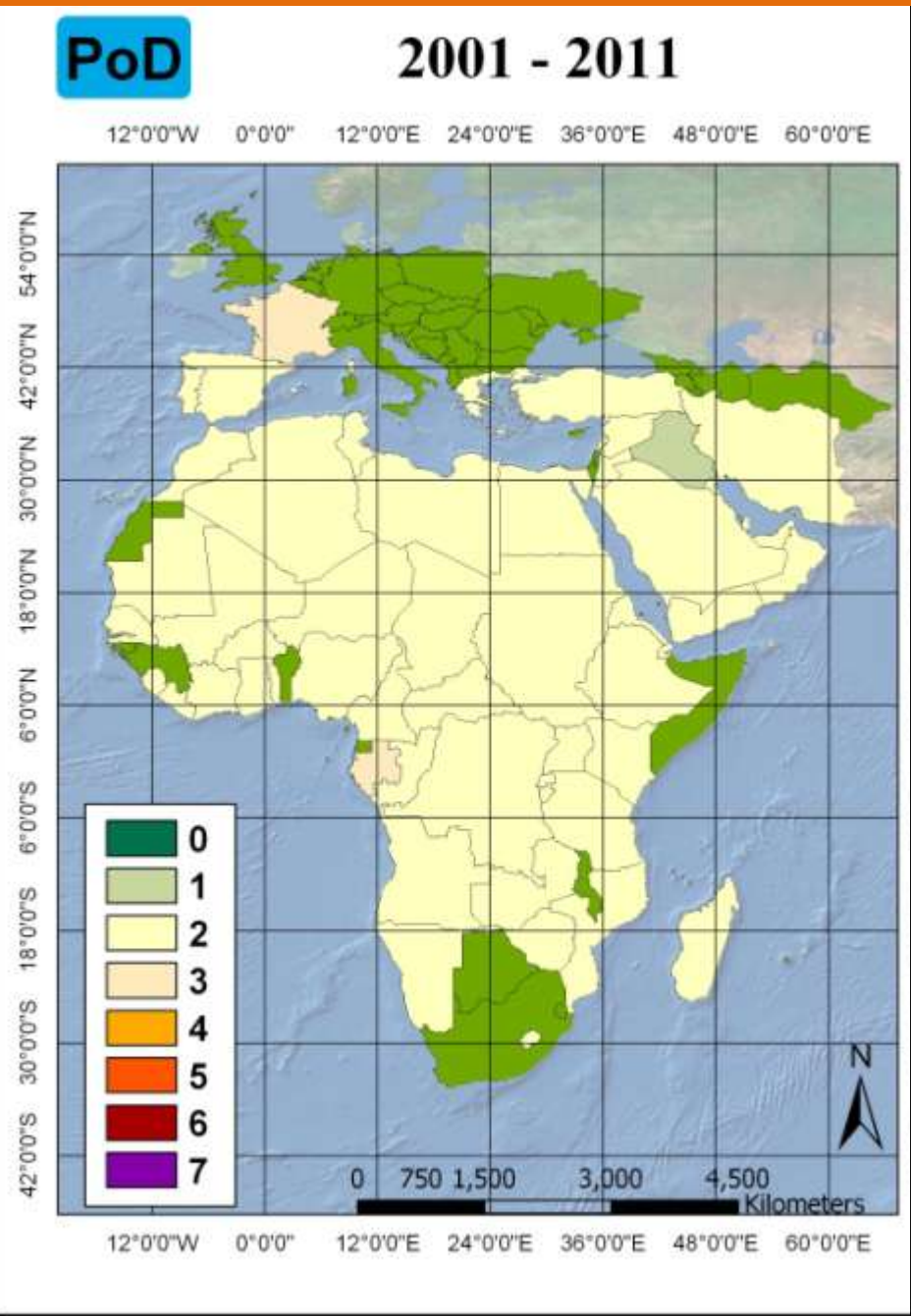


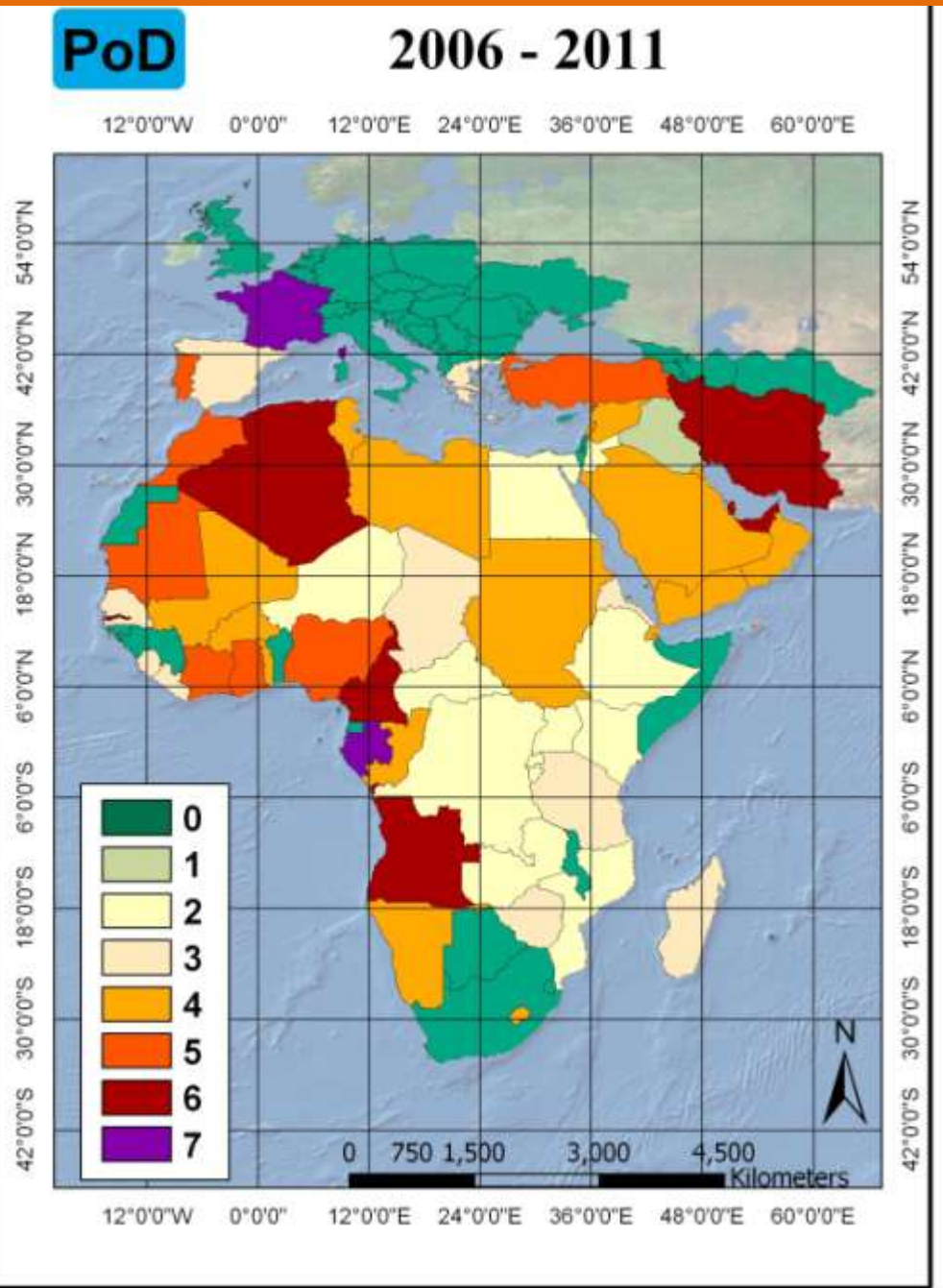
PoC - Annual Agriculture Population %



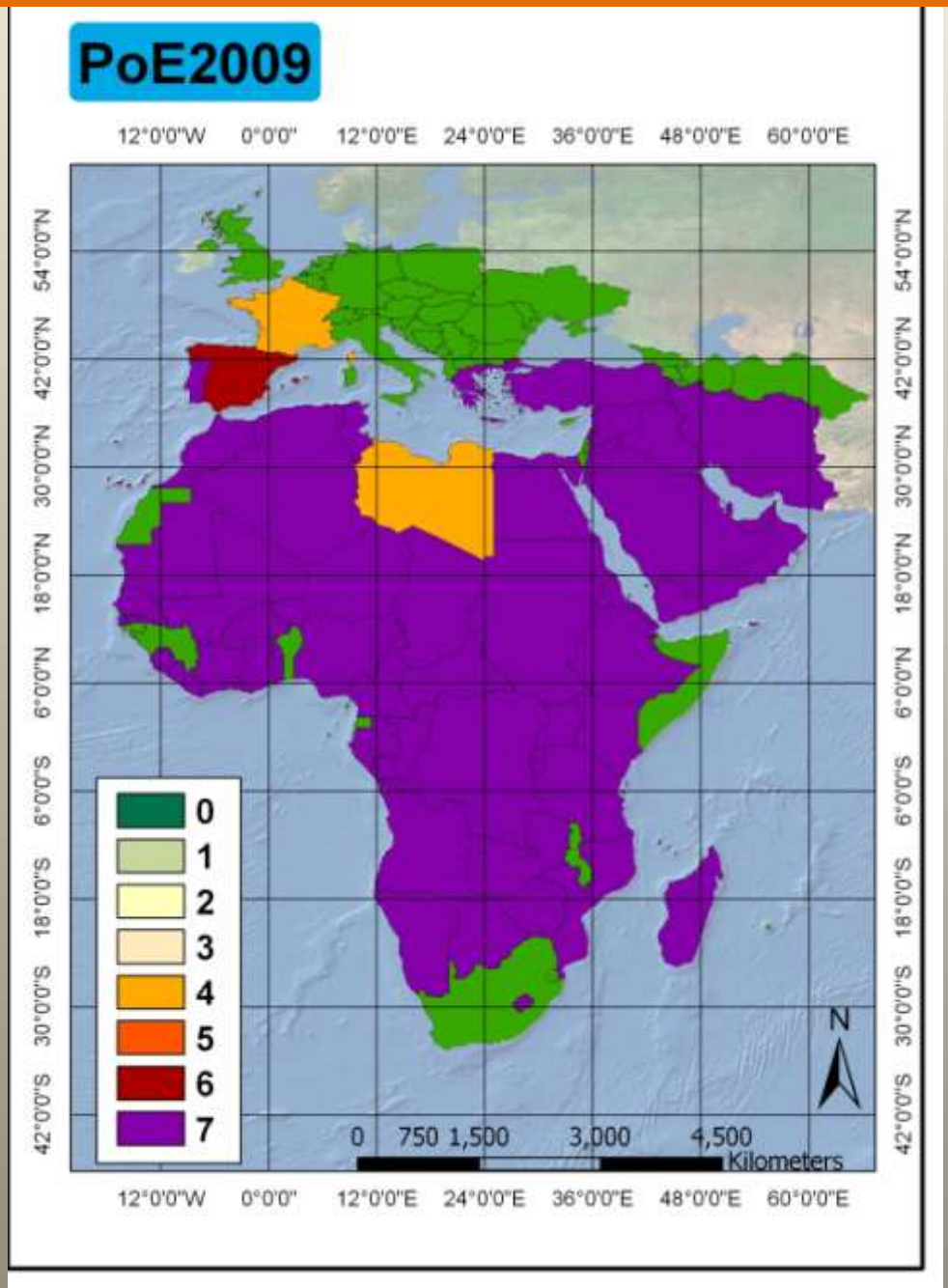


PoD –Change in Rural Population % of total population %

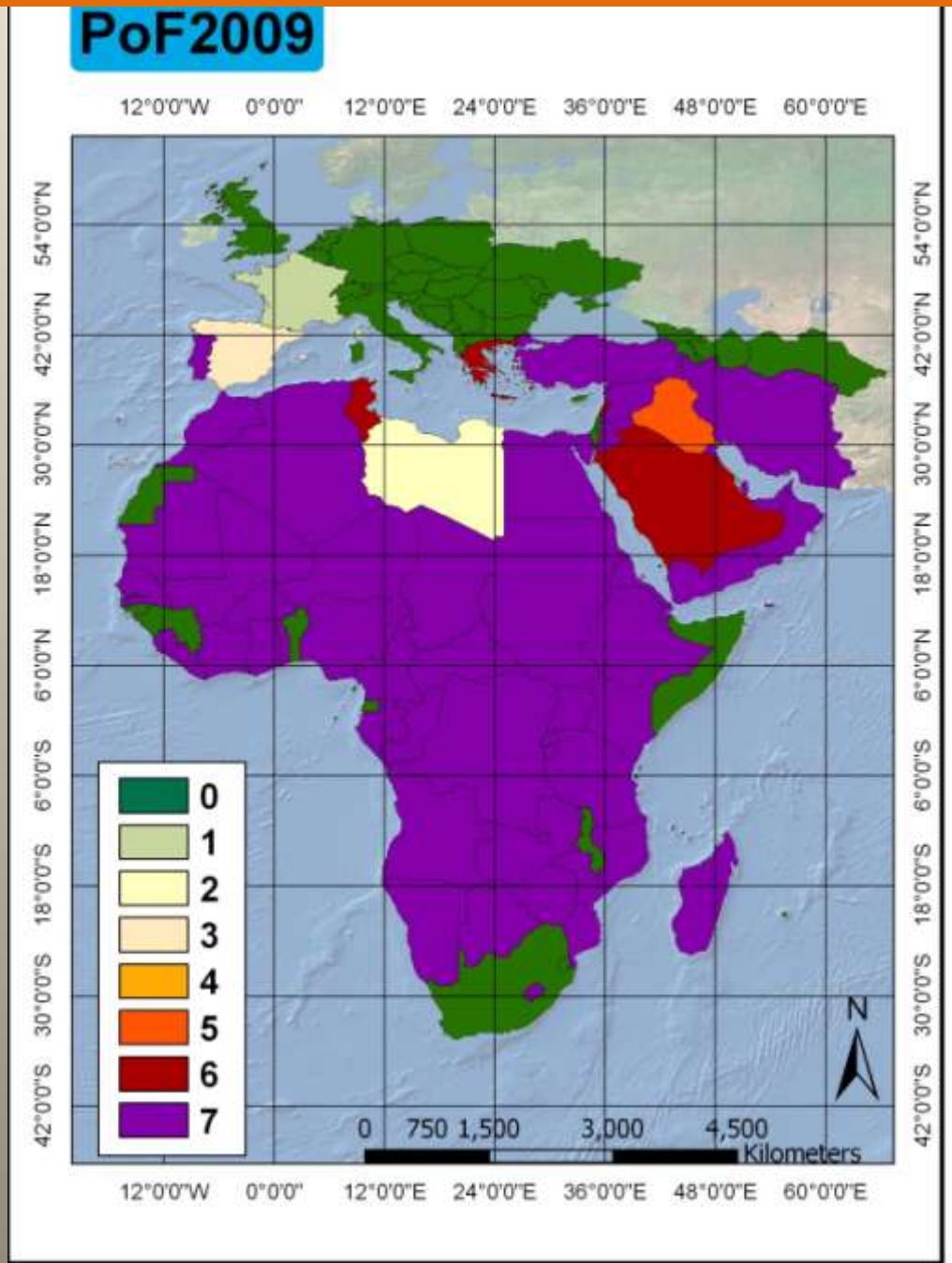




PoE – Population dependent on Agri. [ratio/ha/capita, 2009]



PoF – Population economically active in Agri. [ratio/ha/capita, 2009]



AGRICULTURE DROUGHT
and LAND USE and WATER AVAILABILITY INDICATORS

LuA
LAND USE A. change in Arable land %

LuB
LAND USE change in Forest cover %

WaA
WATER AVAILABILITY A. Freshwater availability per capita %

LuC
LAND USE Change in Permanent crops Cover %

LuD
Change in Crop Production %

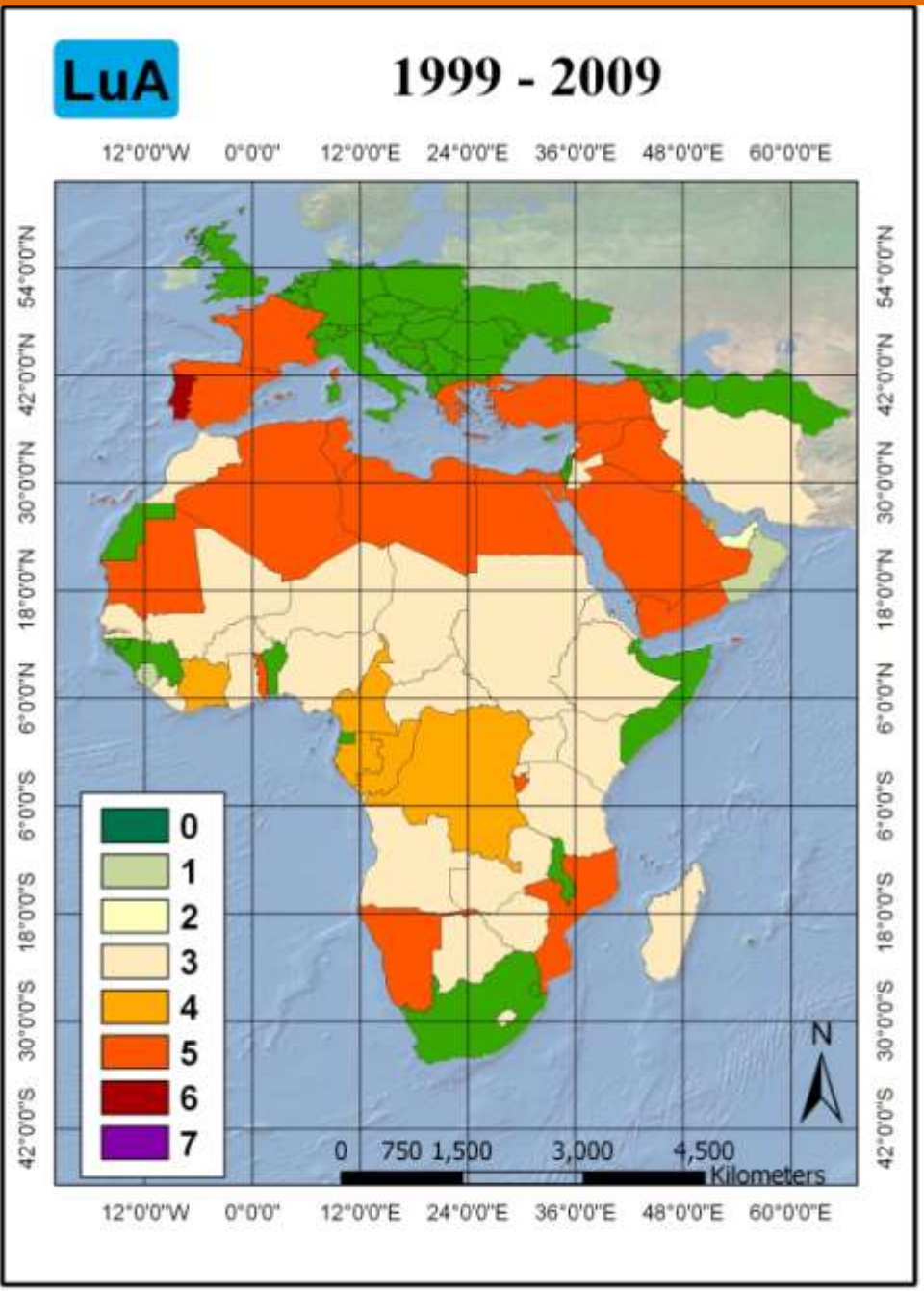
LuE
Evaluation of Crop Production Value Per Ha. Value 2004-2006 in ($)
Crop Production Per Ha. of Land Use for the year 2009 US$

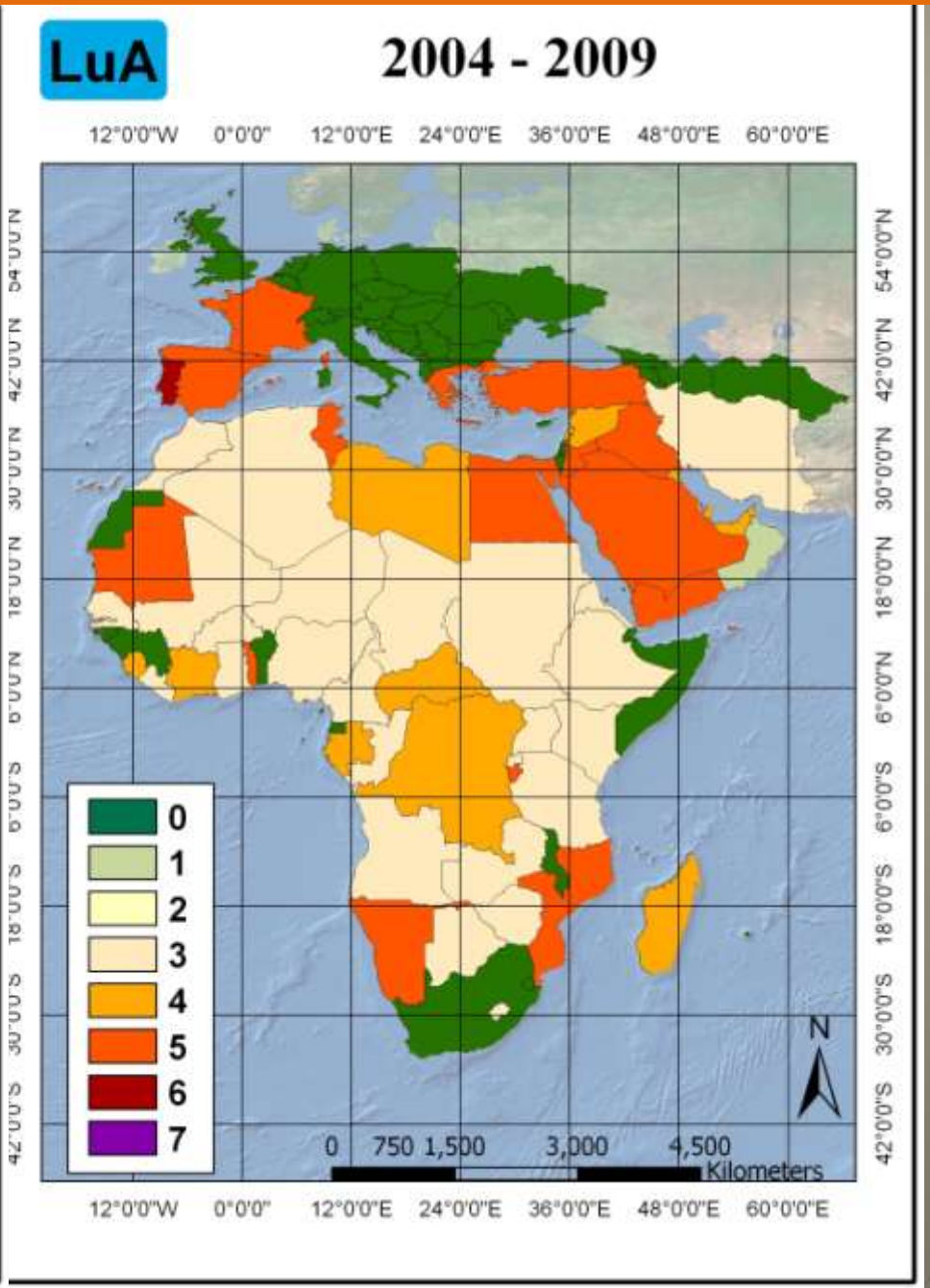
Countries	ADH M H	ADH ALL	Ld M H	LD ALL	EcA	EcA	EcB	EcB	EcC	EcC	EcD	EcD	EcE	EcE
	2000 - 2011	2000 - 2011	1999 - 2011	1999 - 2011	2009 - 1999	2009 - 2004	2009 - 2004	2009- 1999	2009 - 2004	2009 - 1999	2009 - 2004	2009- 1999	2010- 2005	2010- 2000
Gambia	**3**	1	4	3	6	6	4	5	6	2	5	4	3	3
Guinea	**3**	1	5	5										
Malawi	**3**	2	3	3										
Zimbabwe	**3**	3	4	6	7	7	7	6	6	3	7	7	4	6
Angola	**2**	1	5	6	1	4	2	1	5	5	2	1	3	1
Lesotho	**2**	1	7	7	5	7	4	4	5	4	5	7	4	4
Mozambique	**2**	2	3	5	5	6	4	4	5	2	2	2	5	4
Burundi	**1**	1	5	5	6	5	4	5	5	1			6	6
central Africa	**1**	1	5	5	5	6	4	4	5	1	6	4	4	4
DR of the Congo	**1**	1	2	4	5	6	5	4	6	2	4	6	4	4
Guinea-Bissau	**1**	1	2	1										
Madagascar	**1**	1	4	6	5	5	5	4	5	2	5	6	3	2
Rawanda	**1**	1	3	6	5	5	3	4	6	2			3	2
Tanzania	**1**	1	6	6	5	5	5	4	6	6			4	2
Uganda	**1**	1	6	5	5	5	4	4	5	2	4	5	4	4
Zambia	**1**	1	6	7	5	5	3	3	6	3	6	6	3	2

Countries	ADH M H	ADH ALL	Ld M H	LD ALL	PoA	PoA	PoB	PoB	PoC	PoC	PoD	PoD	PoE	PoF
	2000 - 2011	2000 - 2011	1999 - 2011	1999 - 2011	2011 - 2006	2011 - 2001	2011- 2006	2011 - 2001	2011 - 2006	2011 - 2001	2011- 2006	2011 - 2001	2009	2009
Gambia	**3**	1	4	3	4	5	3	3	3	2	6	2	7	7
Guinea	**3**	1	5	5										
Malawi	**3**	2	3	3										
Zimbabwe	**3**	3	4	6	7	7	3	7	5	5	3	2	7	7
Angola	**2**	1	5	6	4	4	5	3	3	2	6	2	7	7
Lesotho	**2**	1	7	7	6	7	3	6	4	3	4	2	7	7
Mozabique	**2**	2	3	5	5	5	5	3	3	2	2	2	7	7
Burundi	**1**	1	5	5	4	5	4	5	3	2	2	2	7	7
central Africa	**1**	1	5	5	5	5	6	5	4	3	2	2	7	7
DR of the Congo	**1**	1	2	4	6	5	3	5	3	3	2	2	7	7
Guinea-Bissau	**1**	1	2	1										
Madagascar	**1**	1	4	6	4	4	5	5	3	2	3	2	7	7
Rawanda	**1**	1	3	6	5	4	5	3	3	2	2	2	7	7
Tanzania	**1**	1	6	6	4	4	3	3	3	2	3	2	7	7
Uganda	**1**	1	6	5	4	4	4	3	3	2	2	2	7	7
Zambia	**1**	1	6	7	5	5	3	5	3	3	2	2	7	7

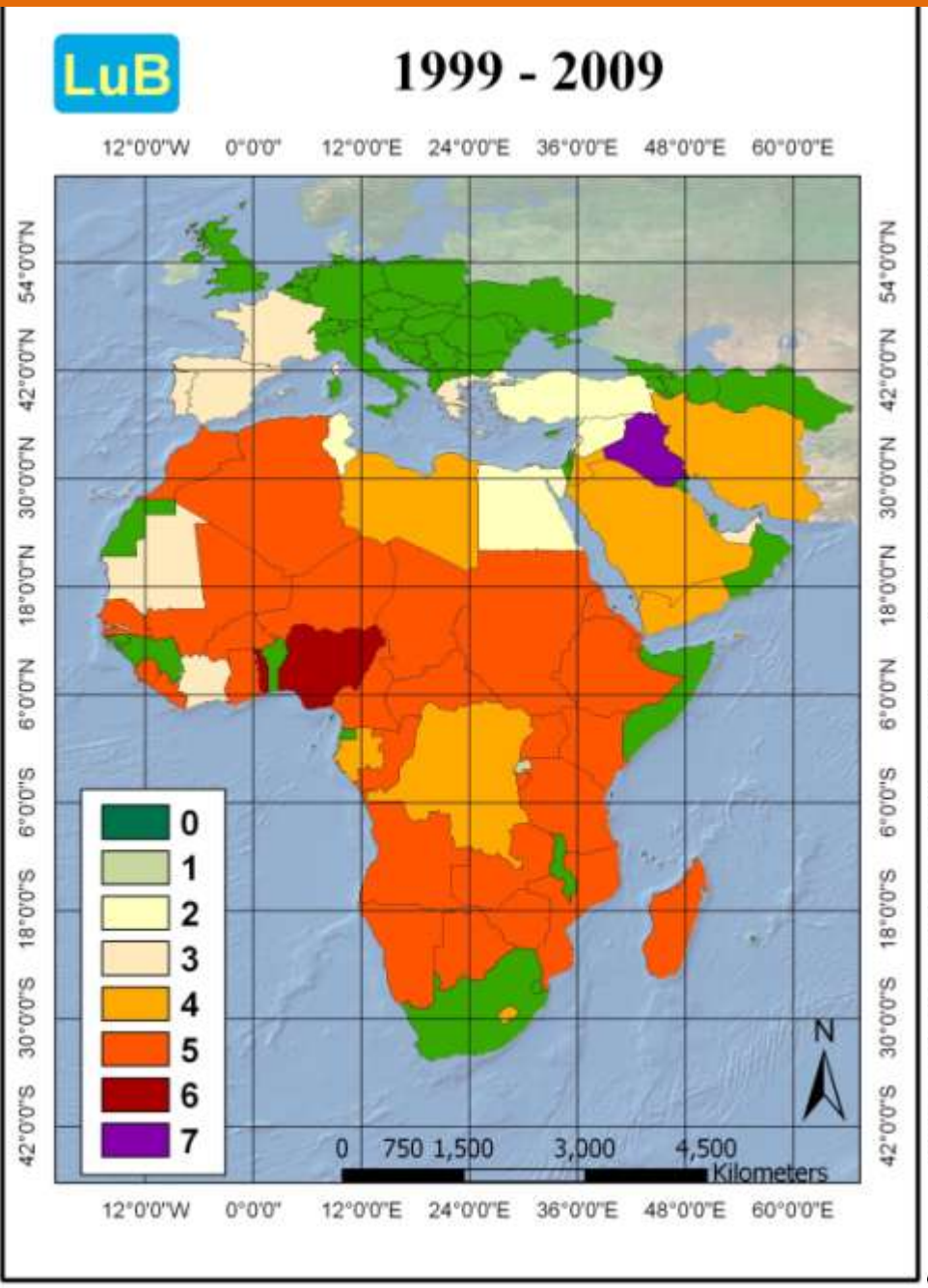
Countries	ADH M H	ADH ALL	Ld M H	LD ALL	LuA	LuA	LuB	LuB	LuC	LuC	LuD	LuD	LuE	WaA	WaA
	2000 - 2011	2000 - 2011	1999 - 2011	1999 - 2011	2009-2004	2009 - 1999	2009-2004	2009 - 1999	2009-2004	2009 - 1999	2009-2004	2009 - 1999	2009	2011-2006	2011-2001
Gambia	**3**	1	4	3	3	2	3	3	4	4	5	5	6	3	4
Guinea	**3**	1	5	5											
Malawi	**3**	2	3	3											
Zimbabwe	**3**	3	4	6	3	3	5	5	4	4	6	6	7	1	2
Angola	**2**	1	5	6	3	3	5	5	4	5	3	1	5	3	4
Lesotho	**2**	1	7	7	3	3	4	4	4	4	5	6	7	2	2
Mozabique	**2**	2	3	5	5	5	5	5	4	4	3	3	6	3	4
Burundi	**1**	1	5	5	5	5	5	5	5	5	6	6	6	3	4
central Africa	**1**	1	5	5	4	3	5	5	4	3	3	3	7	3	3
DR of the Congo	**1**	1	2	4	4	4	4	4	4	4	3	5	6	2	3
Guinea-Bissau	**1**	1	2	1											
Madagascar	**1**	1	4	6	4	3	5	5	4	4	3	3	5	3	4
Rawanda	**1**	1	3	6	3	3	1	1	3	3	3	3	4	2	4
Tanzania	**1**	1	6	6	3	3	5	5	3	3	3	3	6	3	3
Uganda	**1**	1	6	5	3	3	5	5	3	3	5	5	5	3	4
Zambia	**1**	1	6	7	3	3	5	5	4	3	3	2	6	3	4

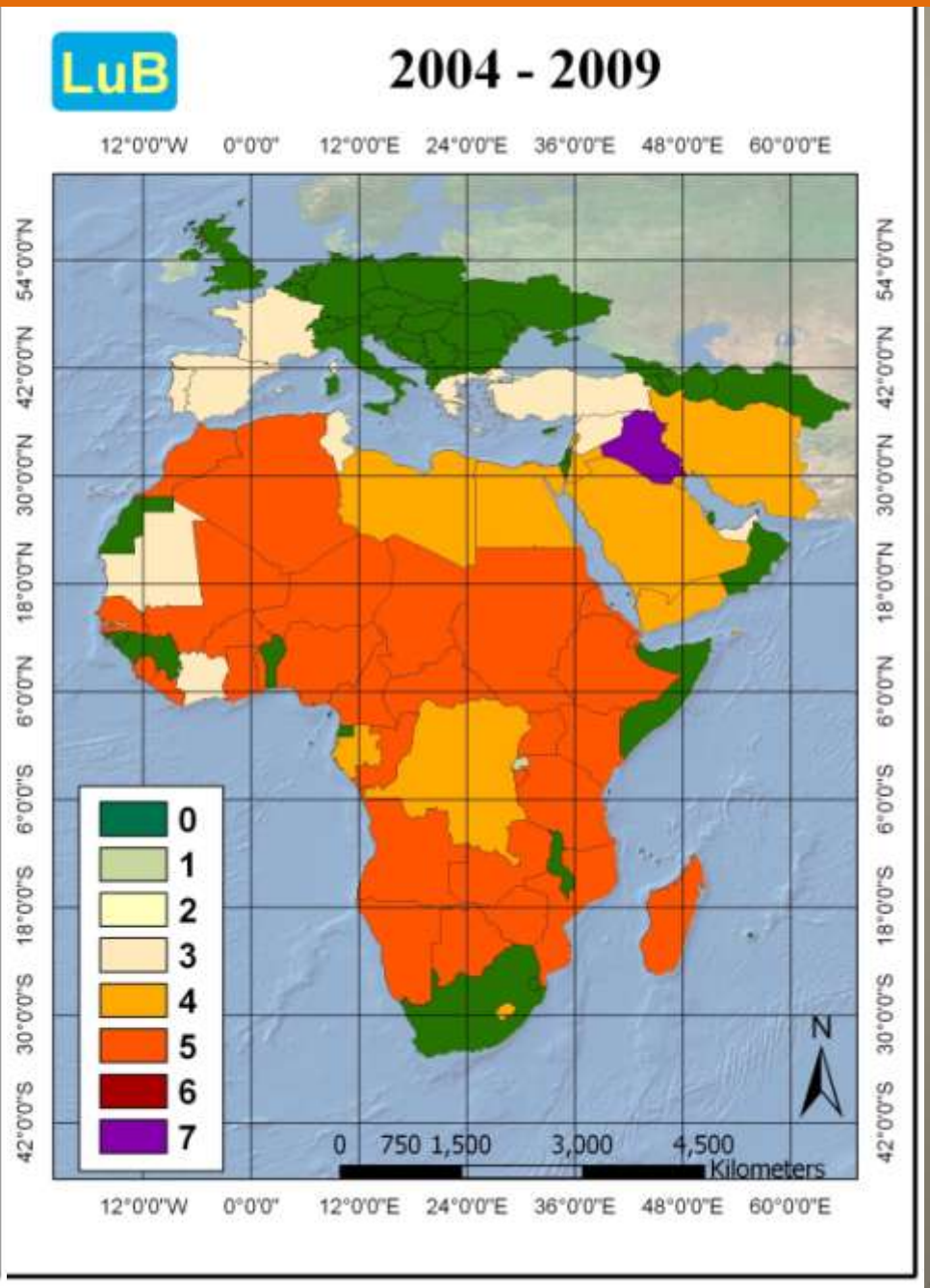
LuA LAND USE A. change in Arable land %



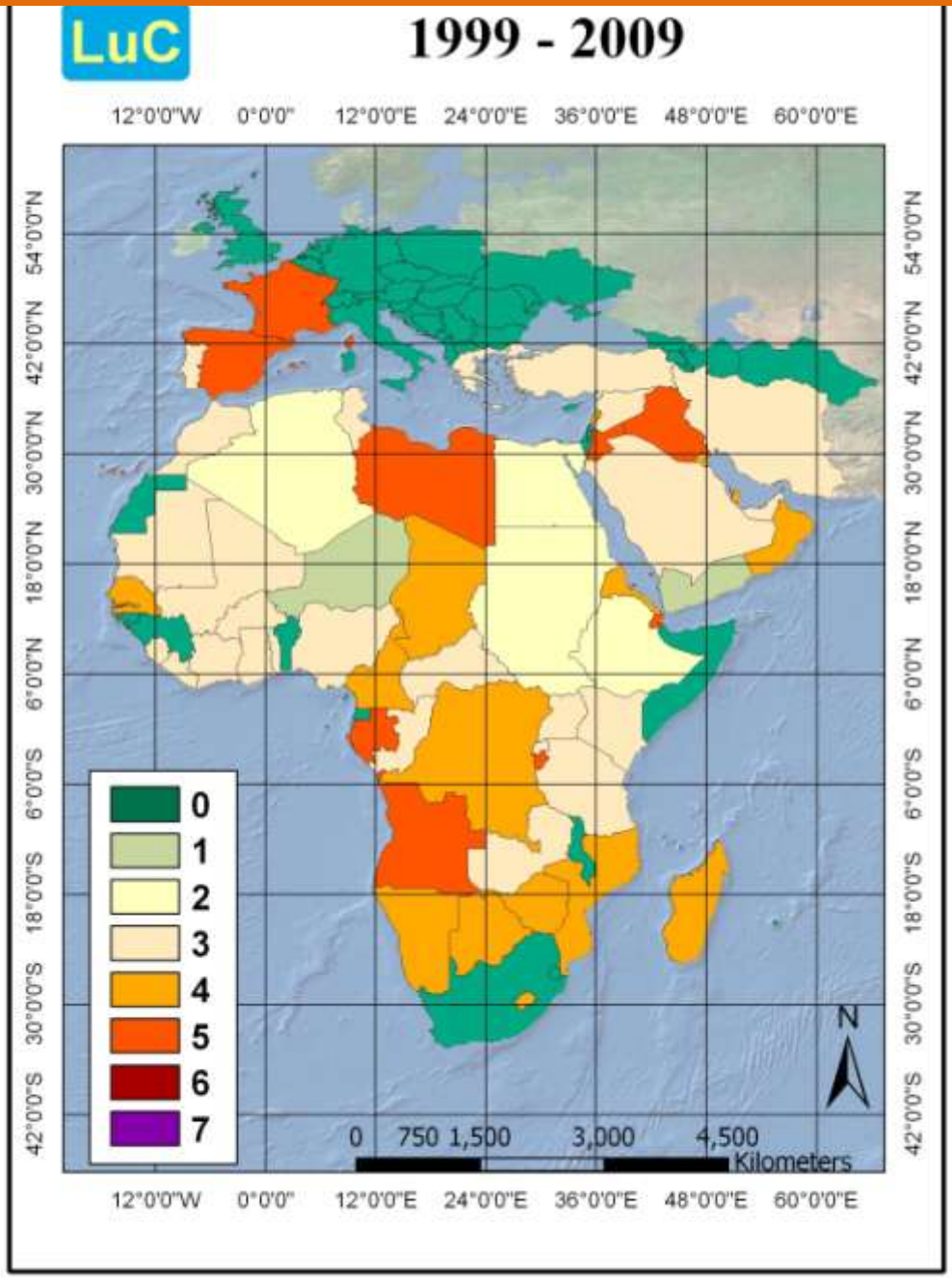


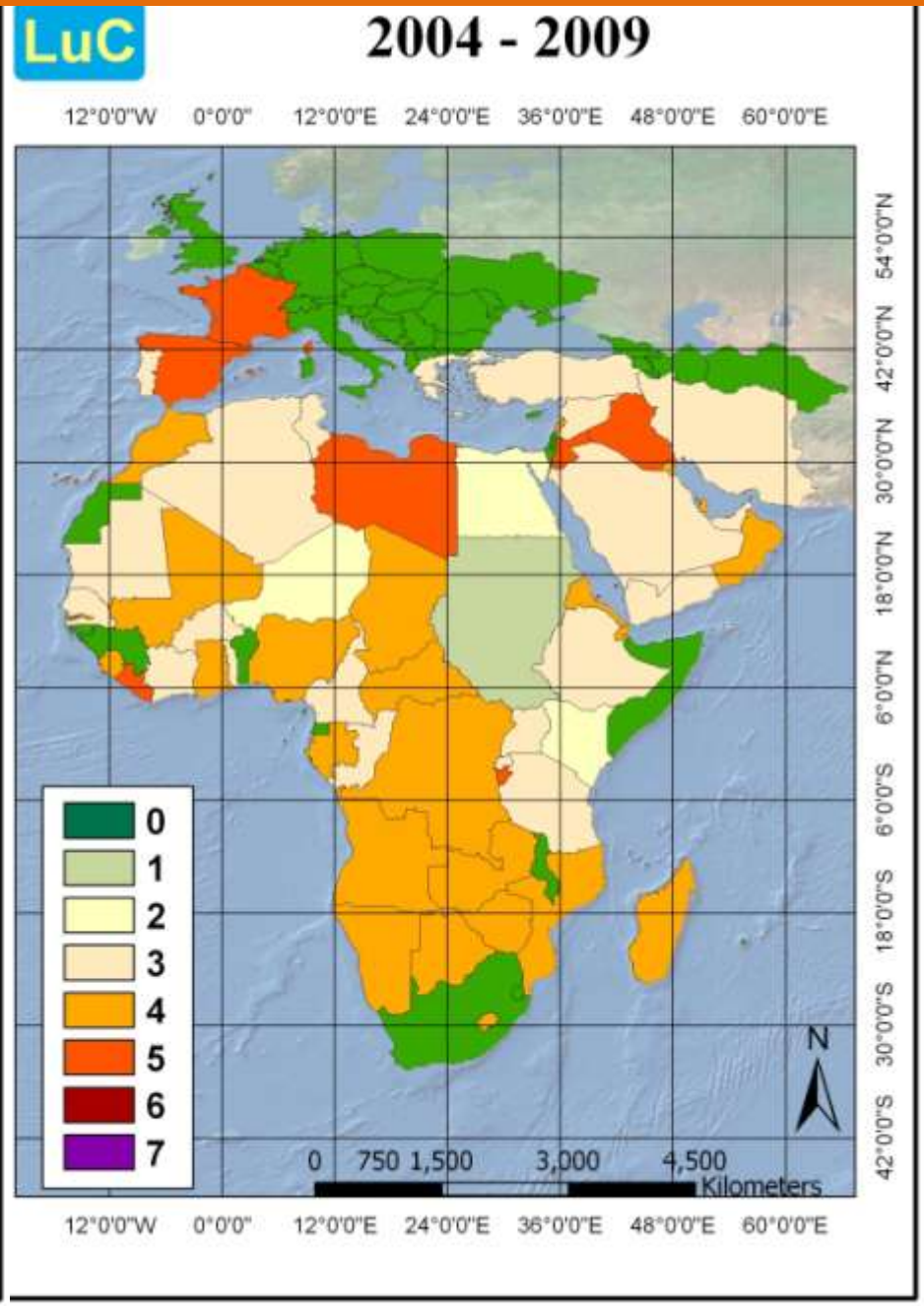
LuB LAND USE change in Forest cover %



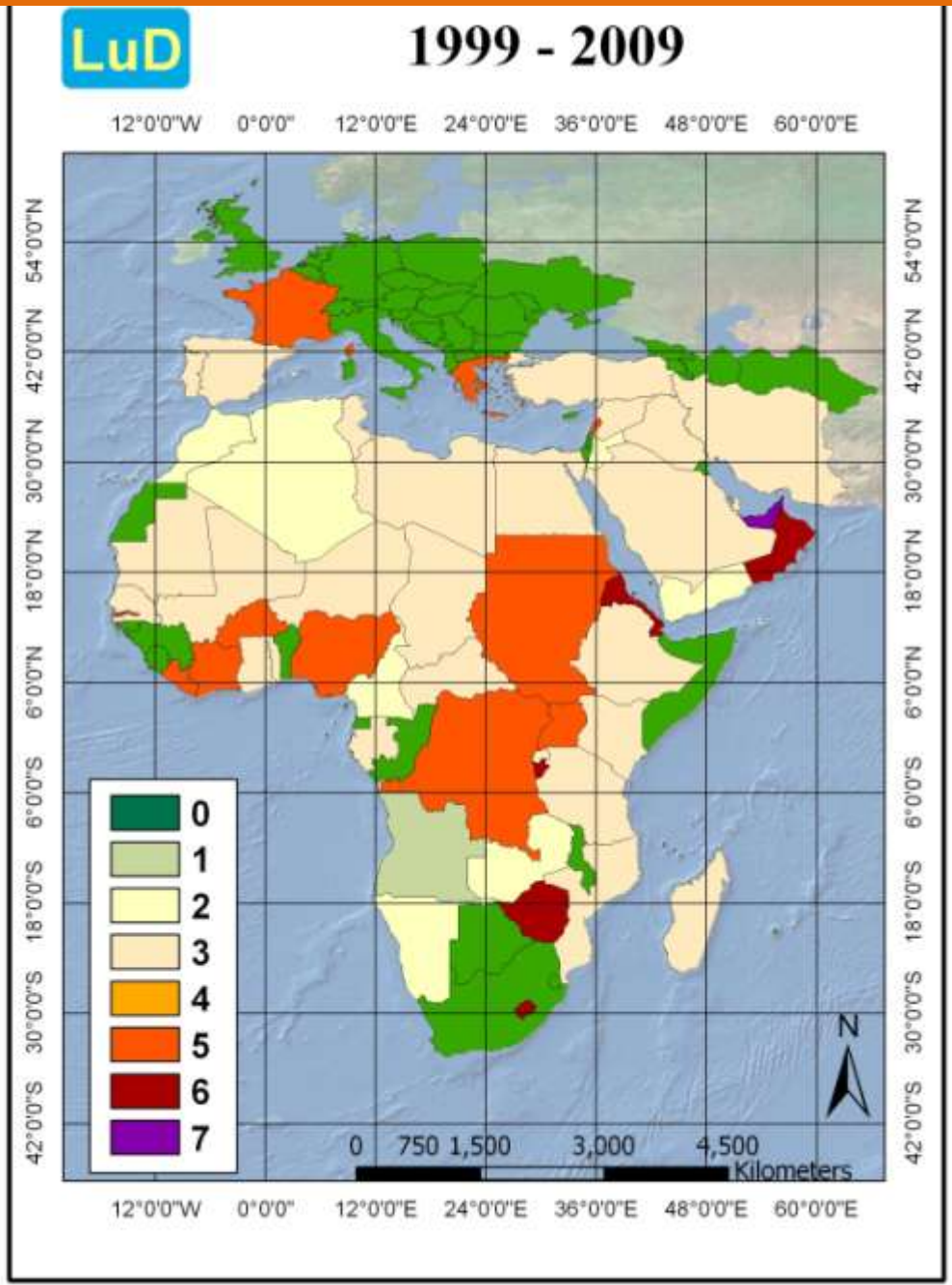


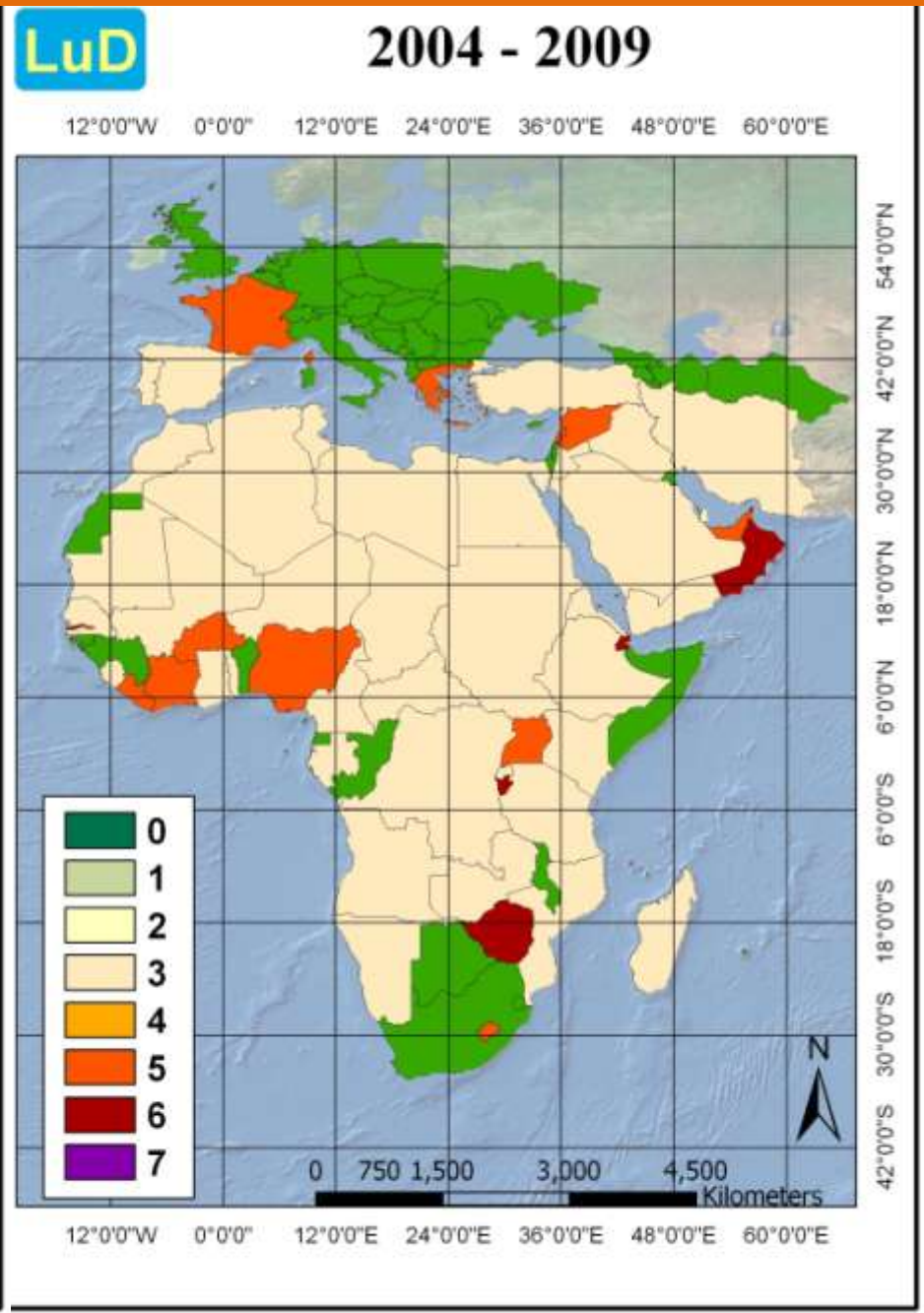
LuC LAND USE Change in Permanent crops Cover %



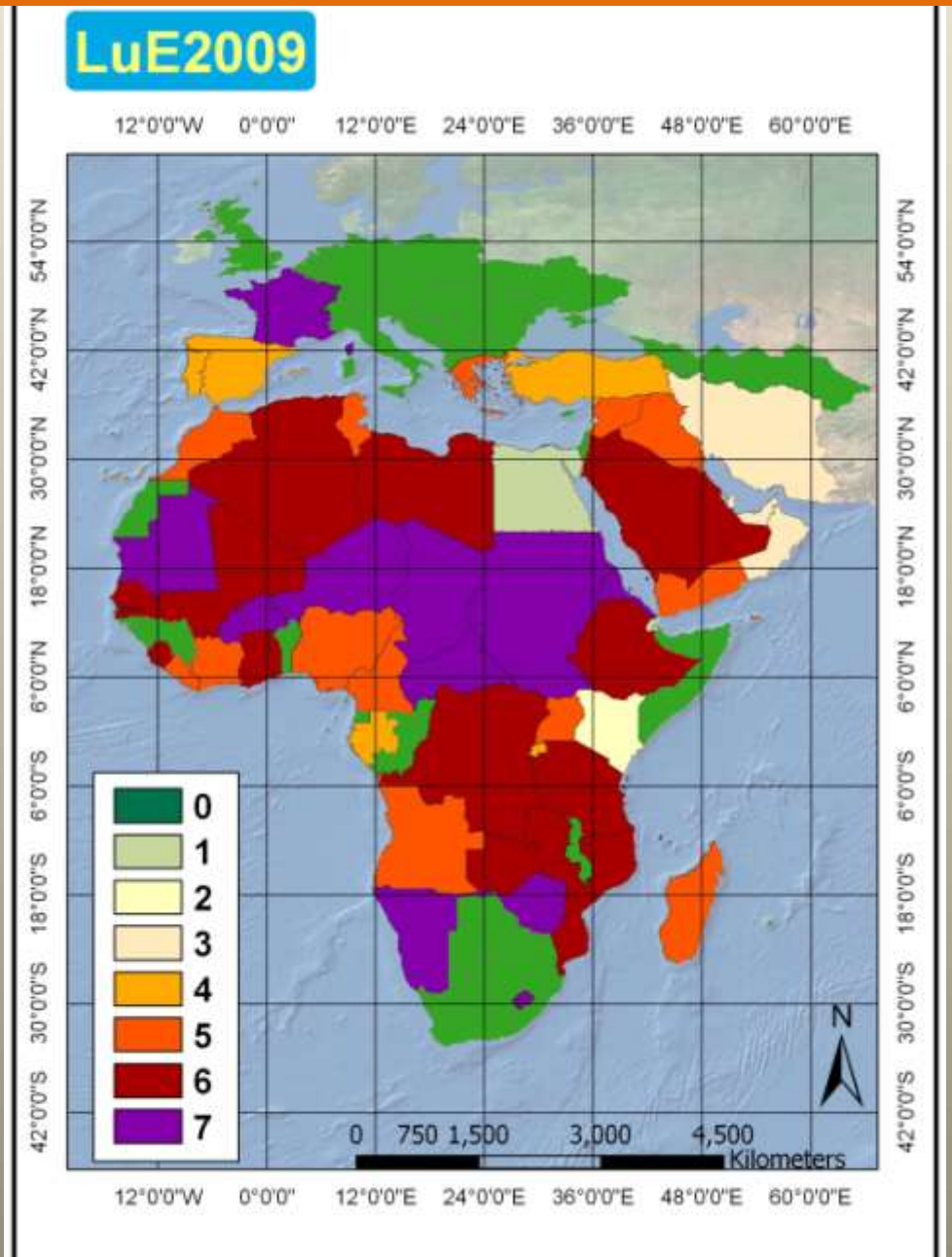


LuD Change in Crop Production %

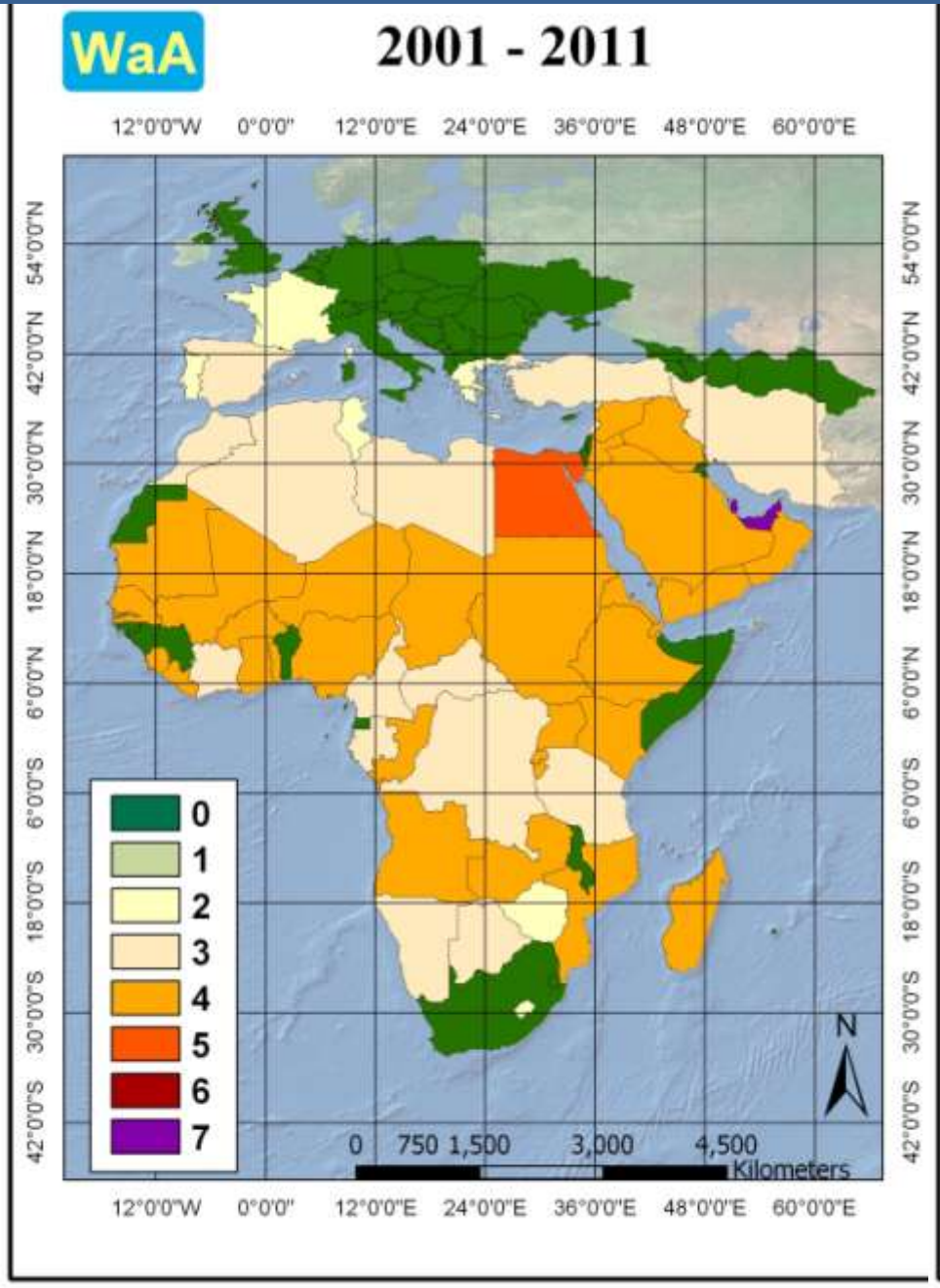


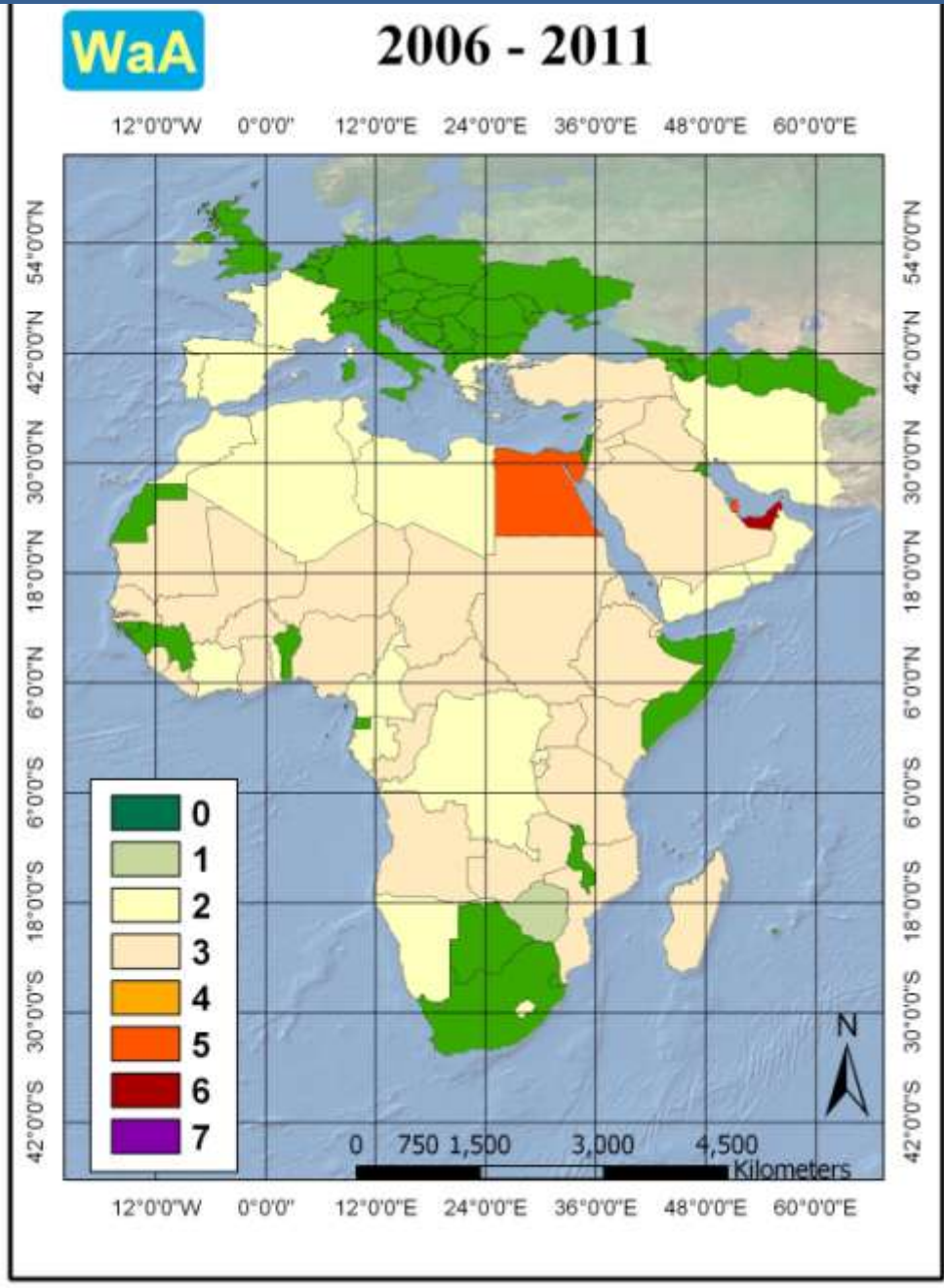


LuE Evaluation of Crop Production Value Per Ha. Value 2004-2006 in (US$) Crop Production Per Ha. of Land Use for the year 2009 US$



WaA WATER AVAILABILITY A. Freshwater availability per capita %



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Thank you