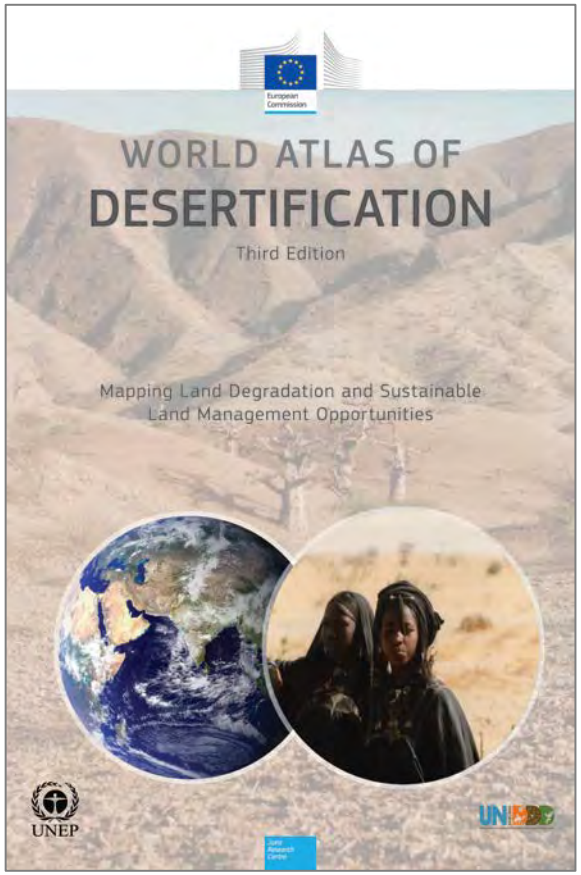


Global mapping of land degradation

Is it possible?

M. Cherlet
E. Ivits
H. Kutnjak
M. Smid
S. Sommer

Joint Research Centre, European Commission

1. WAD Initiative
2. Land Degradation Definition ... Concept
3. Implementation of the concept
    - Land system productive capacity
    - contextual information
4. Status and needs

1. WAD Initiative

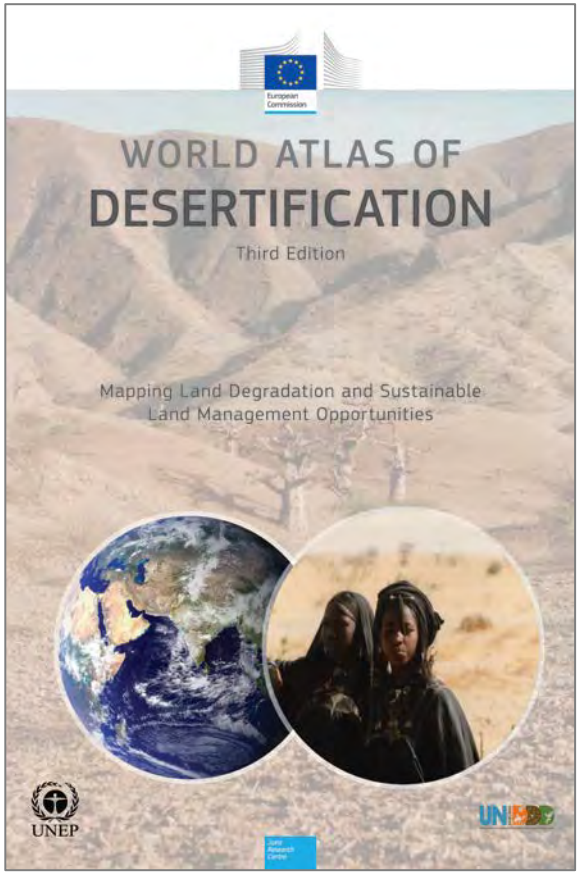
WAD Initiative

European Commission

United Nations Environment Programme
environment for development

UNCCD

Joint Research Centre



WAD Initiative

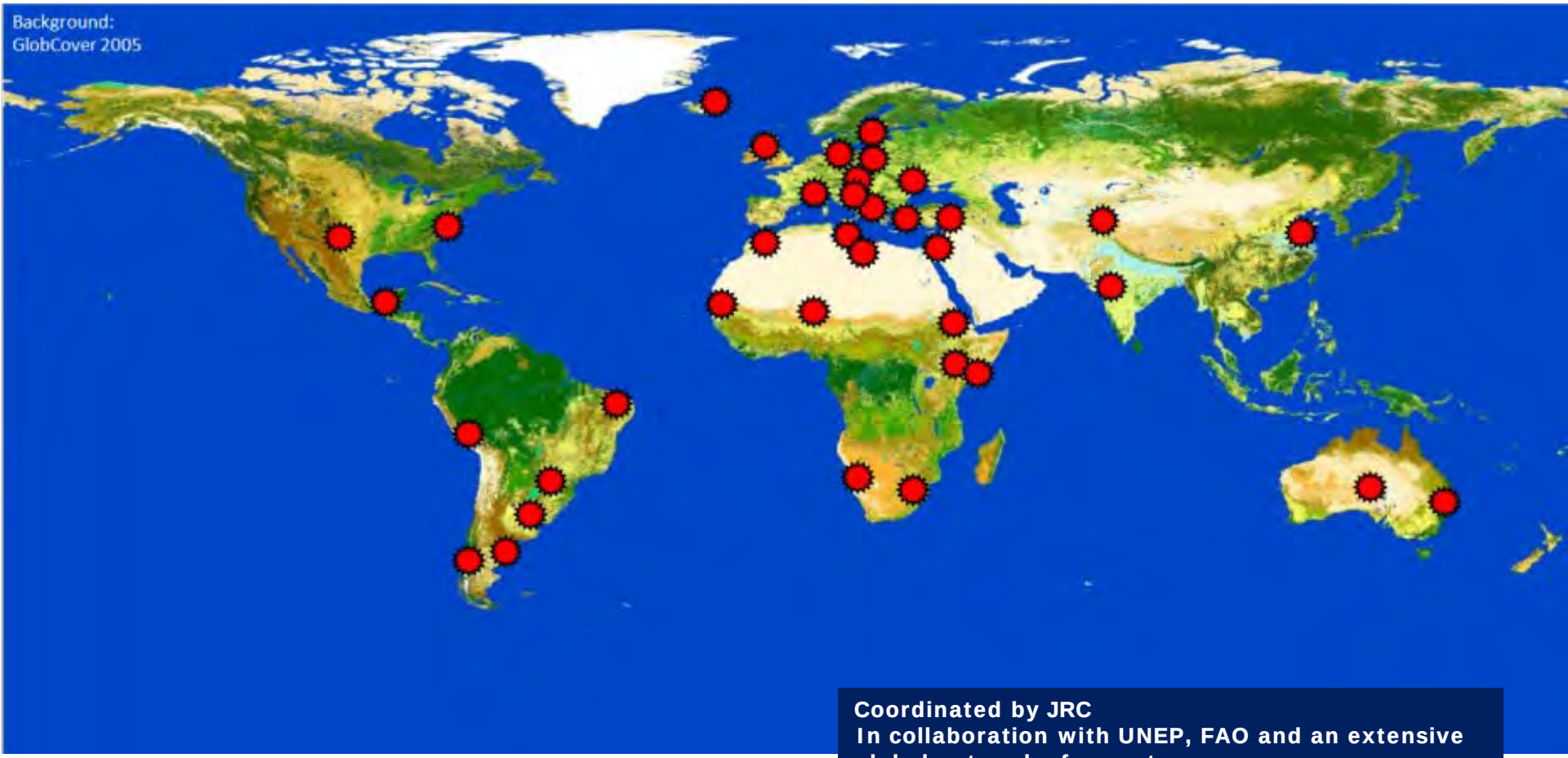
European Commission

United Nations Environment Programme
UNEP environment for development

UNCCD

DG
Joint Research
Centre

Joint
Research
Centre



Coordinated by JRC
In collaboration with UNEP, FAO and an extensive global network of experts

Why a new Atlas?

Holistic and global approach to LDD > agreed assessment concept

Bring indicator reporting/use further

Baseline assessment of Land Degradation and Desertification (LDD)

Foundation for economic valuations

Policy implementation

Fill a long gap …

2. LD Definition ...

Concept

[Definition framework (DSD WG1)

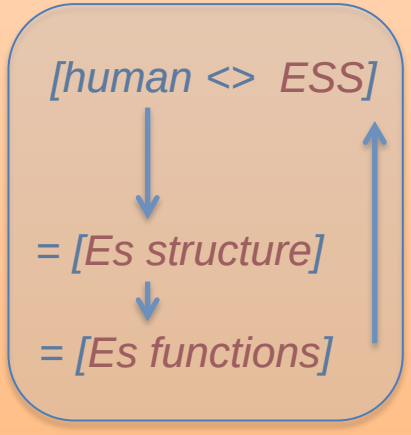
a) Desertification is best to be treated as an extreme case of land degradation, which is expressed in a persistent reduction or loss of biological and economic productivity of lands that are under use by people whose livelihoods depend on this productivity, yet the reduction or loss of this productivity is driven by that use.

Land

*= terrestrial bio-productive **system** also used by humans that comprises:*

- *abiotic elements (**soil**, rainfall, …) and*
- *biotic elements (all biodiversity -- **soil biota**, vegetation) and*
- *all interactions (ecological, hydrological processes, that operate within the system)*

]



[Definition framework (DSD WG1)

a) Desertification is best to be treated as an extreme case of land degradation, which is expressed in a persistent reduction or loss of biological and economic productivity of lands that are under use by people whose livelihoods depend on this productivity, yet the reduction or loss of this productivity is driven by that use.

(b)
the
reh

(c)
lan
inc
da

…loss of biophysical/biological and economic productive capacity of the land (*ES equilibrium*) that is under use …

La

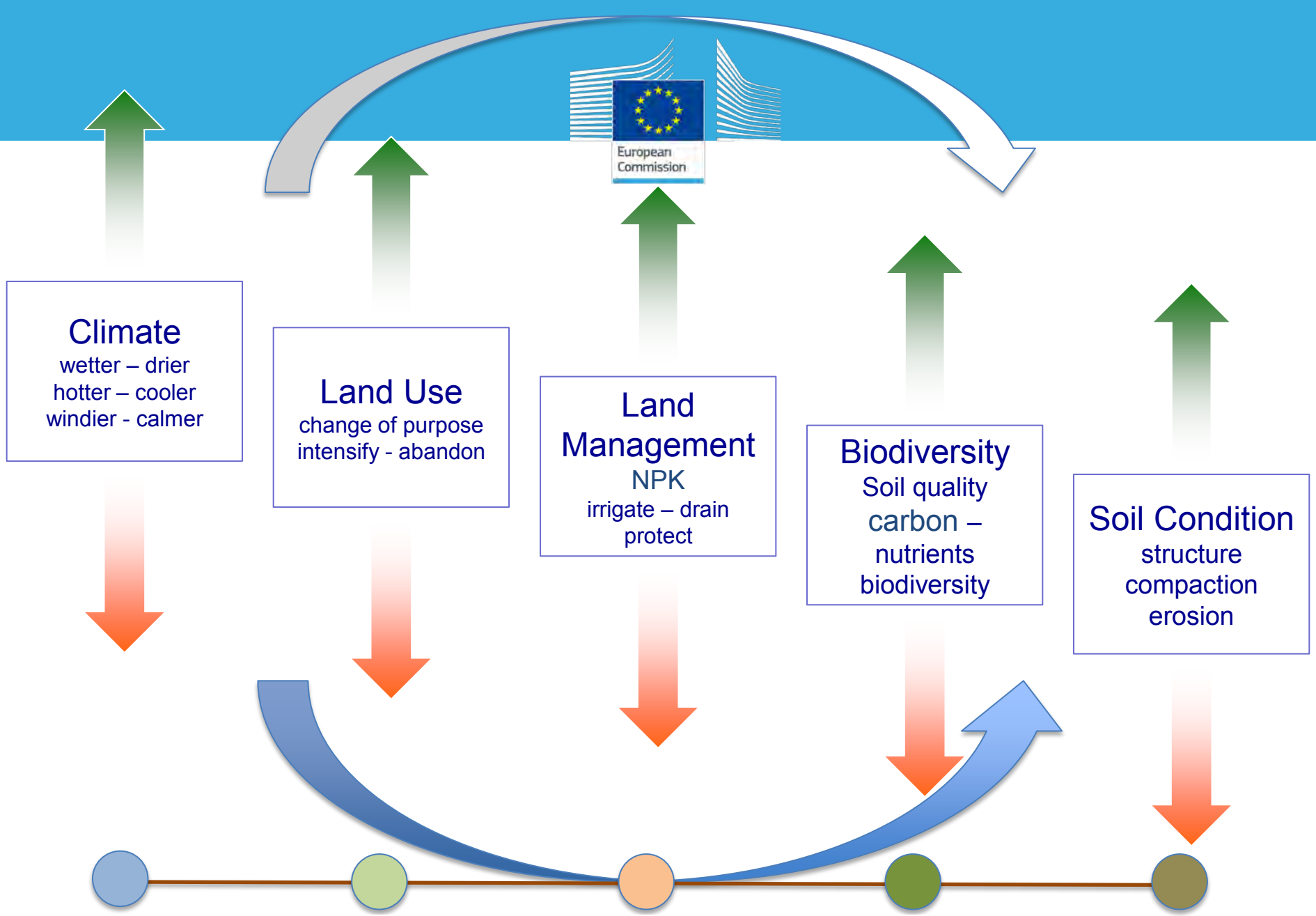
= terrestrial bio-productive system also used by humans that comprises:

- *abiotic elements (soil, rainfall, …) and*
- *biotic elements (all biodiversity -- soil biota, vegetation) and*
- *all interaction (ecological, hydrological processes, that operate within the system)*

= [Es structure]

= [Es functions]

]



Changes in Land-Productivity – ES equilibrium

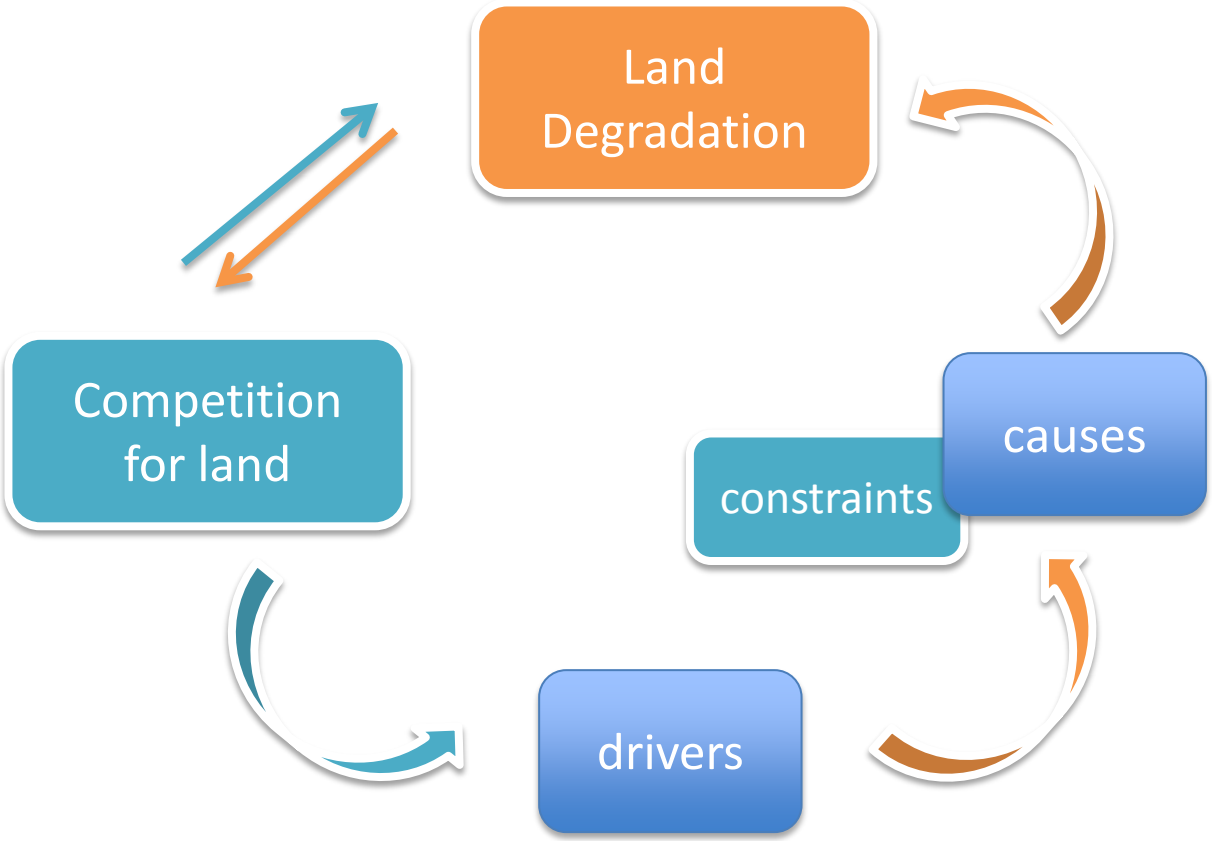
Output = Input

$$C\,N\,P_{out} = C\,N\,P_{in}$$

+ ….. no agreed methodology to address these biophysical and socioeconomic interactions in an integrated way at regional to global scales and to link these to ESS

… but science made progress

(what we can do!)



Drought
Population
Agric. Exp/use
Deforestation
Pasture overuse
Land consumption

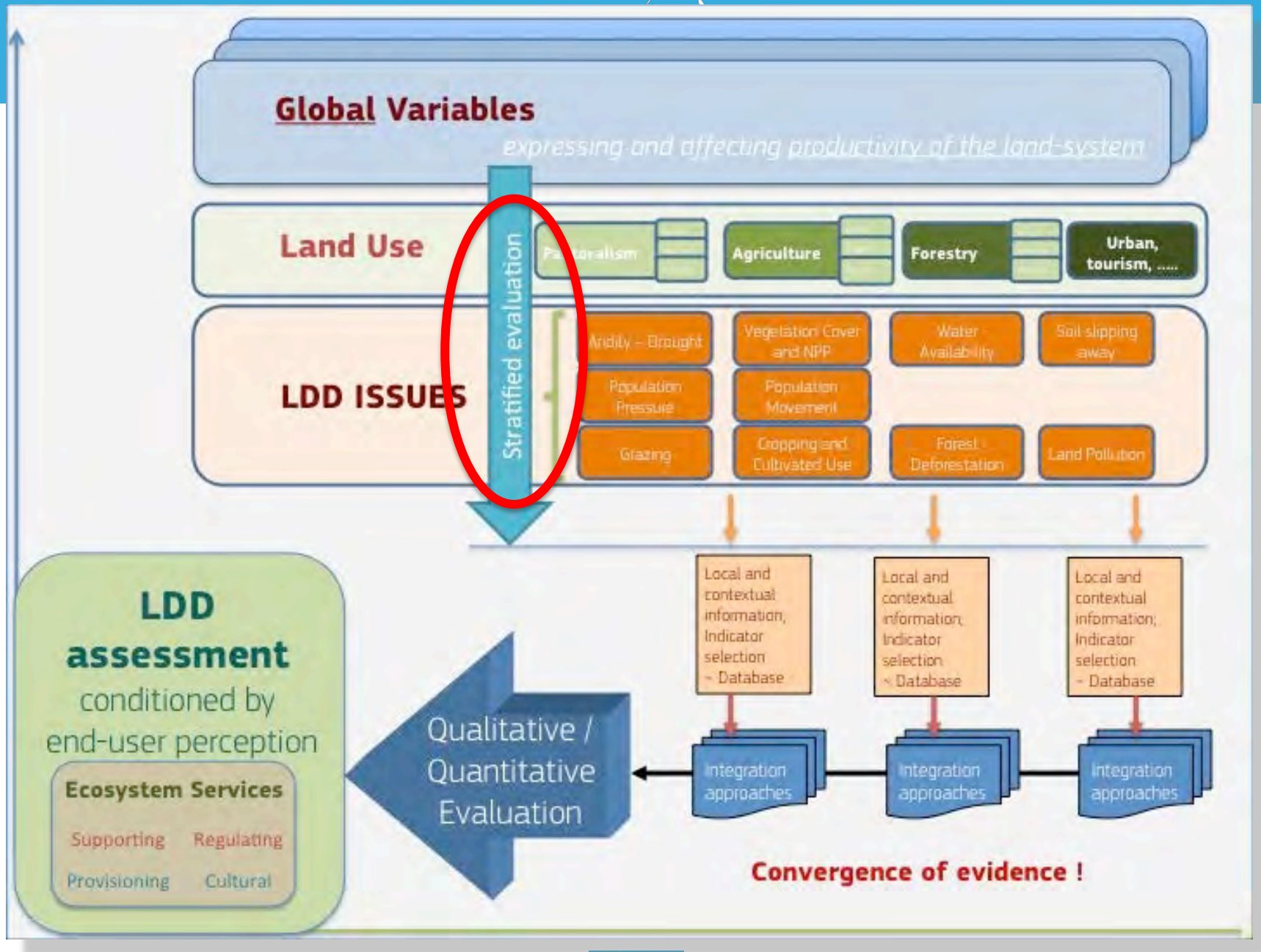
Economic opportunities local/off site
Food security country/subsistence
Consumer behaviour / policies
Land tenure …..
…

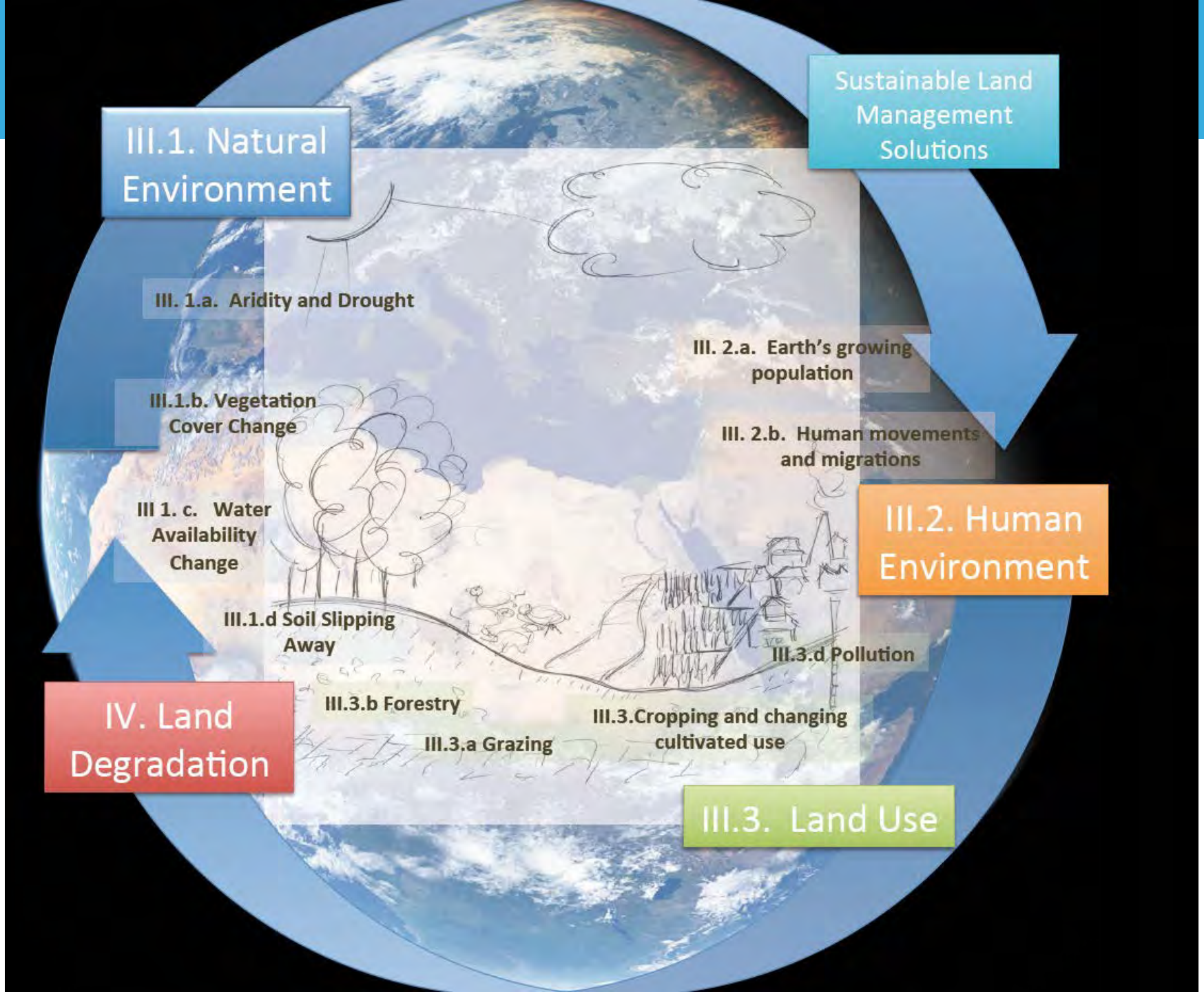
- There are a **limited number of issues** that either alone or in combination drive land degradation; issue and issue pathways provide a global level linkage of land degradation *(Geist and Lambin, 2005-2006)* >

- **Land use** represents the exploitation of the ecosystem and defines the services that the ecosystem should provide; it interfaces with the local character of land degradation *(MA and DDP, Nachtergaele F., 2010, Reynolds et al., 2010)*

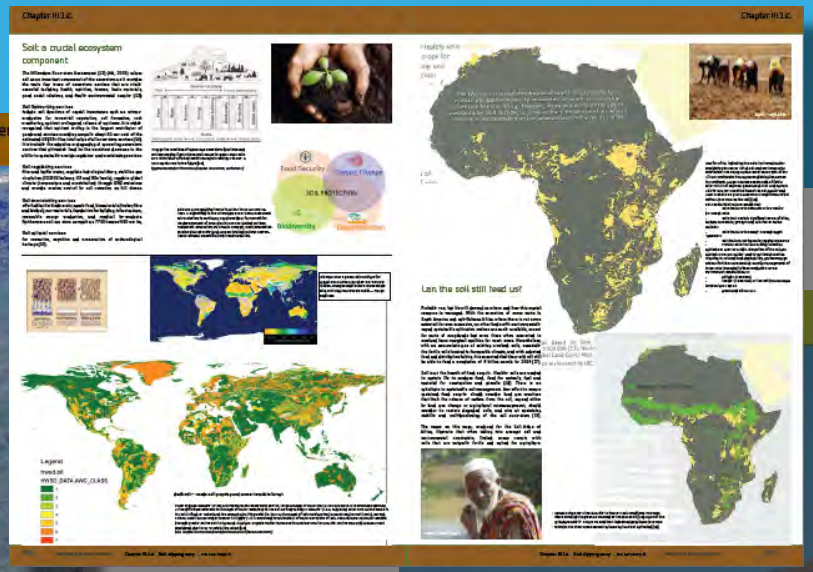
- There are **lots of variables and indicators** to describe (partly) these aspects; they can be integrated through adapted stratifications to explain cause-effect of observed changes in land-system productive capacity *(UNCCD, E. Abraham, Zucca et al., ...)*

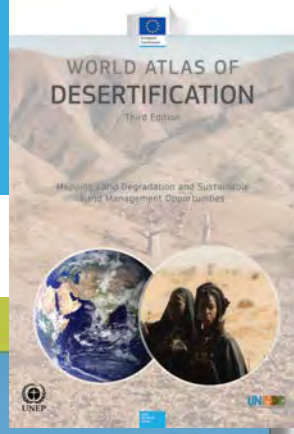
- The **dynamics in the land-system productivity**, biological or economical, is a fundamental aspect of land degradation *(various accepted definitions)*

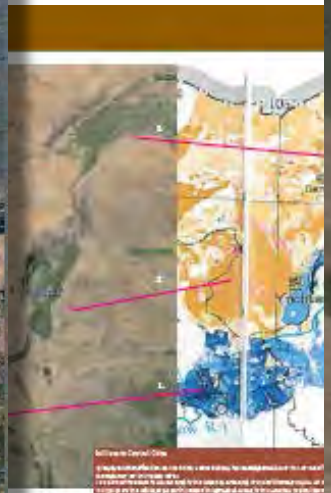

Global Variables
expressing and affecting productivity of the land-system
Land Use
Pastoralism
Agriculture
Forestry
Urban, tourism, ...
LDD ISSUES
Stratified evaluation
Aridity – Drought
Vegetation Cover and NPP
Water Availability
Soil slipping away
Population Pressure
Population Movement
Grazing
Cropping and Cultivated Use
Forest Deforestation
Land Pollution
Local and contextual information, Indicator selection - Database
Local and contextual information, Indicator selection - Database
Local and contextual information, Indicator selection - Database
Integration approaches
Integration approaches
Integration approaches
Qualitative / Quantitative Evaluation
LDD assessment
conditioned by end-user perception
Ecosystem Services
Supporting
Regulating
Provisioning
Cultural
Convergence of evidence !

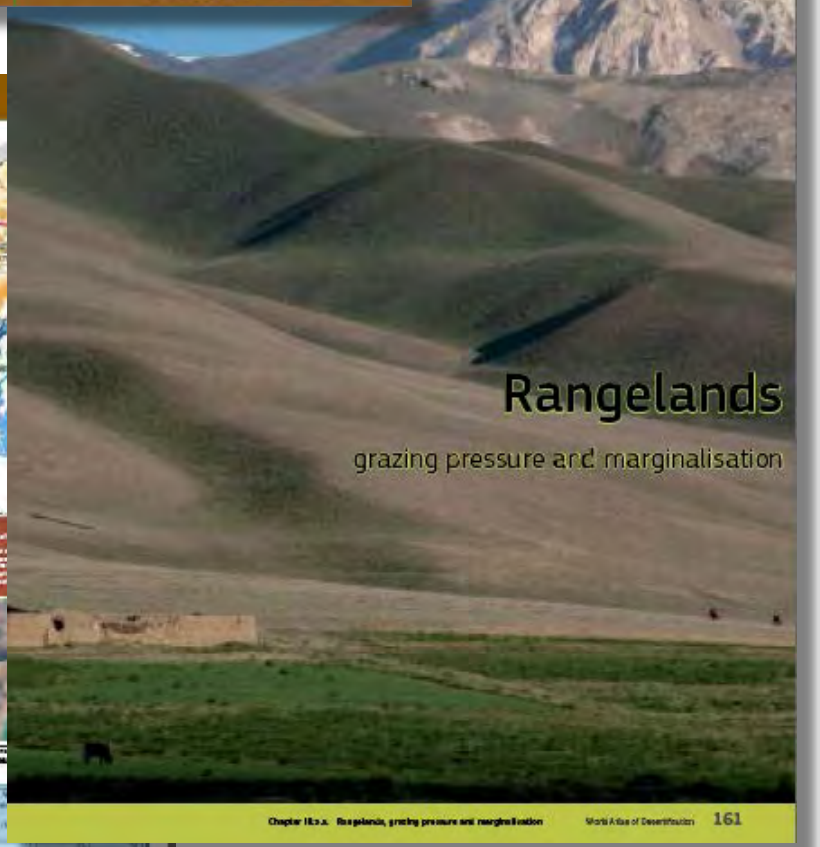

III.1. Natural Environment
Sustainable Land Management Solutions
III. 1.a. Aridity and Drought
III. 2.a. Earth's growing population
III.1.b. Vegetation Cover Change
III. 2.b. Human movements and migrations
III 1. c. Water Availability Change
III.2. Human Environment
III.1.d Soil Slipping Away
III.3.d Pollution
IV. Land Degradation
III.3.b Forestry
III.3.Cropping and changing cultivated use
III.3.a Grazing
III.3. Land Use


Soil slipping away
.... we can stop it


Soil: a crucial ecosystem component
Can the soil still feed us?


WORLD ATLAS OF
DESERTIFICATION
Third Edition
UNEP




Rangelands
grazing pressure and marginalisation
Chapter III.3.a. Rangelands, grazing pressure and marginalisation World Atlas of Desertification 161

en

European Commission

JOINT RESEARCH CENTRE

World Atlas of Desertification (WAD)

Europa > European Commission > JRC > IES > LRM > Desert > WAD

Home | Desertification | Atlas | Mapping

Report on "An assessment of Land Productivity Dynamics - towards a valuation of Land Degradation in the EU"

User Login

User Name
cherlmi

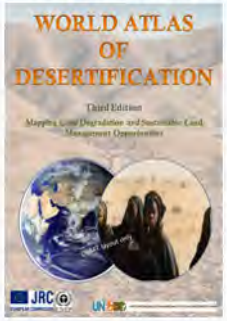
Password
•••••••

Remember Me

Log in

Forgot your password?
Forgot your username?

Table of Contents



Welcome to WAD Portal

A new World Atlas of Desertification (WAD) is being compiled under the coordination of the Joint Research Centre (JRC) of the European Commission, in partnership with the United Nations Environment Programme (UNEP). The WAD will be available as both a published reference atlas and an online digital information portal.

This website will be developed as a digital atlas interface. At first, access will be restricted to the official working groups, but gradually more and more public content will be added.

The new World Atlas of Desertification will be built on recent scientific progress. It aims to be a pragmatic exercise and an example of how to implement up-to-date concepts and robust approaches for assessing and mapping land degradation and desertification.

The World Atlas of Desertification is expected to be the foundation for better addressing and including desertification and land degradation in strategies that address food security, resource efficiency, energy and emissions schemes, development and poverty reduction.

Desertification | Atlas

ToC | Mapping


photo: Dr. P. Zdruli


Photo: A. Brink


photo: B. Houskova

http://wad.jrc.ec.europa.eu

For more information please contact
Michael Cherlet: (+ 39) 0332 78 **9982** michael.cherlet@jrc.ec.europa.eu

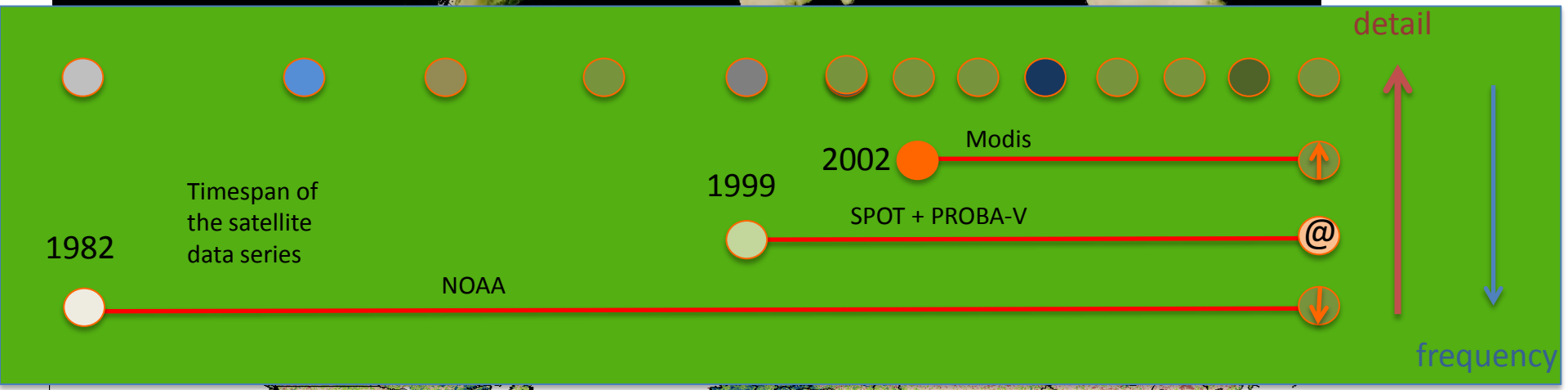
3. Implementation of the concept

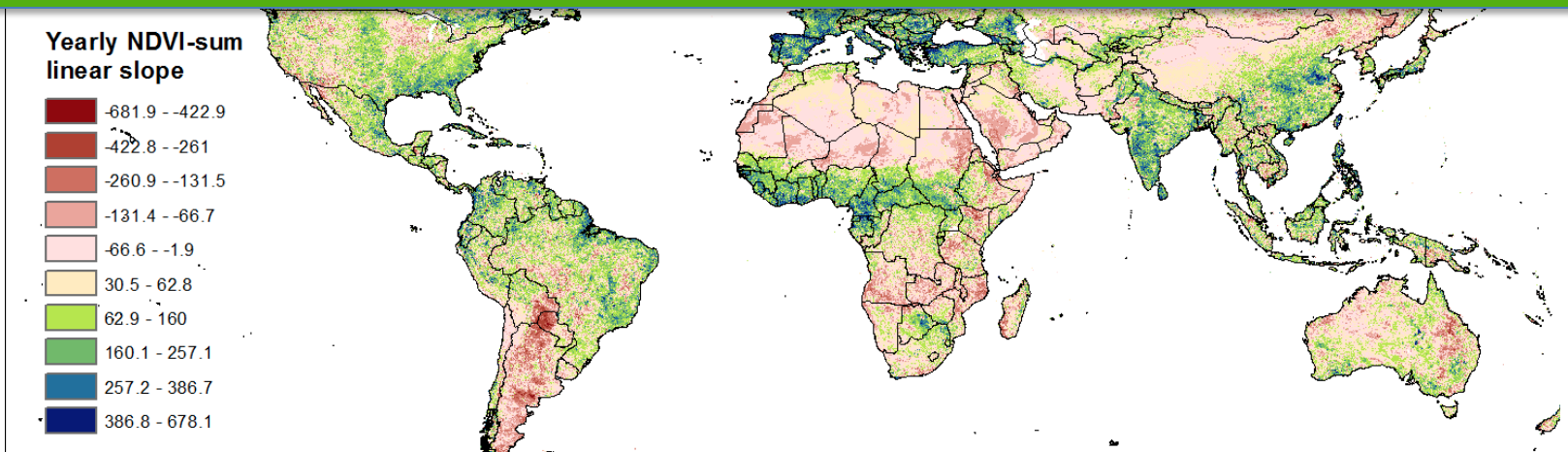
a. Land System Productive capacity

b. Contextual information

Global variables / Indicators – satellite observation

MODIS
(ex. Oct13)



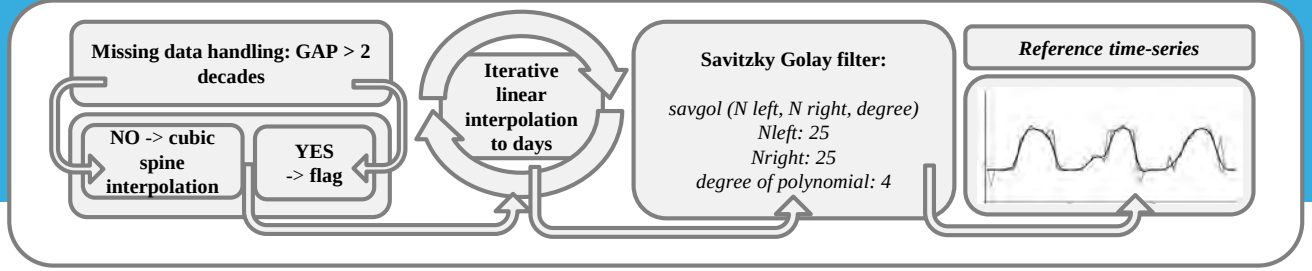


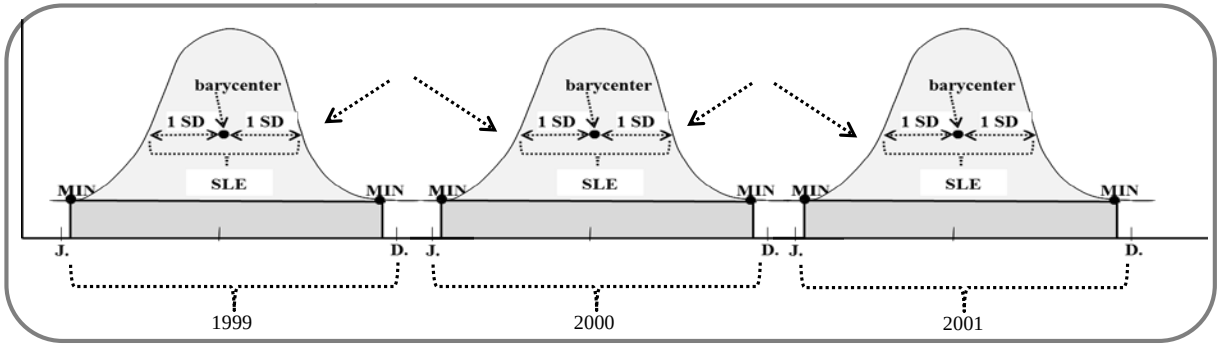
NPP proxy
Sum NDVI
Gimms3G

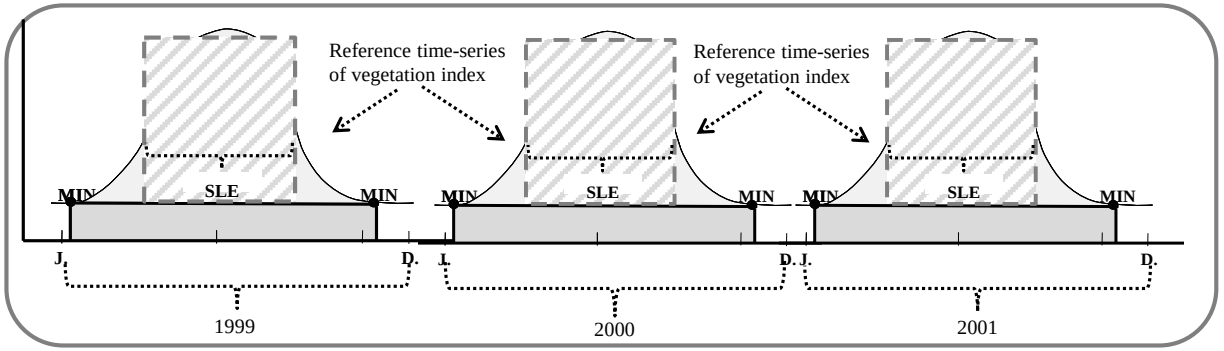
Slope over
1982-2010

Decomposing the yearly satellite based vegetation index (NDVI, FAPAR) curve into a number of **phenological and productivity** variables allows to better describe the land system dynamics

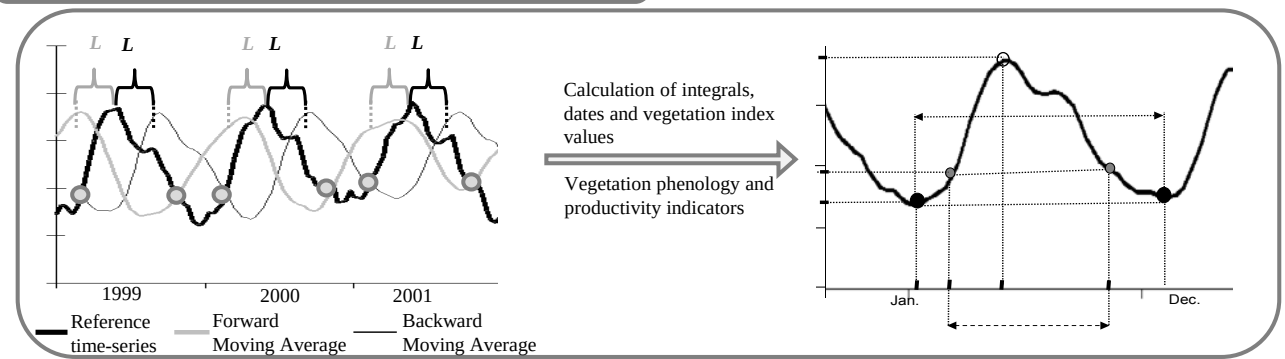
"phenolo"



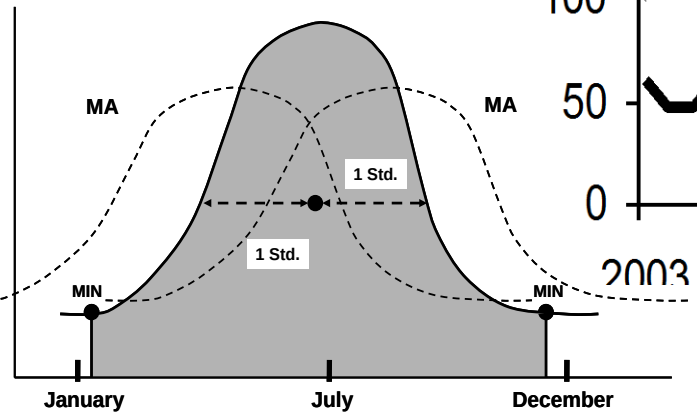


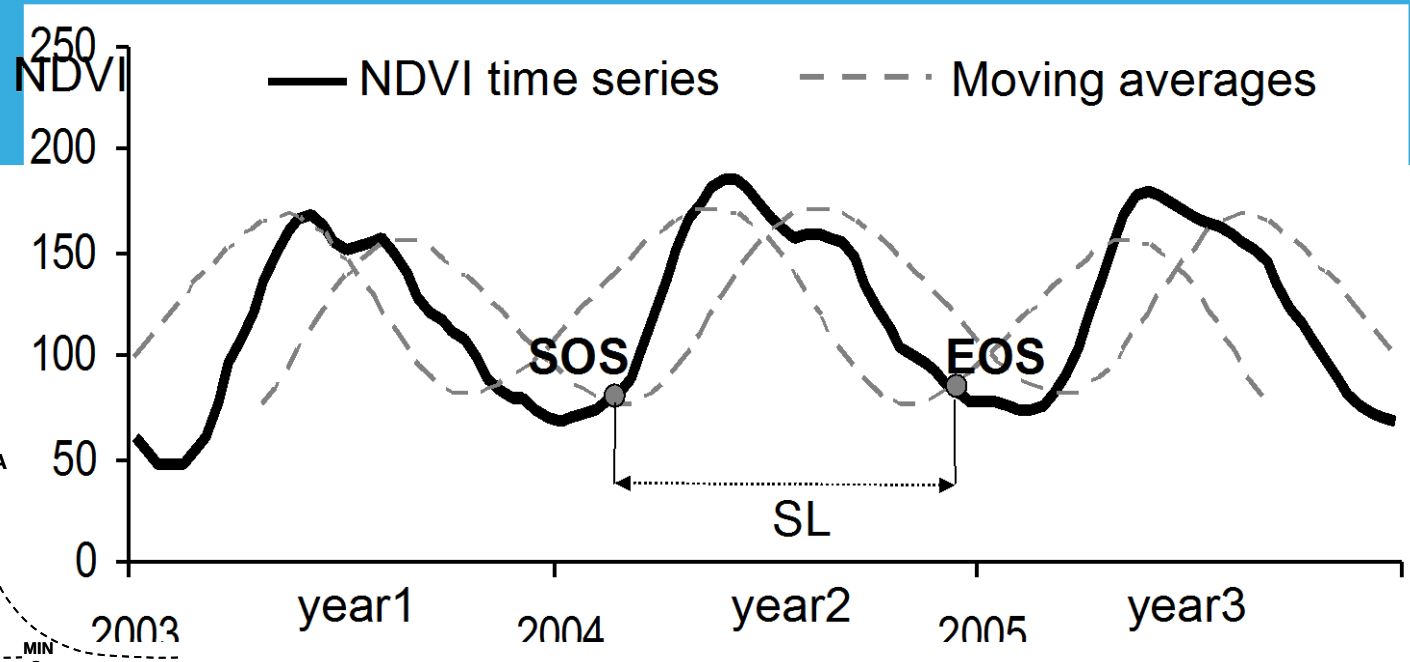


$$L = \frac{(365 - SLE_{1999}) + (365 - SLE_{2000}) + (365 - SLE_{2001})}{3}$$



Lagging:
Prior-moving average





Reed, 1994)

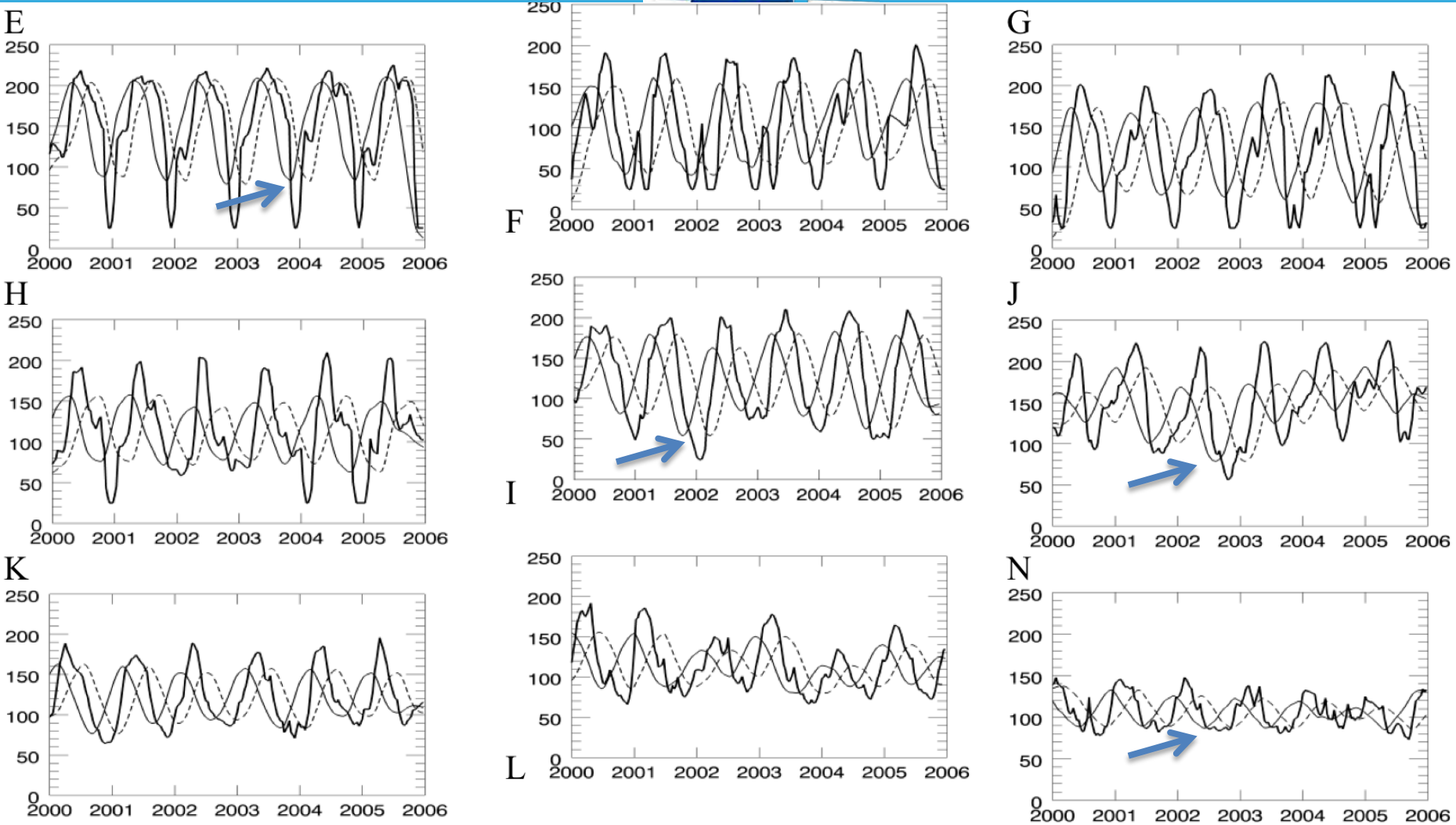
$$L = \frac{\sum_{i=1}^{N} (365 - SLE)}{N}, \text{ eq. (1)}$$

SLE = estimated SLE calculated as 2 times the standard deviation from the barycenter under the NDVI curve
L = the lag (in days),
N= number of years
365 = is the number of days in the year

(2009)

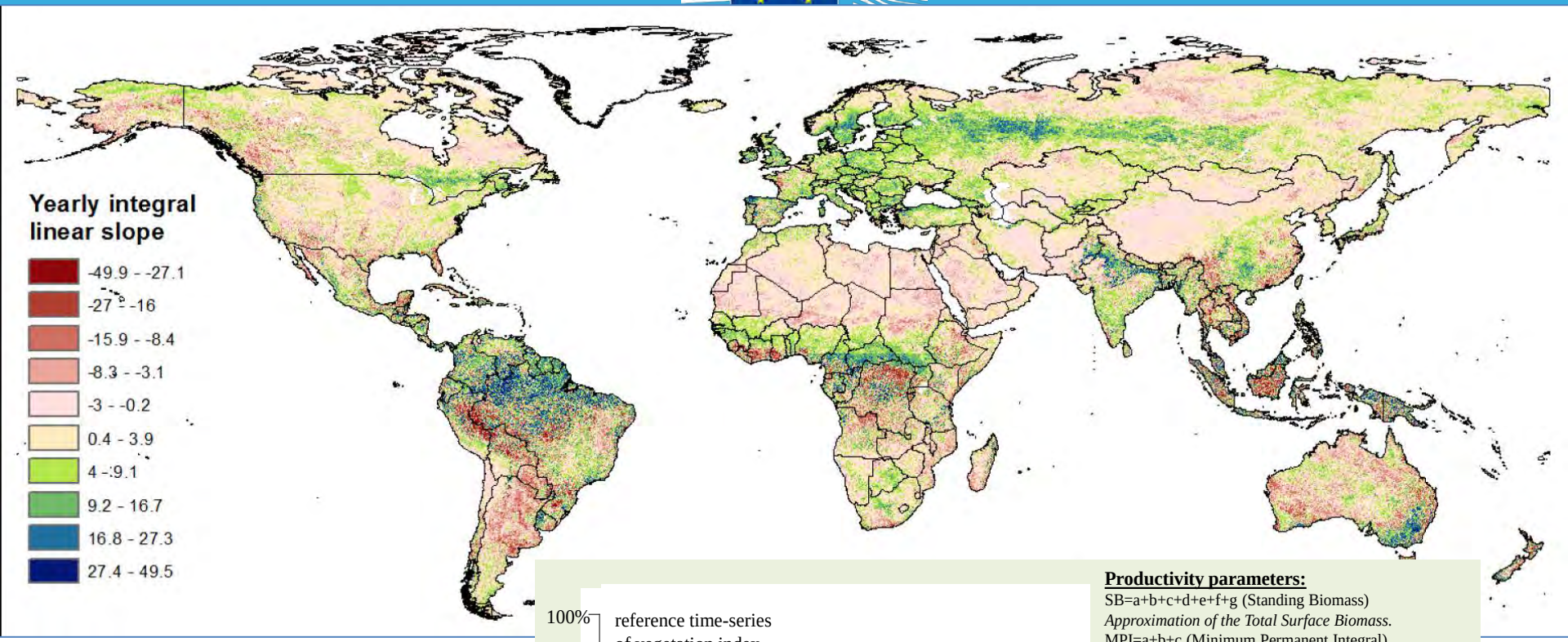
(2013)

Joint Research Centre



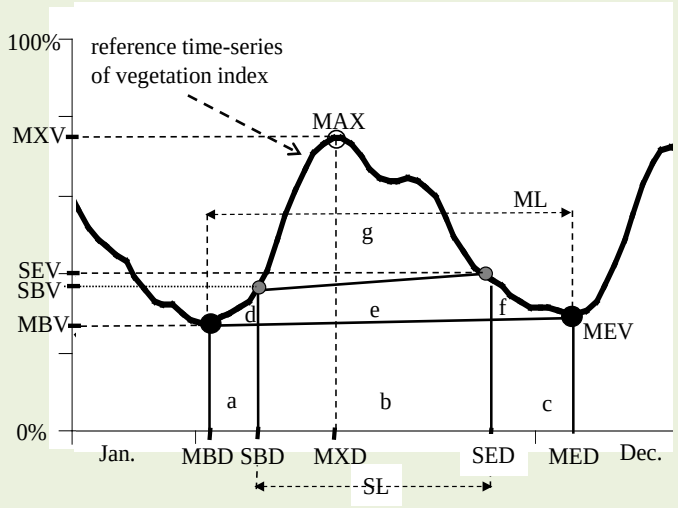
SPOT VGT NDVI

Phenological and productivity variables



Phenological and productivity variables

(above: e.g. slope of Seasonal Integrated Biomass over 1982-2010)

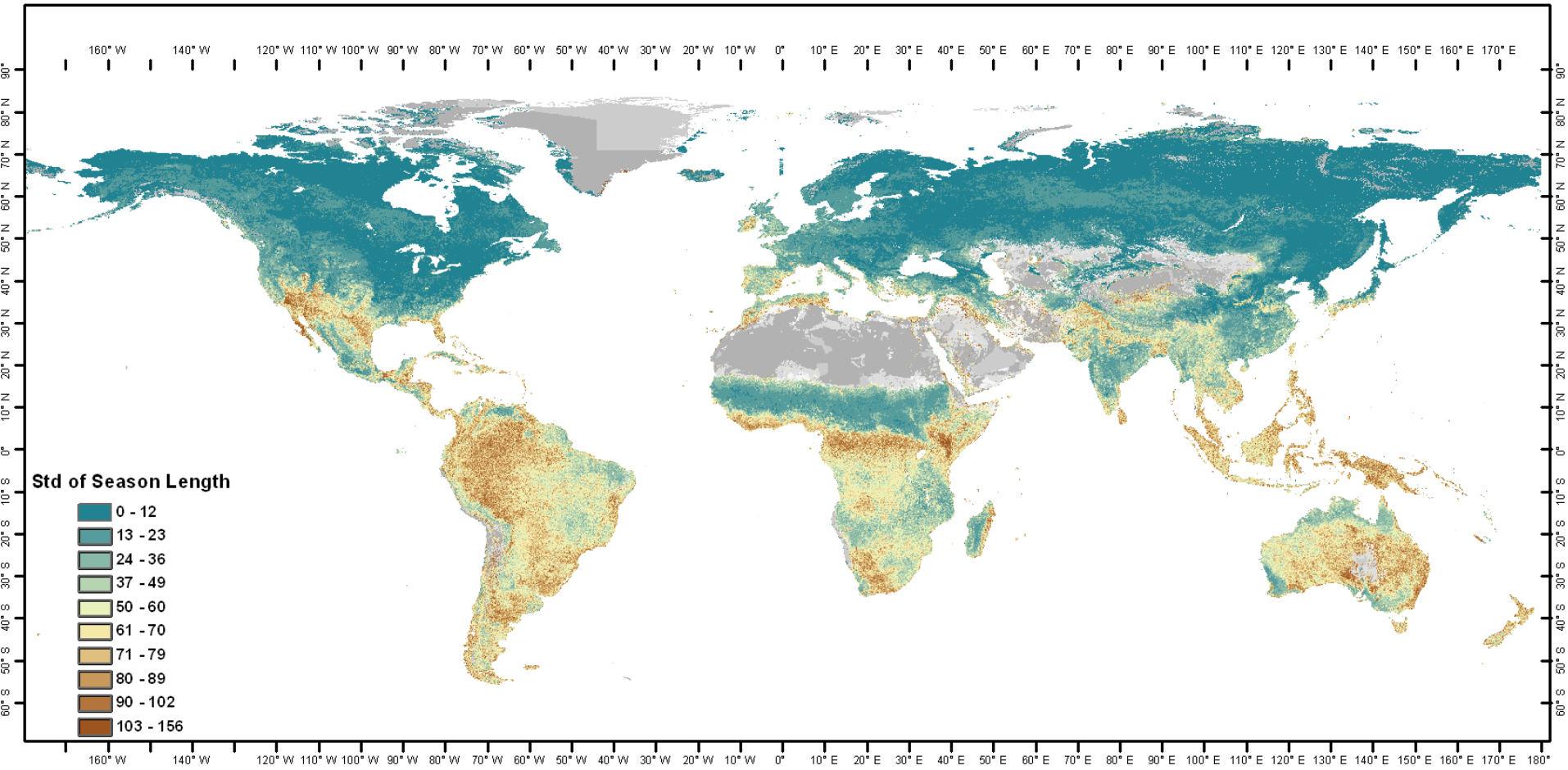


Productivity parameters:

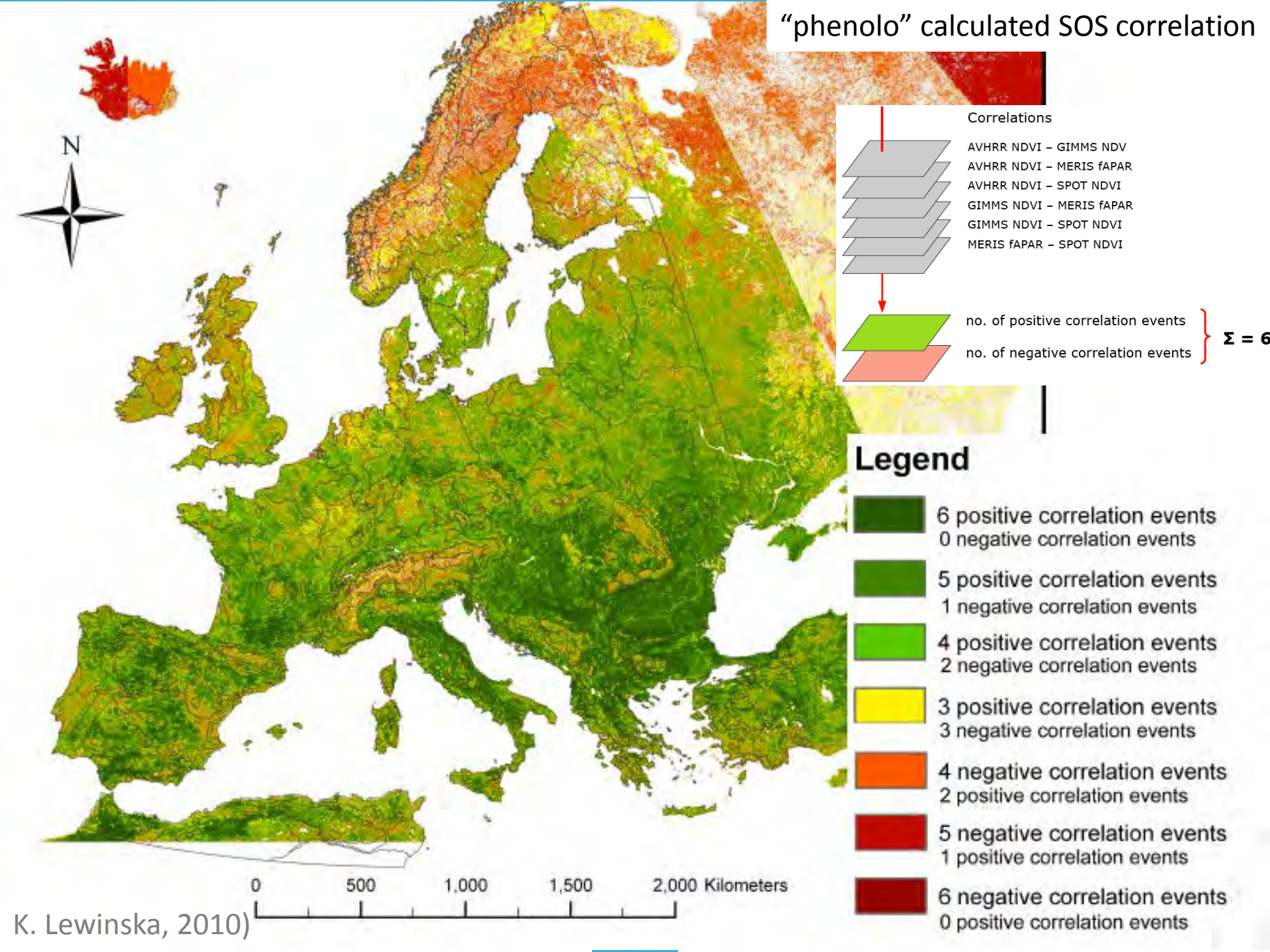
SB=a+b+c+d+e+f+g (Standing Biomass)
Approximation of the Total Surface Biomass.
MPI=a+b+c (Minimum Permanent Integral)
Area characterising the perennial vegetation component and depending on the vegetation index used may also contain components of soil substrate.
SER=d+f (Season Exceeding Residual Integral)
The amount of senescent vegetation outside of the growing season. May be more indicative to before/after harvest of agricultural areas.
CF=g (Cyclic fraction)
This parameter may be directly related to purely seasonal growth.
PF=d+e+f (Permanent Fraction)
The amount of vegetation that does not have a characteristic seasonal cycle within the growing season.

Phenological parameters:

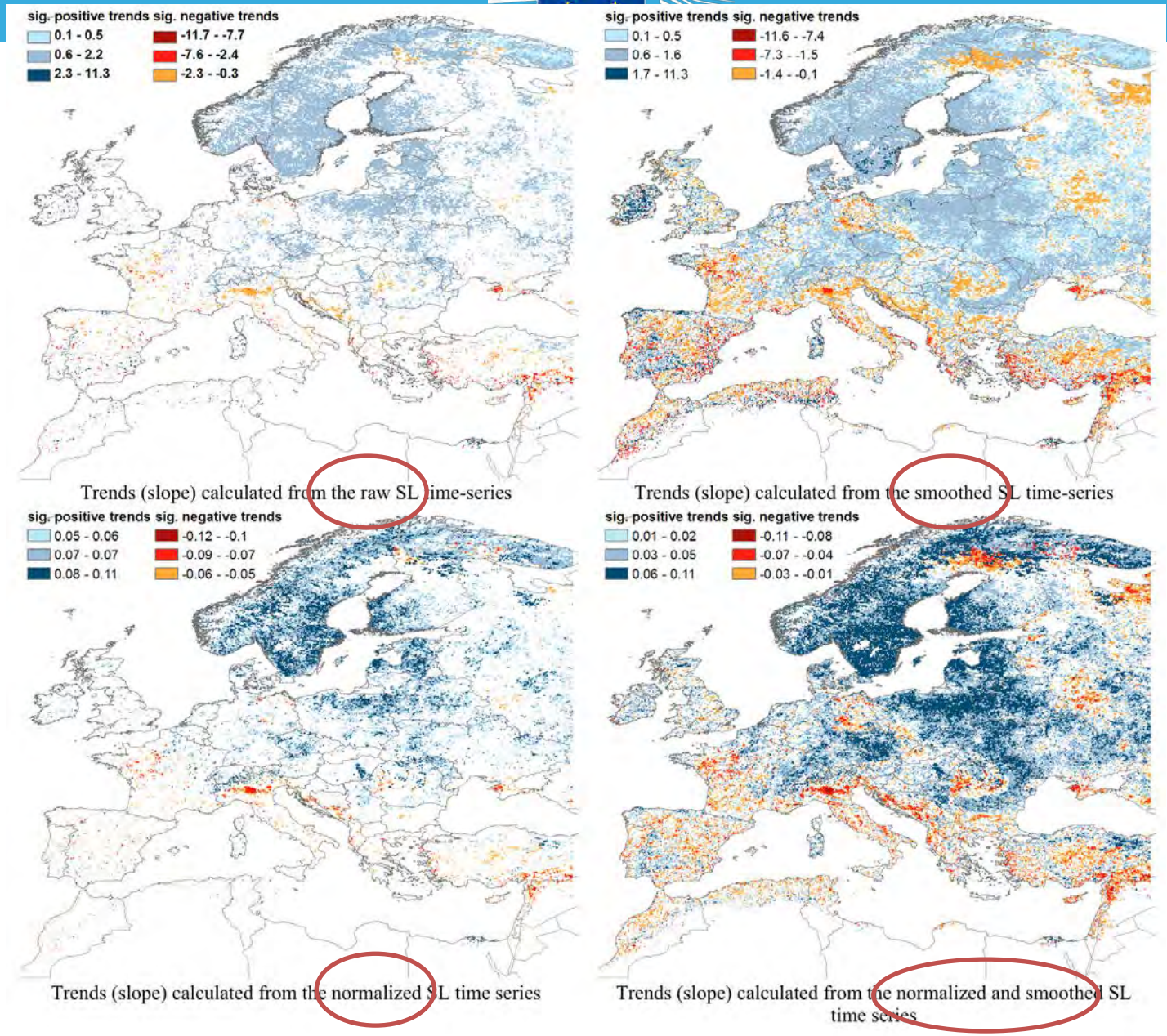
SBD = Season Begin Day.
SL = Season Length.
MXV = Maximum Value of the vegetation index.
MXD = Maximum Day.
SBV = Season Begin Value of the vegetation index.

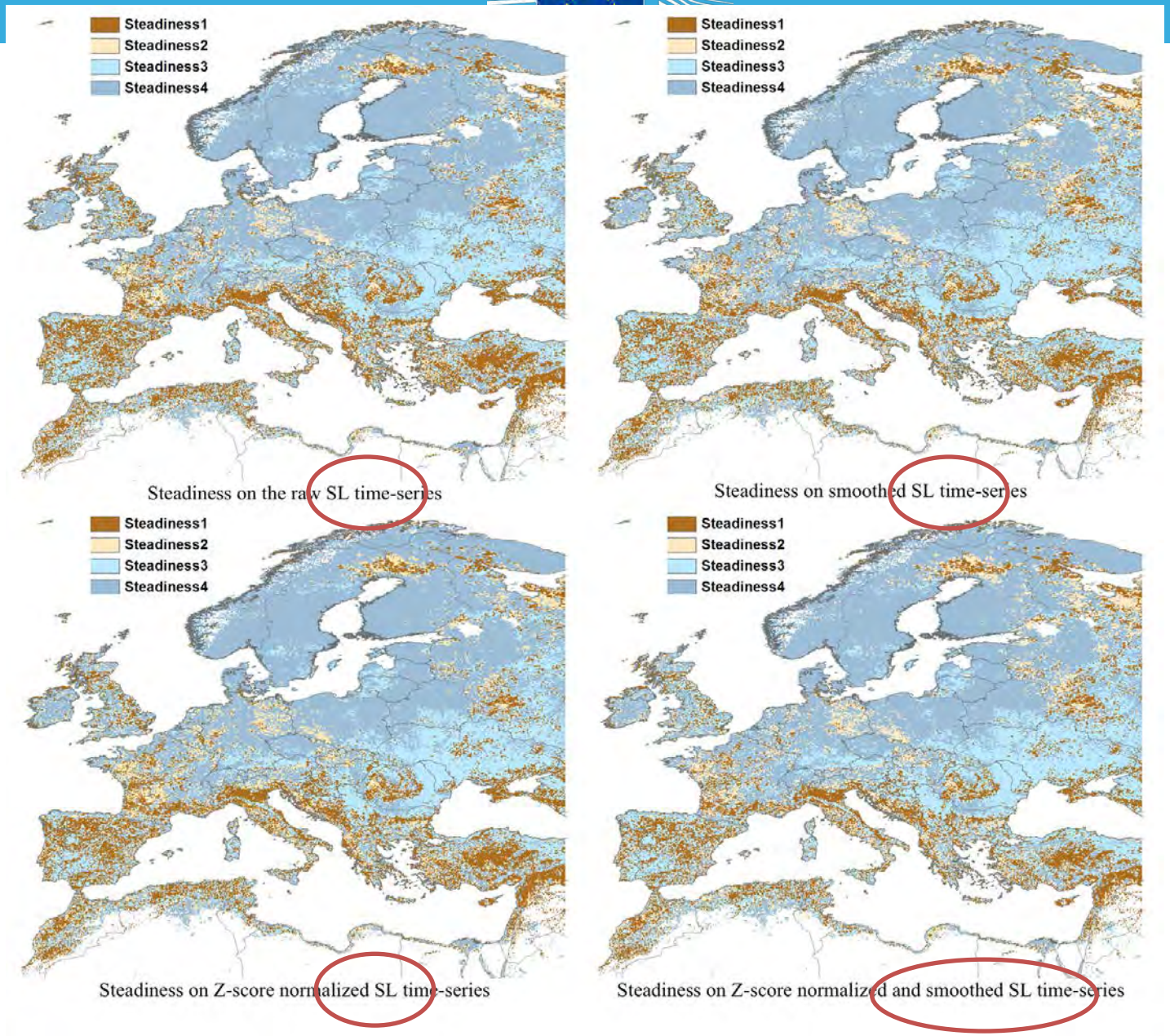


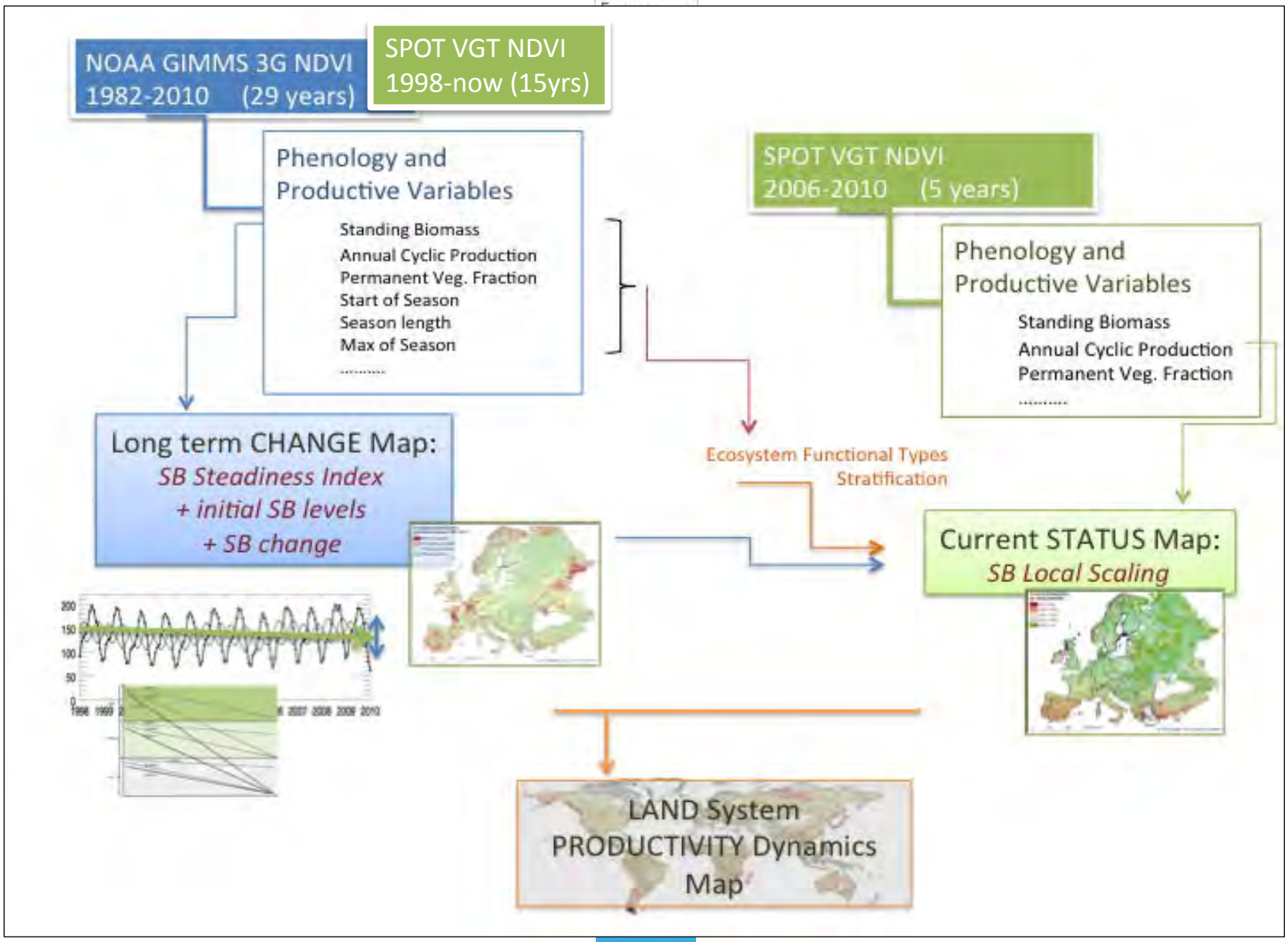
Variability of Vegetative Growing Season Length
Based on Growing Season Length
as calculated from GIMMS NDVI ‘81-’06

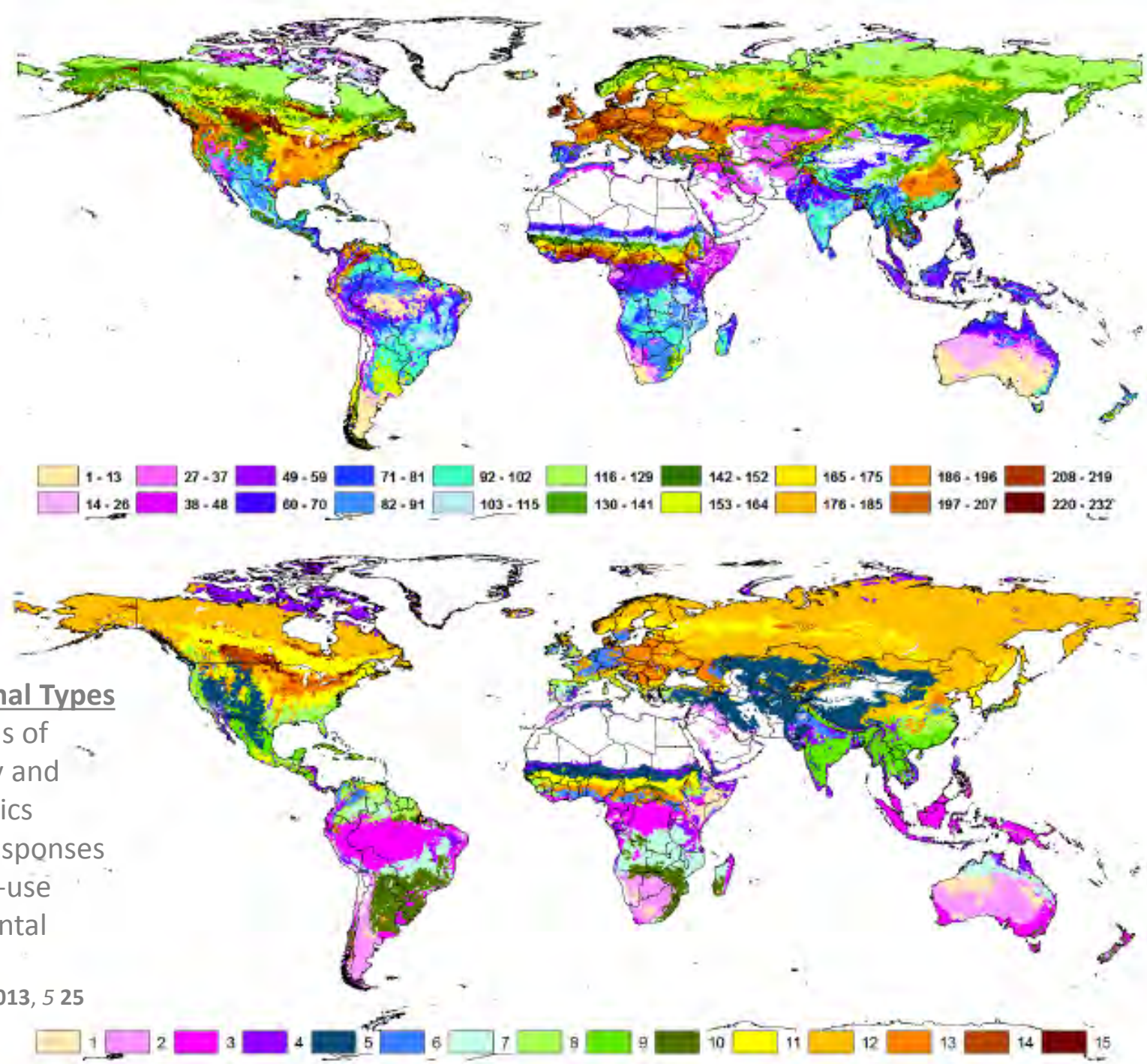


K. Lewinska, 2010)


sig. positive trends sig. negative trends
0.1 - 0.5
0.6 - 2.2
2.3 - 11.3
-11.7 - -7.7
-7.6 - -2.4
-2.3 - -0.3
Trends (slope) calculated from the raw SL time-series
sig. positive trends sig. negative trends
0.1 - 0.5
0.6 - 1.6
1.7 - 11.3
-11.6 - -7.4
-7.3 - -1.5
-1.4 - -0.1
Trends (slope) calculated from the smoothed SL time-series
sig. positive trends sig. negative trends
0.05 - 0.06
0.07 - 0.07
0.08 - 0.11
-0.12 - -0.1
-0.09 - -0.07
-0.06 - -0.05
Trends (slope) calculated from the normalized SL time series
sig. positive trends sig. negative trends
0.01 - 0.02
0.03 - 0.05
0.06 - 0.11
-0.11 - -0.08
-0.07 - -0.04
-0.03 - -0.01
Trends (slope) calculated from the normalized and smoothed SL time series

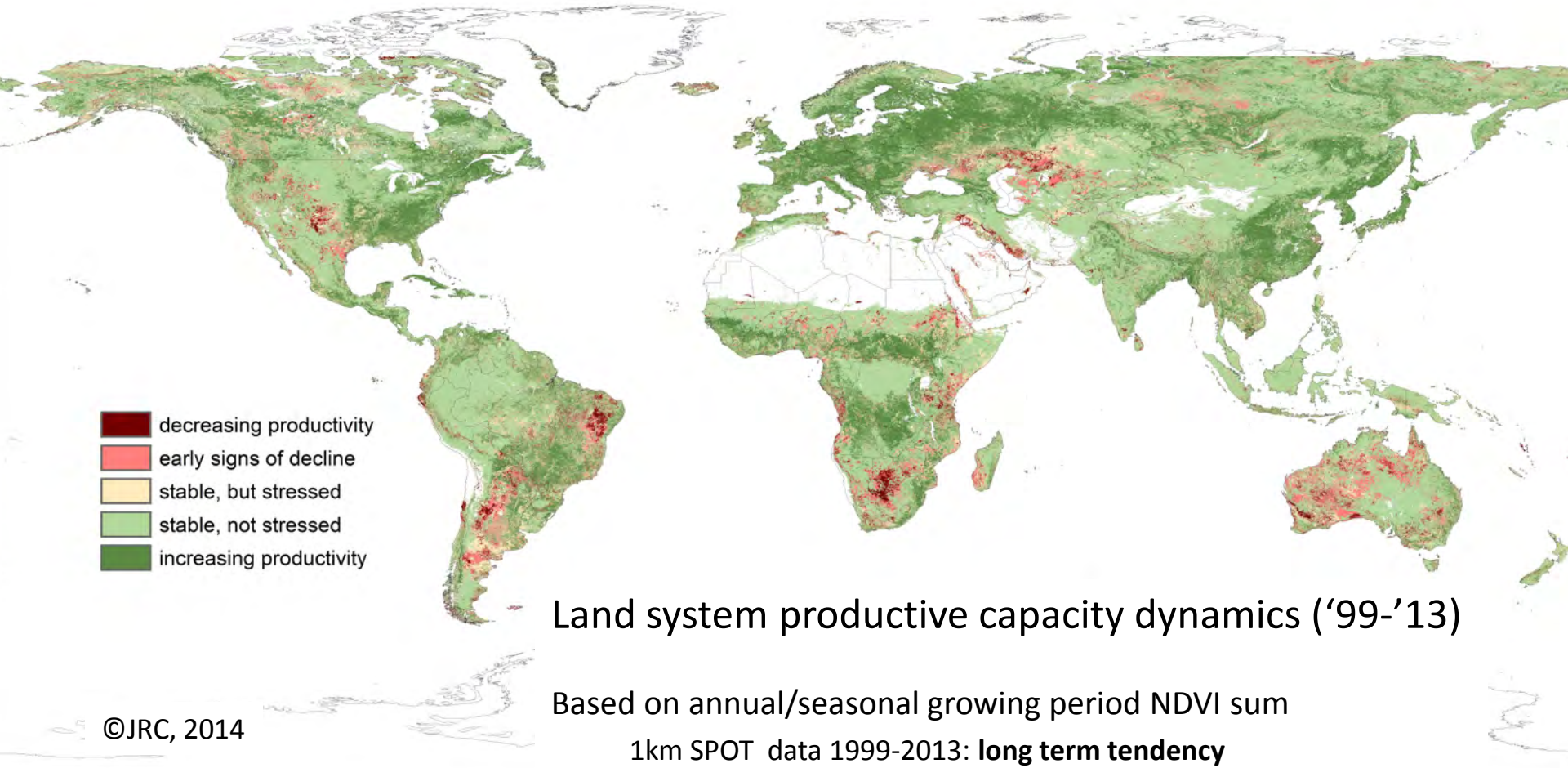

Steadiness1
Steadiness2
Steadiness3
Steadiness4
Steadiness on the raw SL time-series
Steadiness1
Steadiness2
Steadiness3
Steadiness4
Steadiness on smoothed SL time-series
Steadiness1
Steadiness2
Steadiness3
Steadiness4
Steadiness on Z-score normalized SL time-series
Steadiness1
Steadiness2
Steadiness3
Steadiness4
Steadiness on Z-score normalized and smoothed SL time-series


NOAA GIMMS 3G NDVI
1982-2010 (29 years)
SPOT VGT NDVI
1998-now (15yrs)
Phenology and
Productive Variables
Standing Biomass
Annual Cyclic Production
Permanent Veg. Fraction
Start of Season
Season length
Max of Season
.....
SPOT VGT NDVI
2006-2010 (5 years)
Phenology and
Productive Variables
Standing Biomass
Annual Cyclic Production
Permanent Veg. Fraction
.....
Long term CHANGE Map:
SB Steadiness Index
+ initial SB levels
+ SB change
Ecosystem Functional Types
Stratification
Current STATUS Map:
SB Local Scaling
LAND System
PRODUCTIVITY Dynamics
Map



Ecosystem Functional Types with similar patterns of seasonal phenology and productivity dynamics exhibiting similar responses to climate and land-use induced environmental conditions.

Ivits et al, Remote Sens. **2013**, *5* **25**

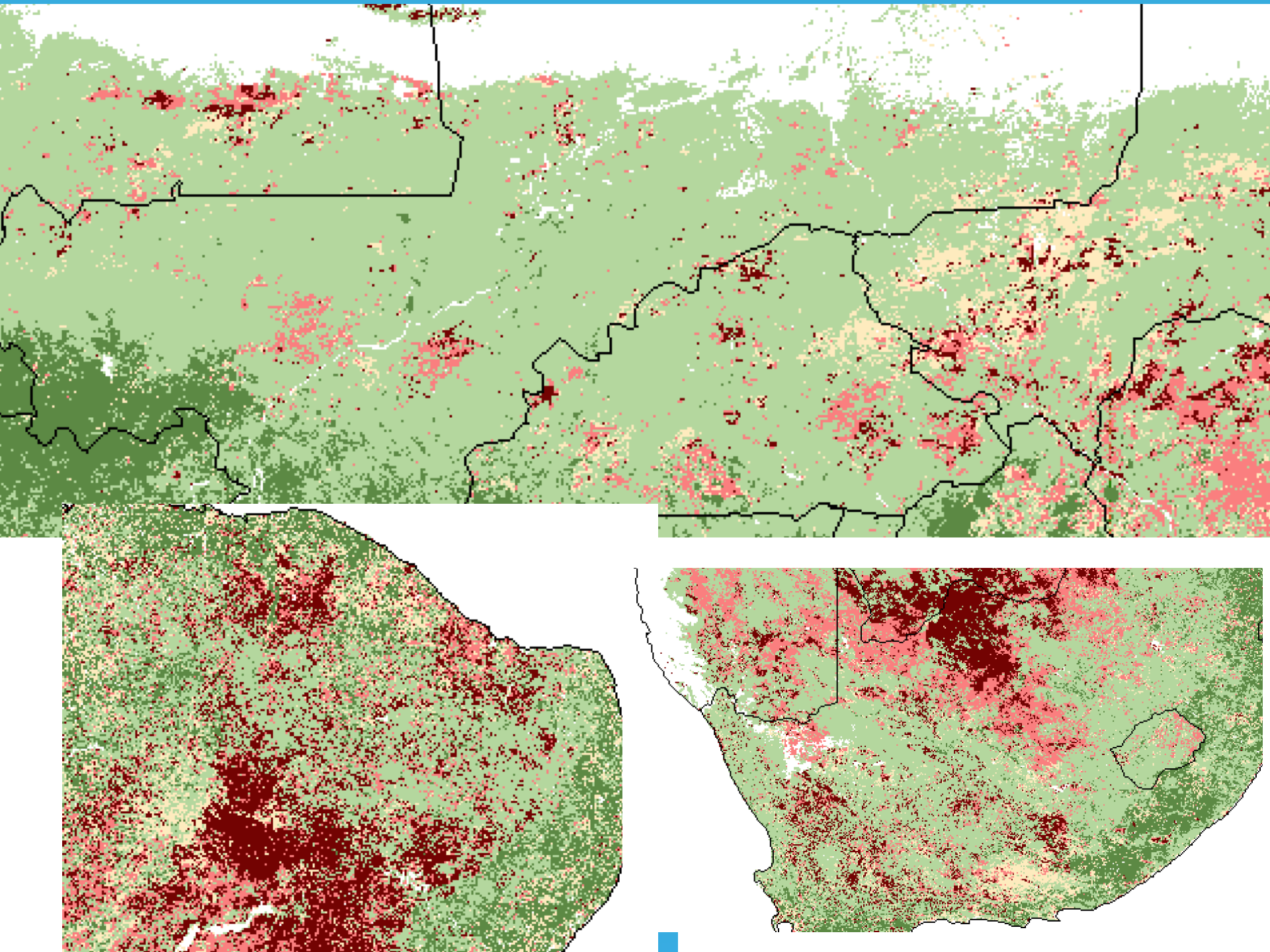


Land system productive capacity dynamics (‘99-’13)

Based on annual/seasonal growing period NDVI sum

1km SPOT data 1999-2013: **long term tendency**
1kmSPOT data 2008-2013: **current performance**

540 observations on +- 150 M points on land !!
ecosystem functioning stratification
seasonality mask
seasonal productivity (where season)
yearly productivity (where no season) [PBL}



An Assessment of Land System Productivity Dynamics in Europe (1982-2010)

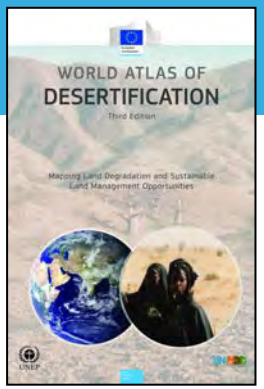
declining productivity
early-signs of decline
stable, but stressed
stable, not stressed
increasing productivity

Forests and semi natural vegetation account for 50% of all areas where land-productivity is **increasing**

Agriculture' accounts for 35% of the **declining** areas

N

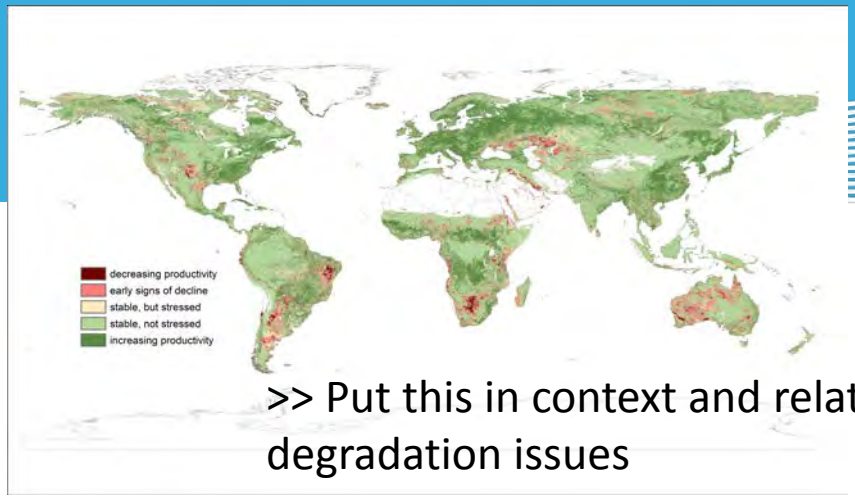
Kilometers
0 250 500 1,000



% of EU land
in each Land Productivity category

1.5%
5.6%
7.9%
70.2%
14.9%

Investments in sustainable land management might be needed [trade-offs known]

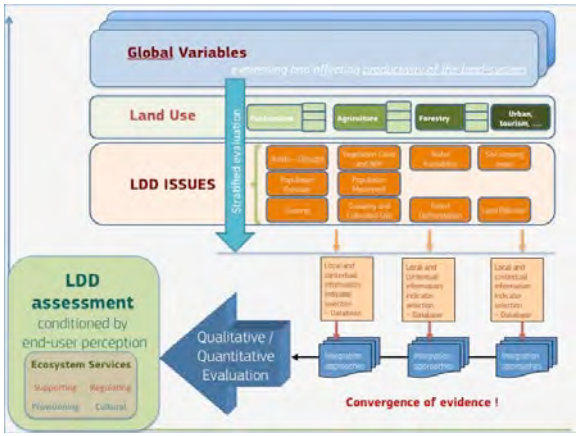


European Commission

>> Put this in context and relate to biophysical and socio-economical land degradation issues

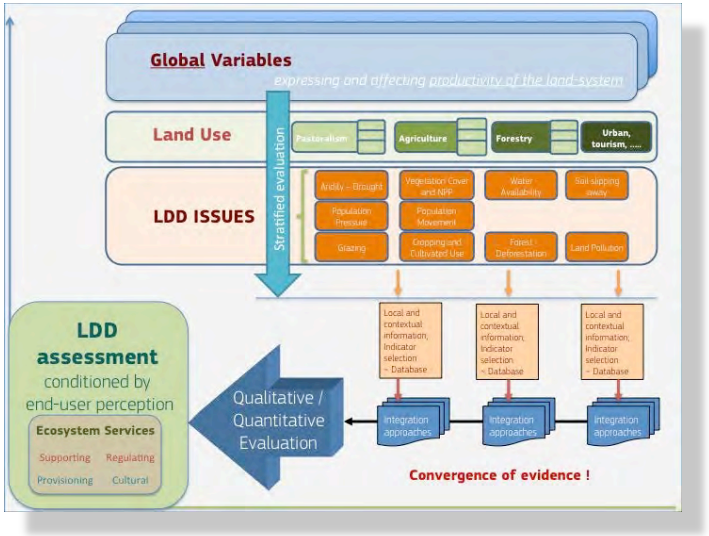
Evaluation of dynamics of land-system (surface) conditions through spatial stratifications:

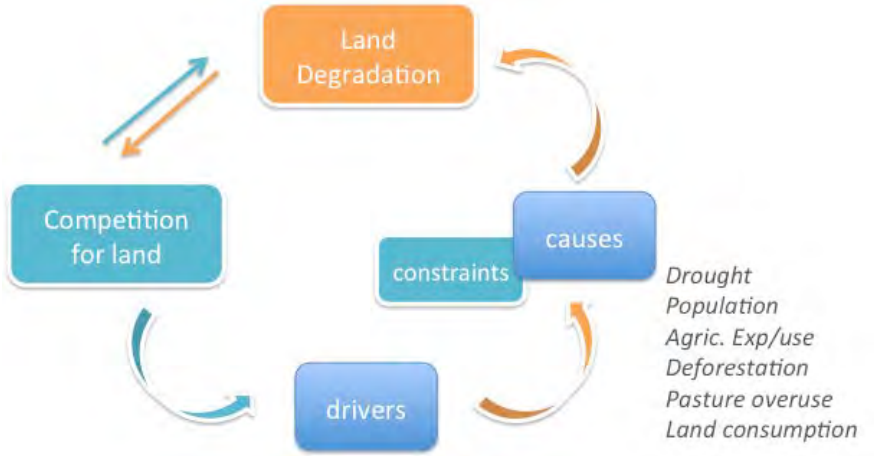
1. drought
2. soil processes
3. land management (fires)
4. land use change
5. land take



Convergence of evidence!

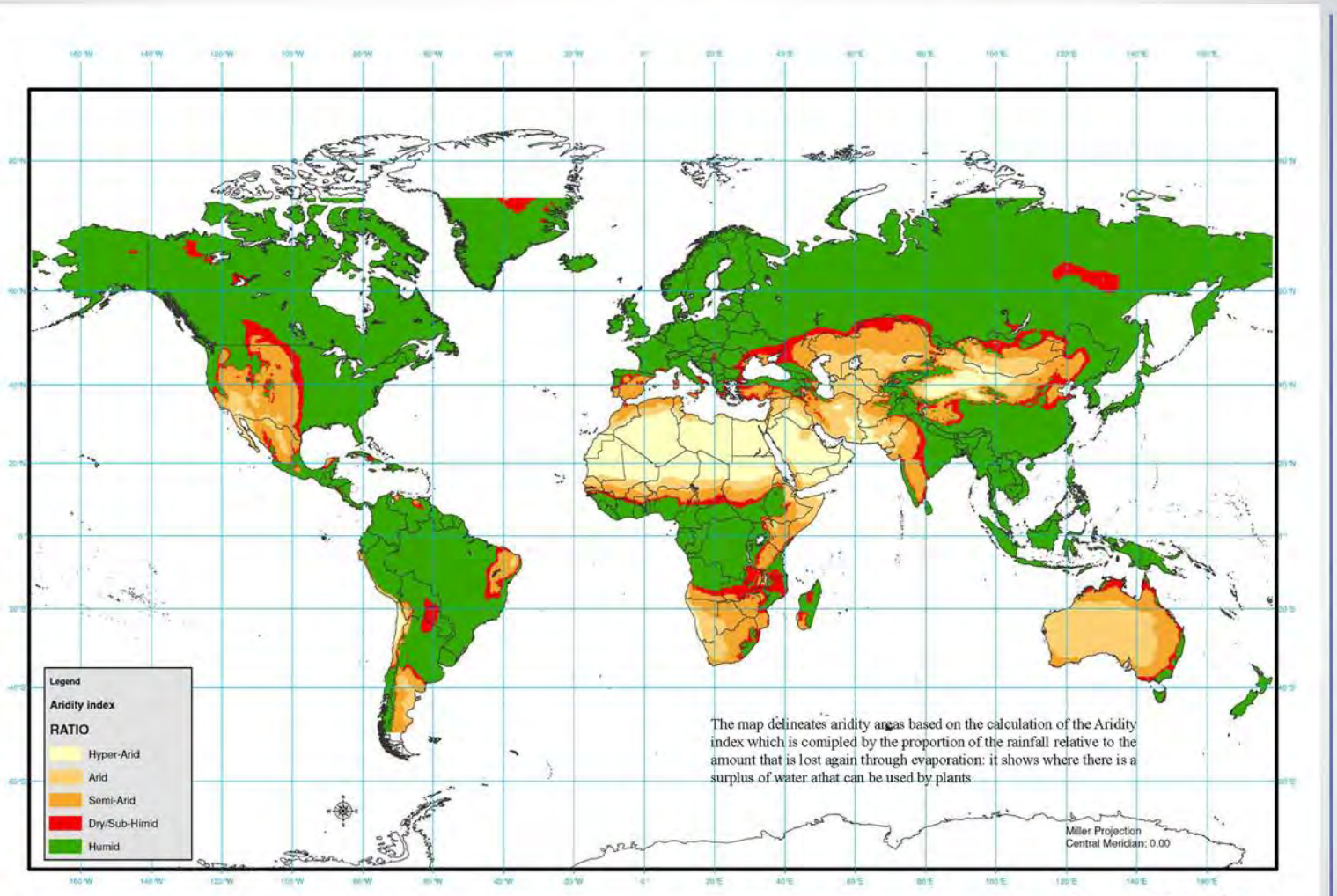
Translation to ecosystem service change (case studies)





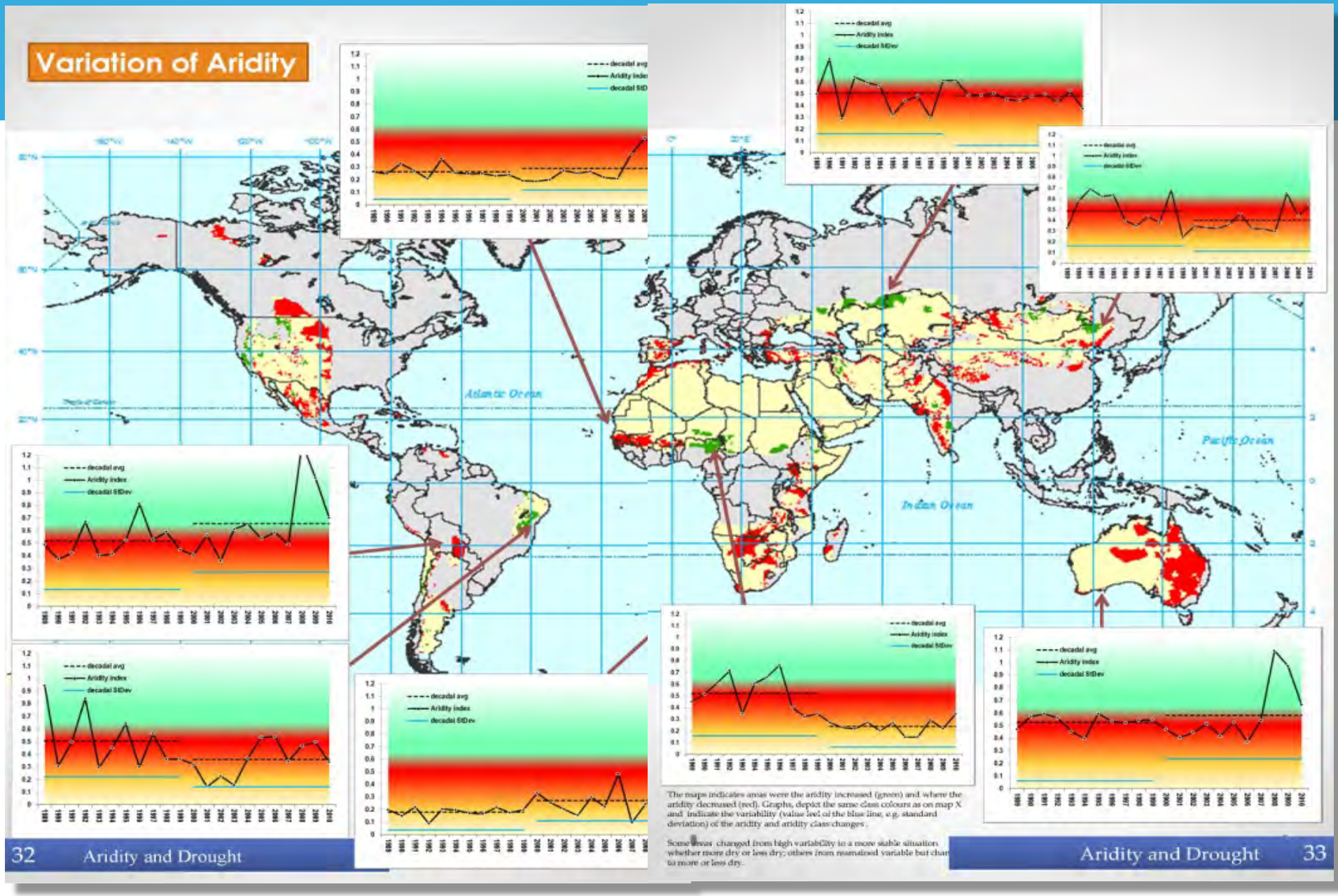
Looking at causal pathways: aridity & drought

Joint Research Centre



Rain/Eto ratio between 1989 to 2010

JRC ies
EUROPEAN COMMISSION
Institute for Environment and Sustainability



Aridity variations

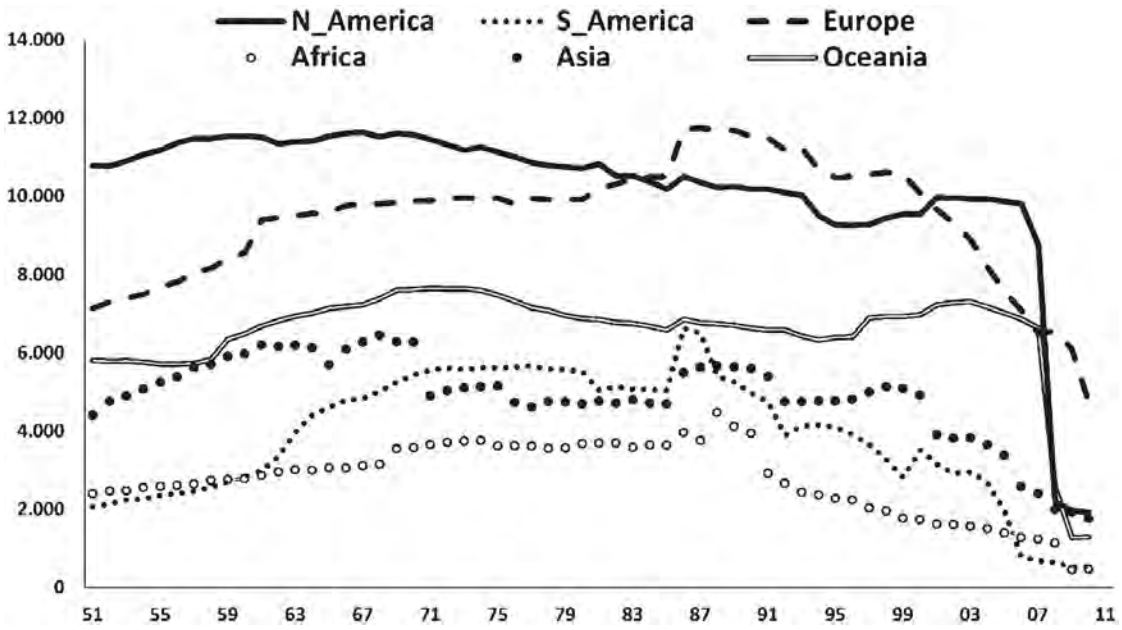
(F. Micale et al.,2013)

INTERNATIONAL JOURNAL OF CLIMATOLOGY
Int. J. Climatol. (2013)
Published online in Wiley Online Library
(wileyonlinelibrary.com) DOI: 10.1002/joc.3875

RMetS
Royal Meteorological Society

World drought frequency, duration, and severity for 1951–2010

Jonathan Spinoni,* Gustavo Naumann, Hugo Carrao, Paulo Barbosa and Jürgen Vogt
Joint Research Centre, Institute for Environment and Sustainability, Climate Risk Management Unit, Ispra (VA), Italy



Number of stations per continent used by GPCC to compute global monthly precipitation grids

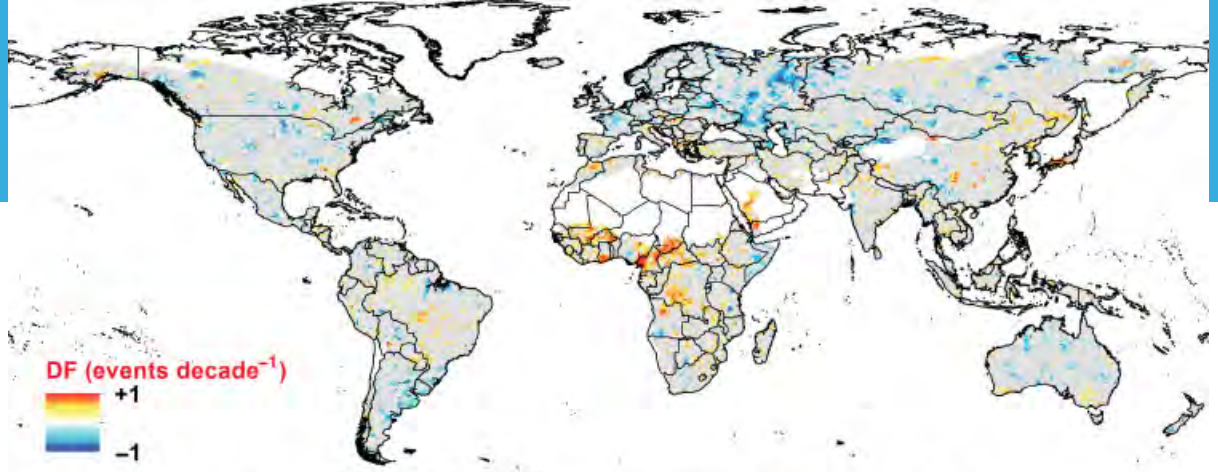
Table 1. Classification used for SPI by McKee *et al.* (1993).

SPI value	Class
SPI ≥ 2.0	Extreme wet
$1.5 \leq$ SPI < 2.0	Very wet
$1.0 \leq$ SPI < 1.5	Wet
$-1.0 <$ SPI < 1.0	Normal
$-1.5 <$ SPI ≤ -1.0	Dry
$-2.0 <$ SPI ≤ -1.5	Very dry
SPI ≤ -2.0	Extreme dry

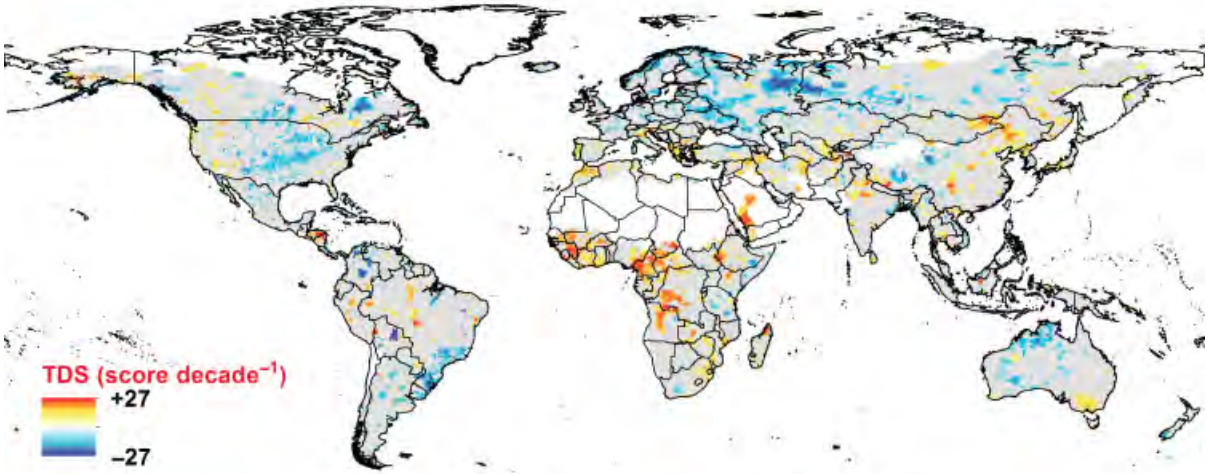
Standardized Precipitation Index (SPI)
>> negative anomalies

Joint Research Centre

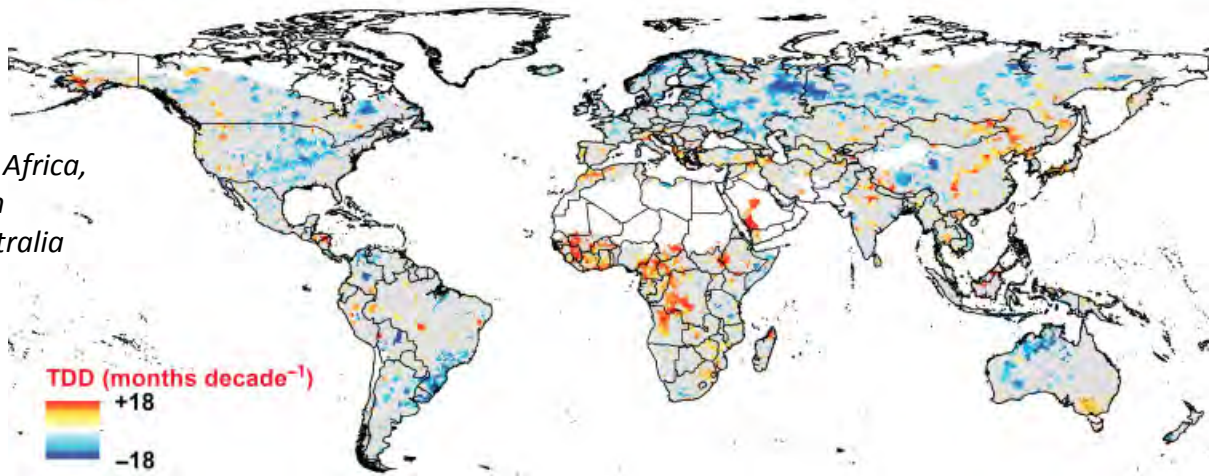
Linear trends
(sign. At 95%)



Drought frequency



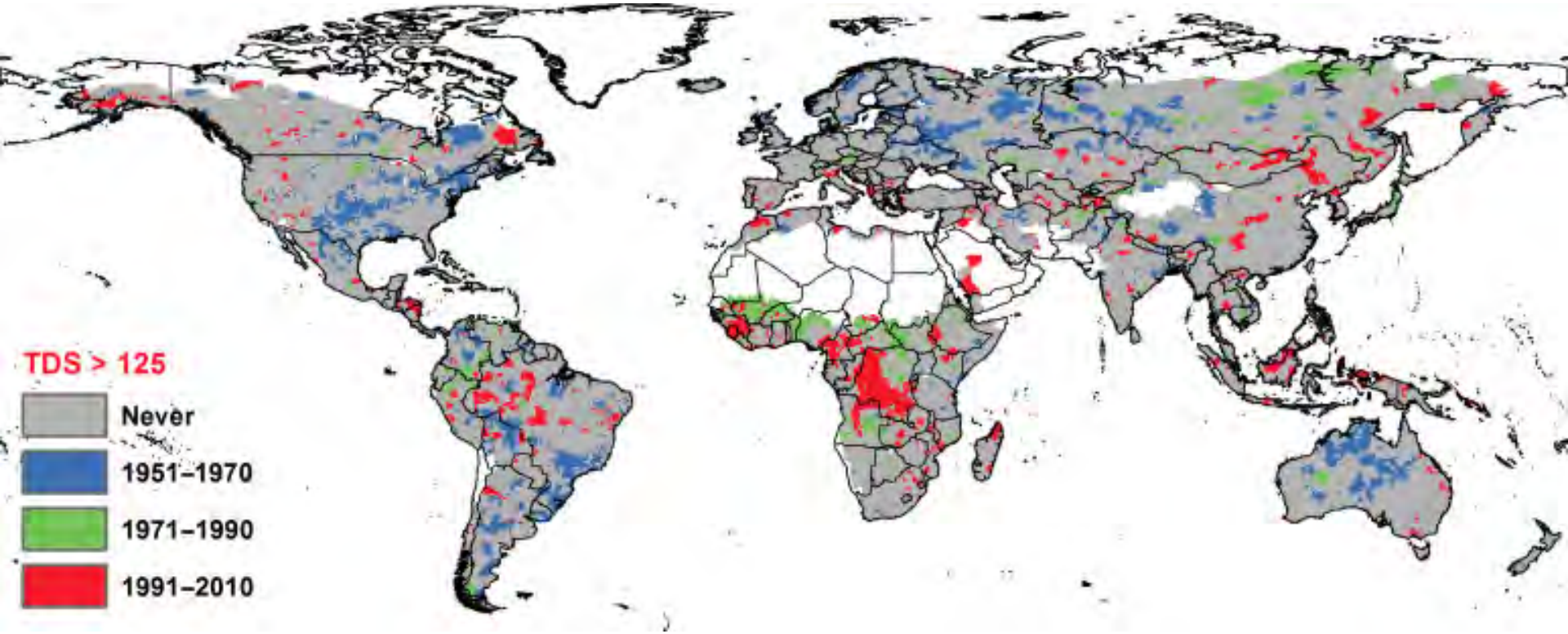
total drought severity



total drought duration

for 1951–2010

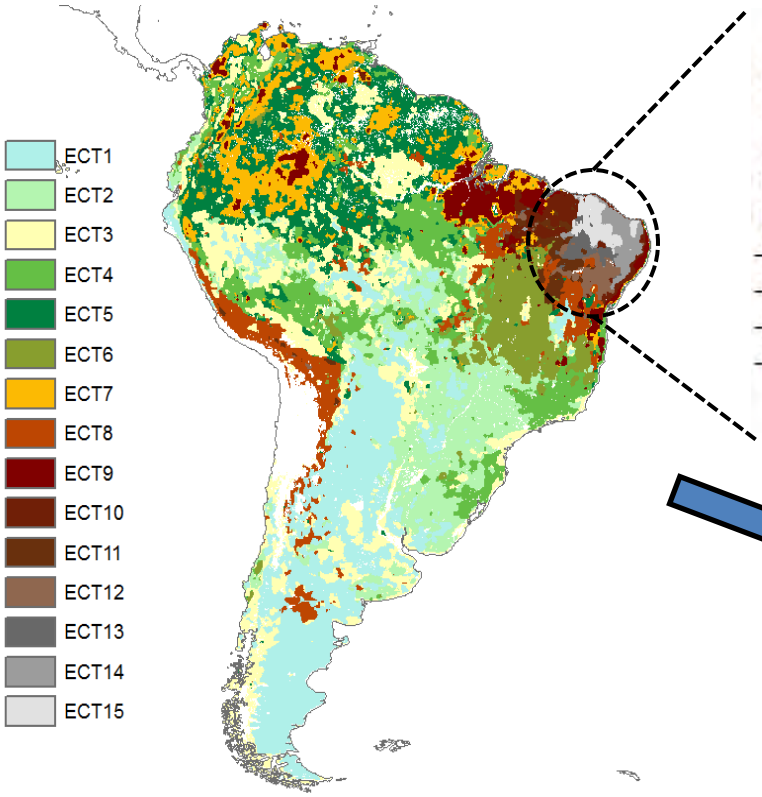
"Mediterranean, Central Africa, Amazonia, North-Eastern China, and Southern Australia are subject to significant increases."

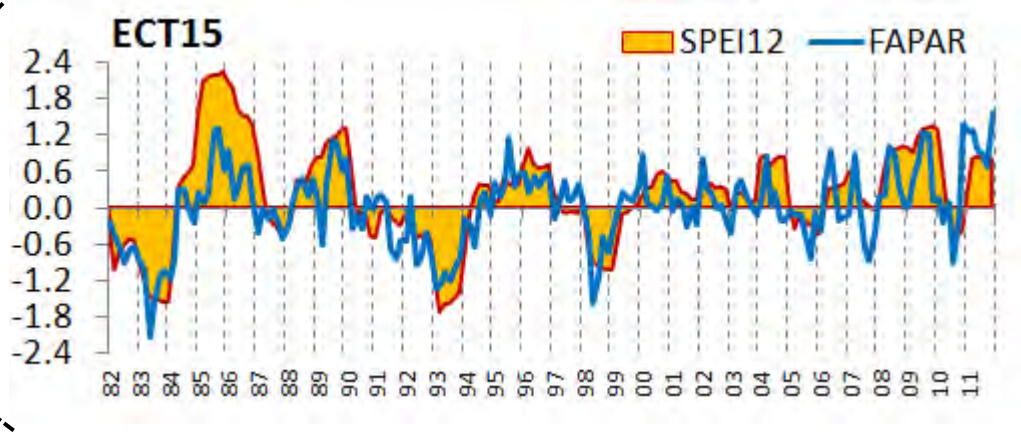


Drought hot spots in the periods 1951–1970, 1971–1990, and 1991–2010.

Global ecosystem response to climatic anomalies

Classification of Ecosystem Change Types by spatio-temporal analysis of co-varying SPEI and FAPAR anomalies Combined EOF analysis (1982-2011)





Assessment of negative anomalies:

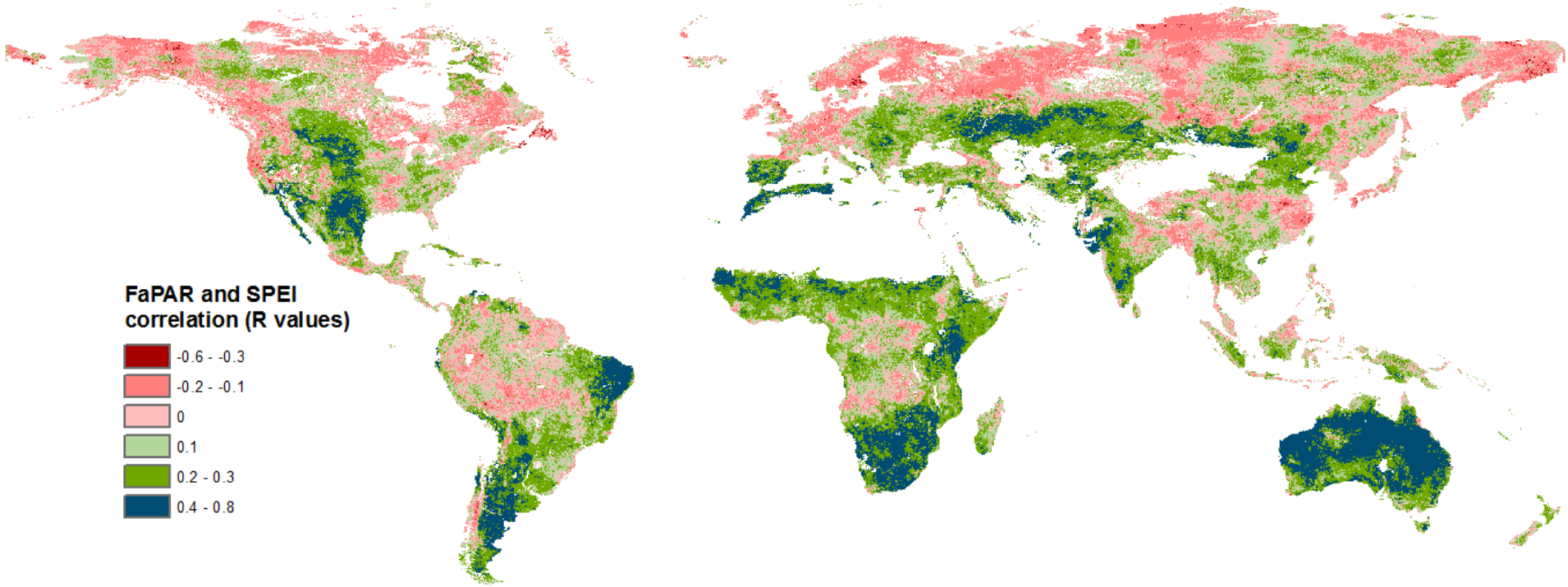
Spatial: where (agriculture?)
Timing: when (within growing season?)
Duration: how long
Frequency: how many times
Severity: how strong

Ivits et al. / Remote Sensing (2014 – in print)

Joint Research Centre

Looking at causal pathways: drought

European Commission

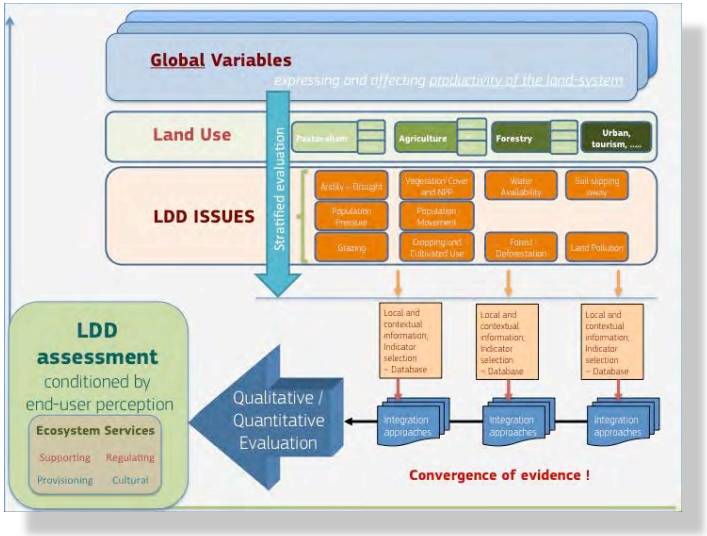


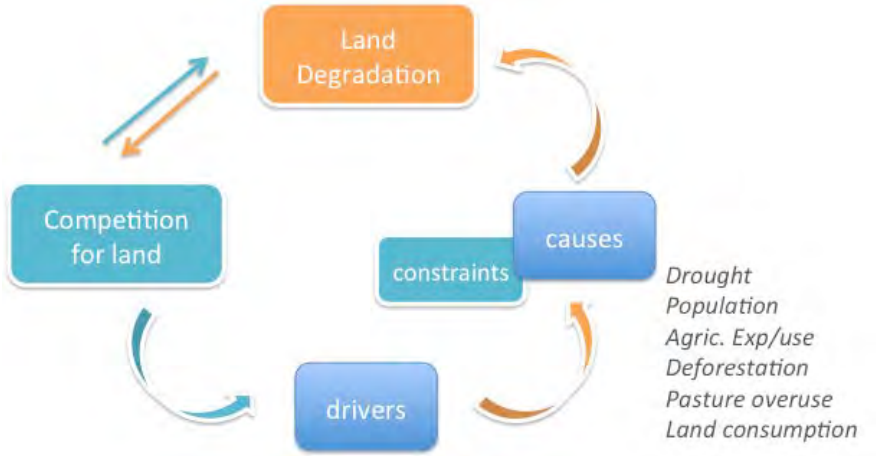
Correlation between FaPAR and SPEI (1982-2010)

- Climate effect on biomass productivity changes

  .....> add to the evidence base – don't exclude!)

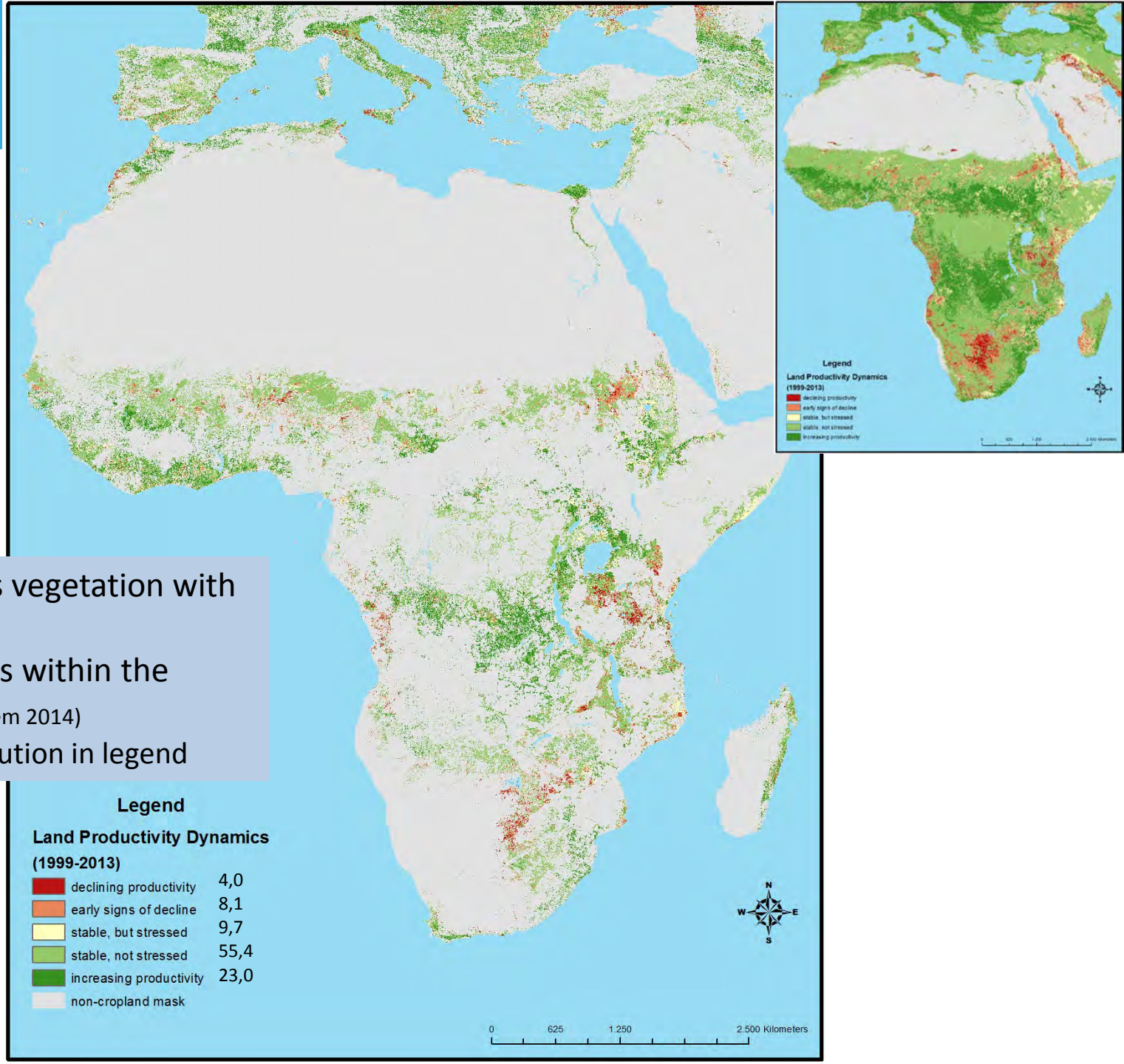
Joint Research Centre

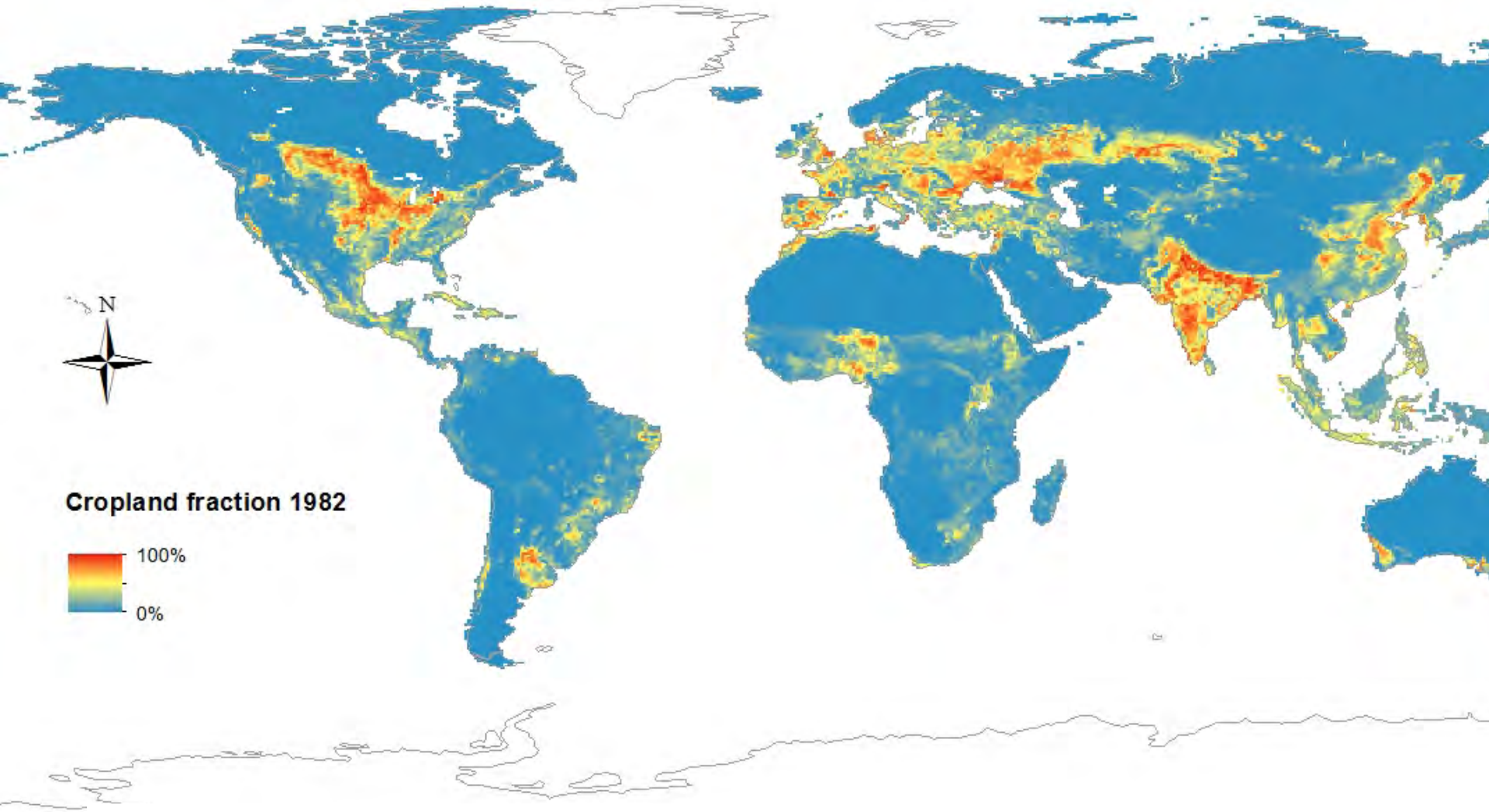




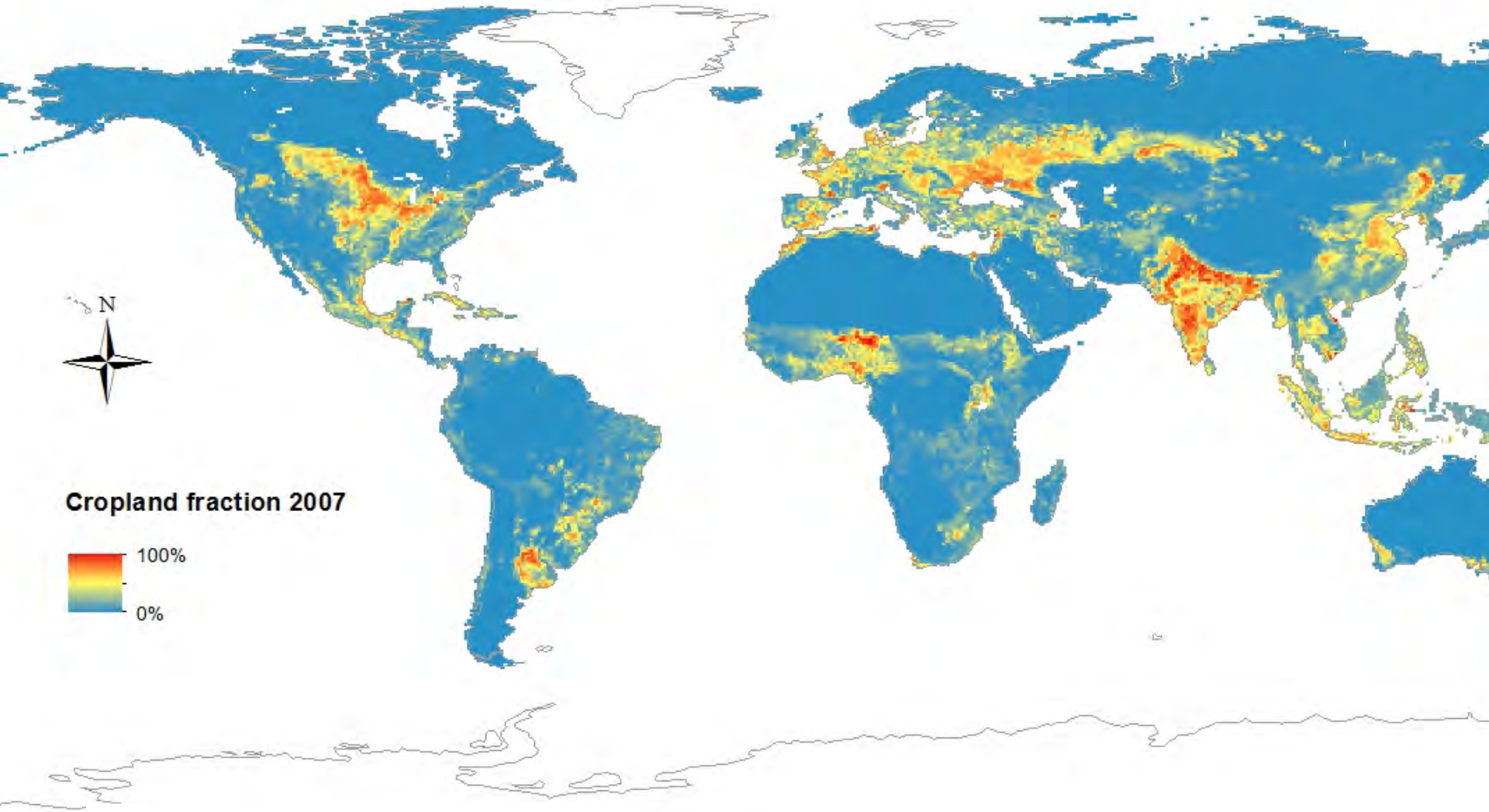
Looking at causal pathways: agriculture

68.7% of Africa has vegetation with seasonality
of which 20,6% falls within the cropmask (C. Van Cutsem 2014)
with LPD class distribution in legend

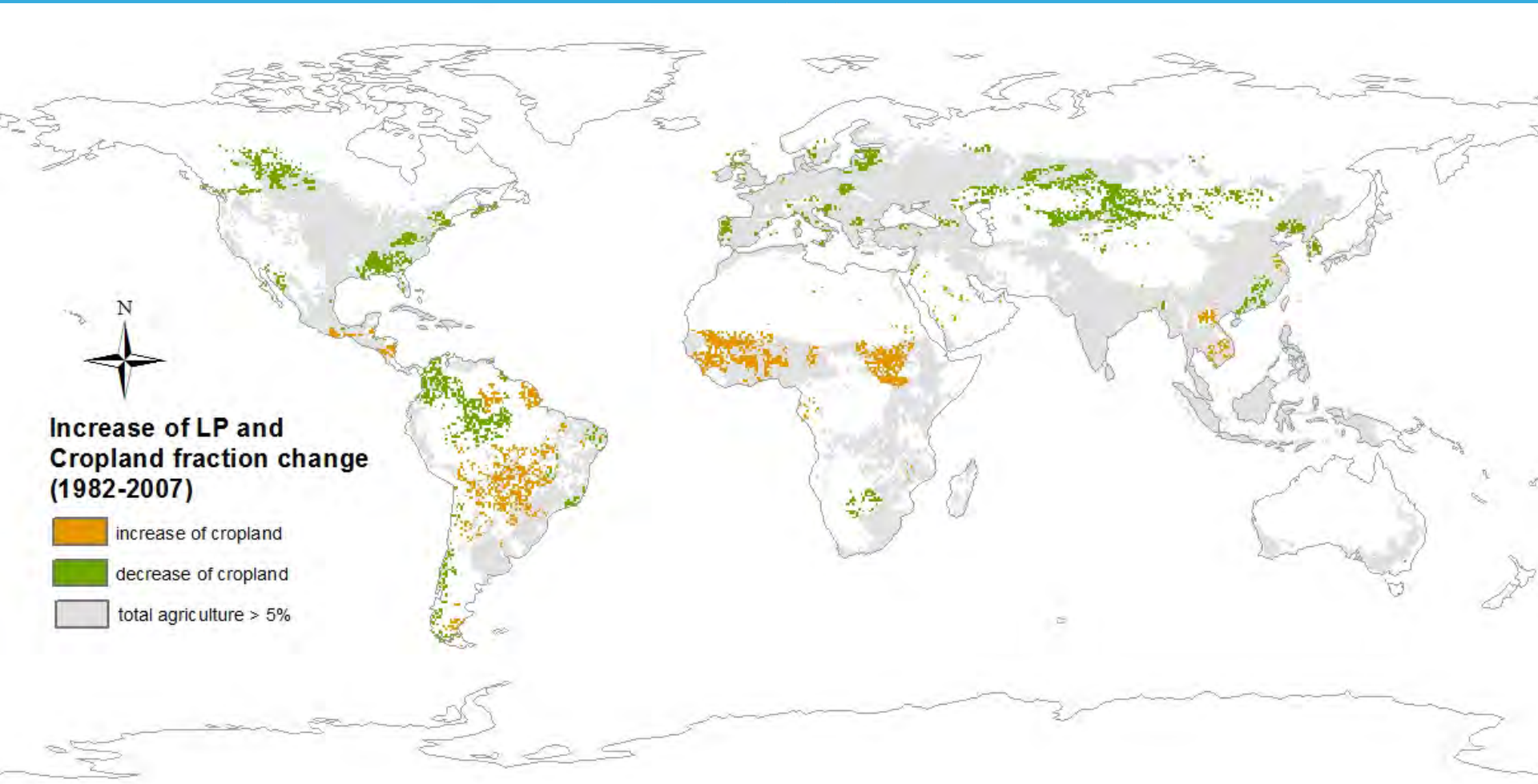


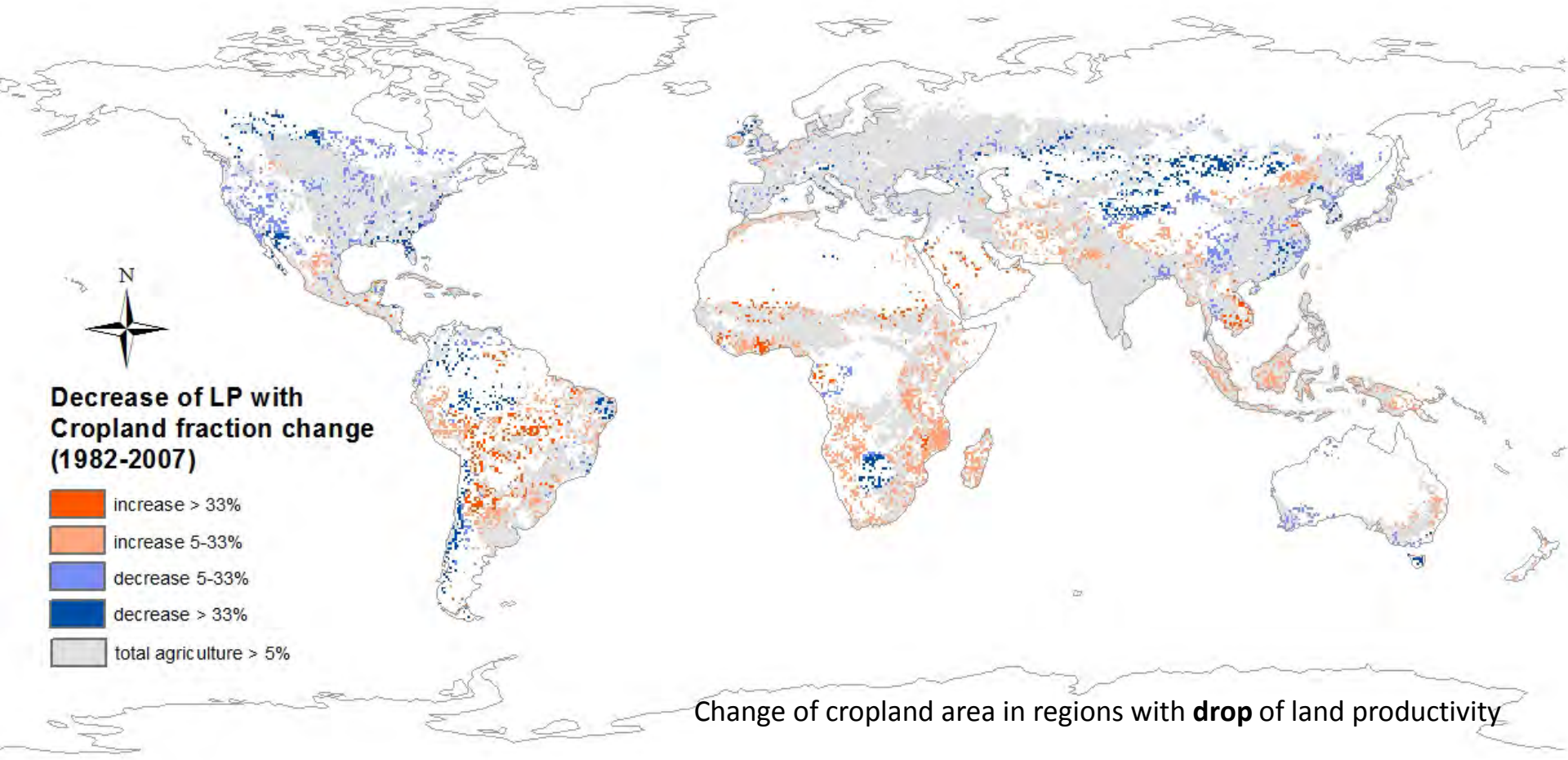


Derived from dataset of Ramankutty (2008) (0.5 degree)



Derived from dataset of Ramankutty (2008)

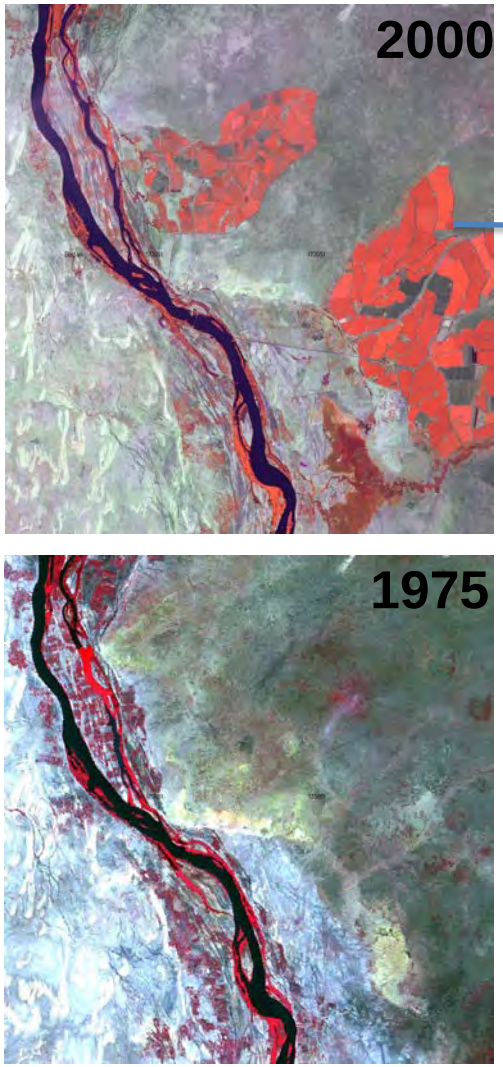

N
Increase of LP and
Cropland fraction change
(1982-2007)
increase of cropland
decrease of cropland
total agriculture > 5%



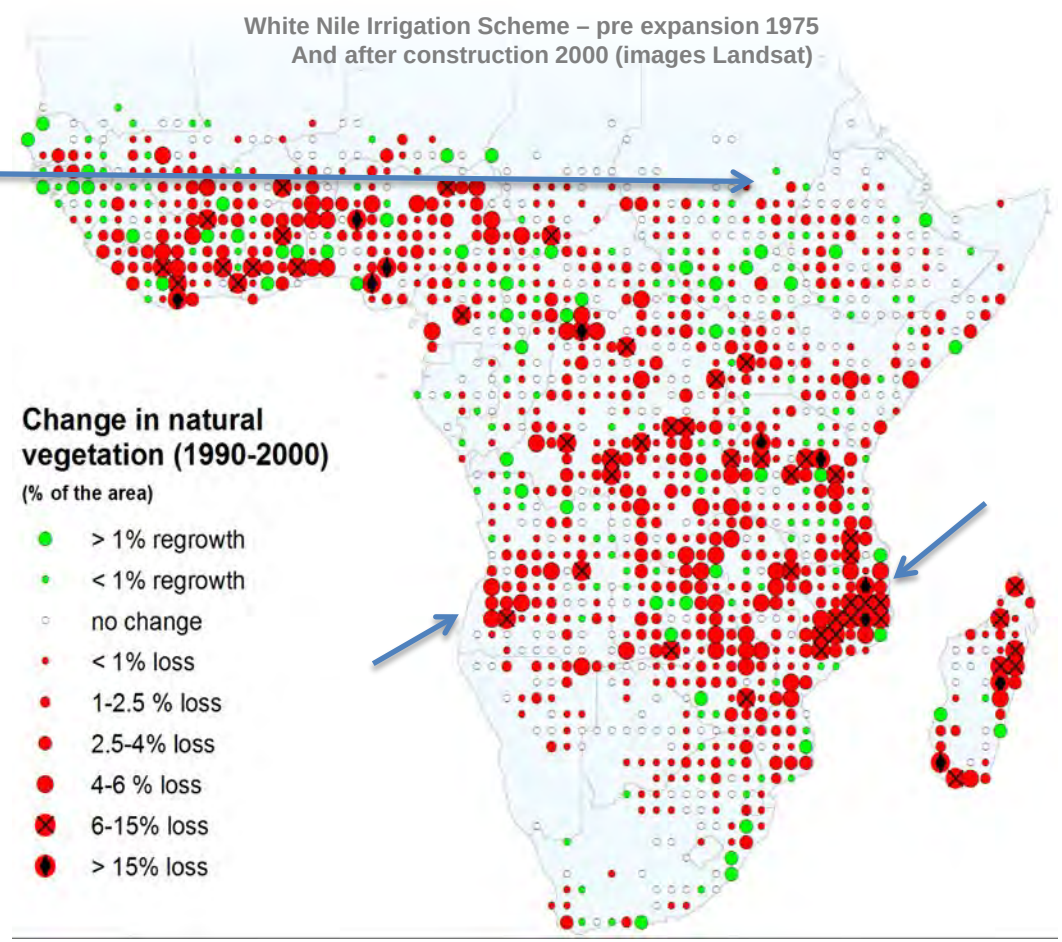
Change of cropland area in regions with **drop** of land productivity

Continent/Region	Increased area [km²]	Decreased area [km²]
Africa	3.517.626	343.743
Asia	2.124.133	1.774.110
Australia	141.912	206.172
Europe	55.850	334.003
North America	275.720	1.379.779
South America	2.121.663	931.581
Oceania	50.583	0

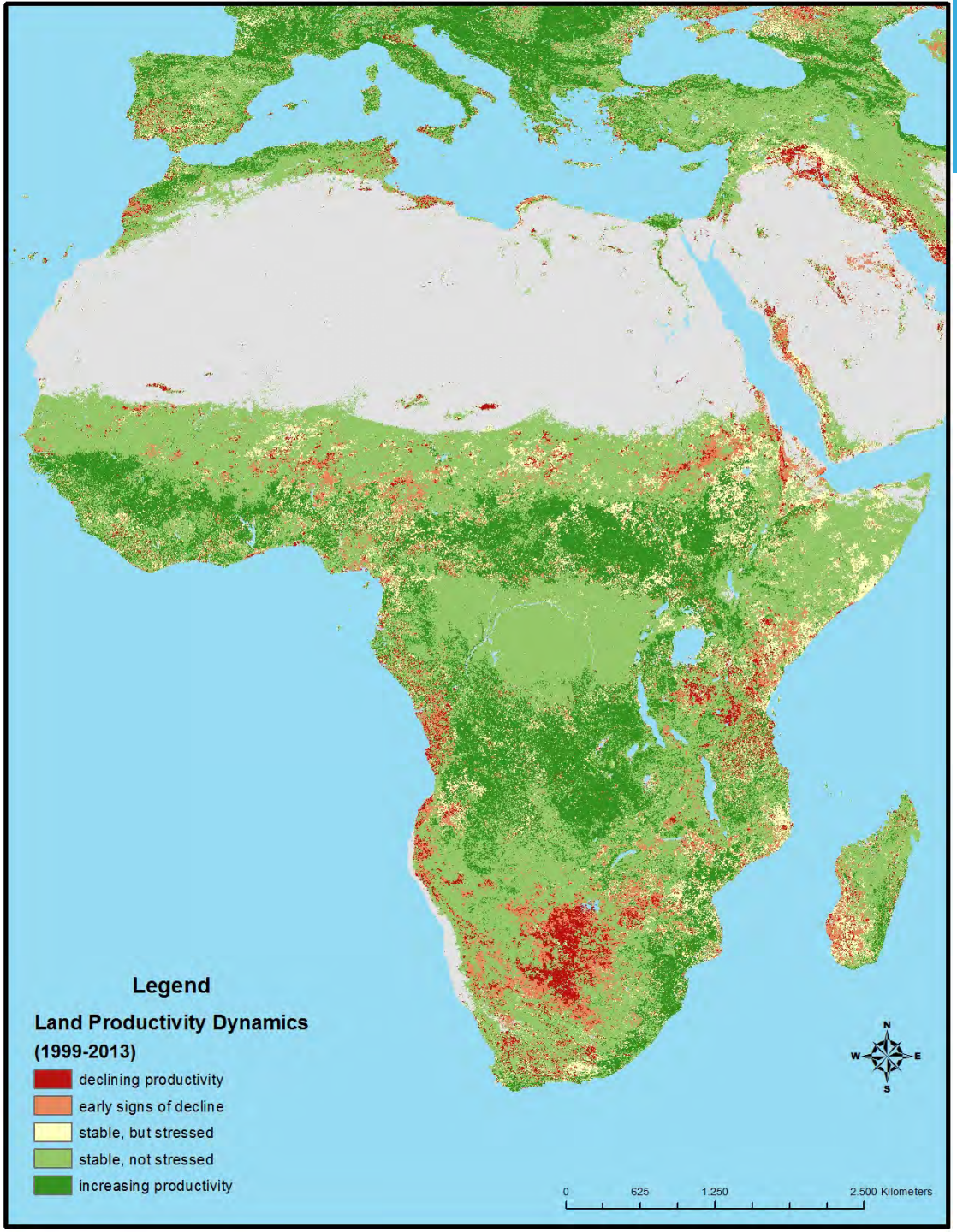
50,000 km2 of natural vegetation converted to agriculture each year

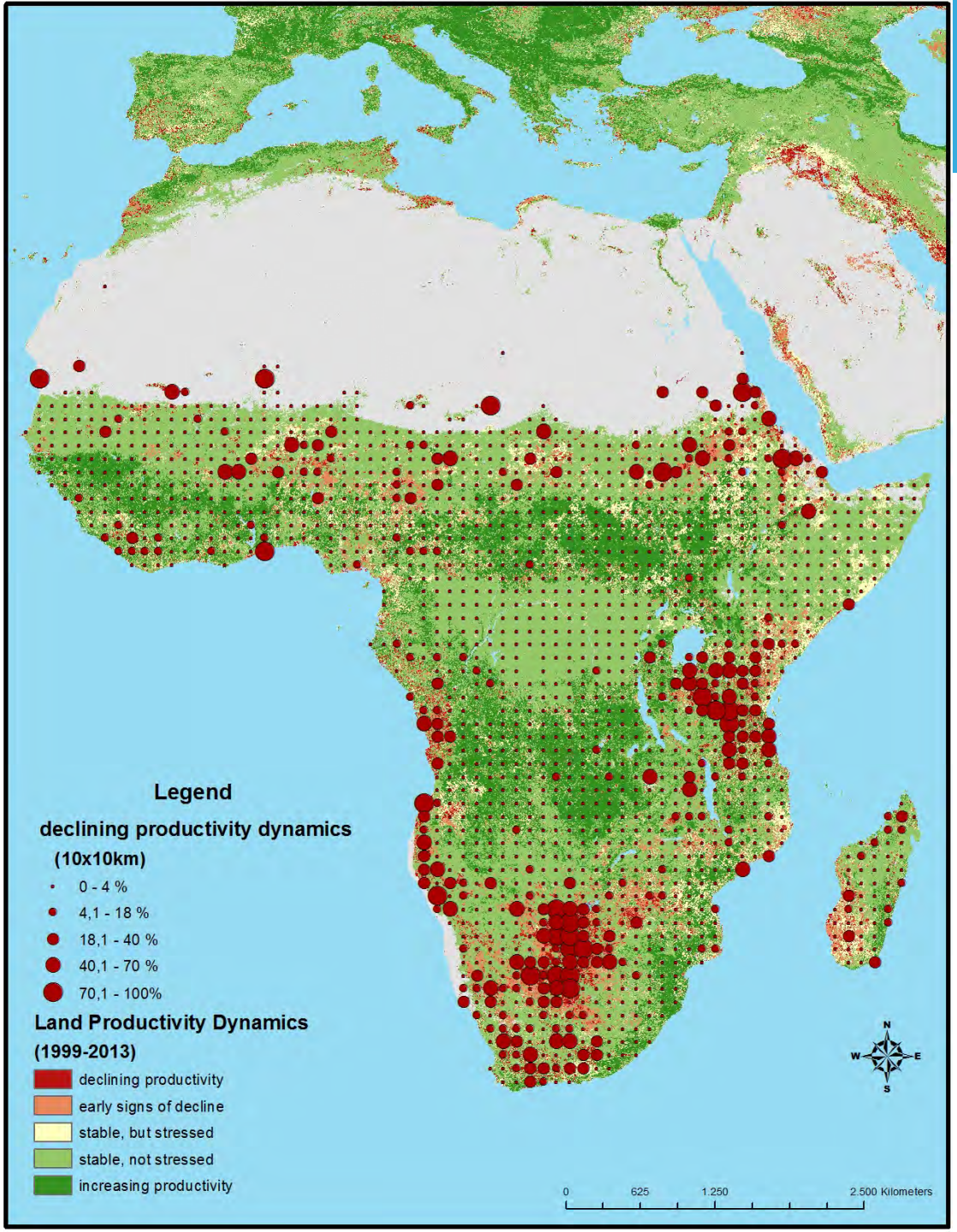


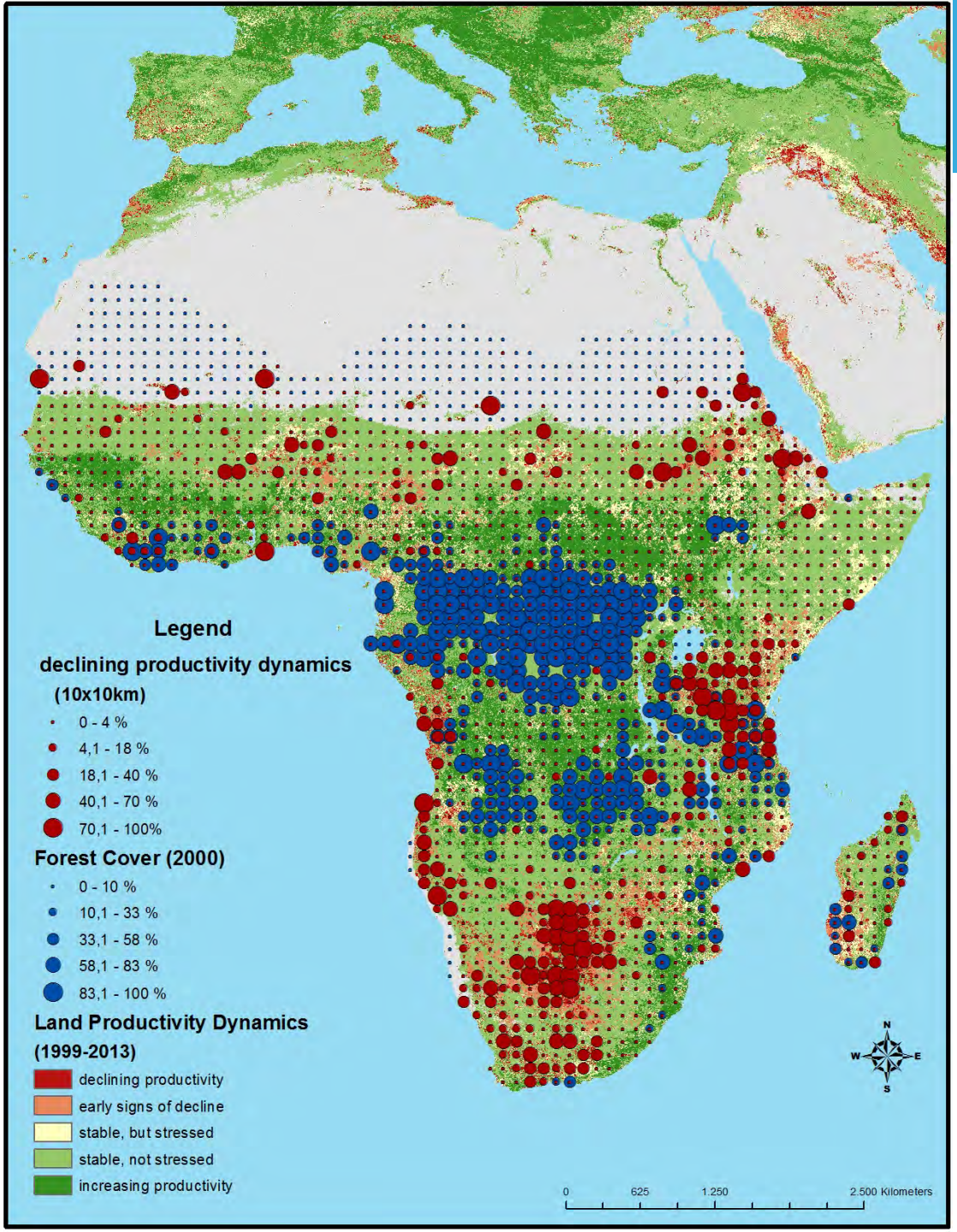
White Nile Irrigation Scheme – pre expansion 1975
And after construction 2000 (images Landsat)

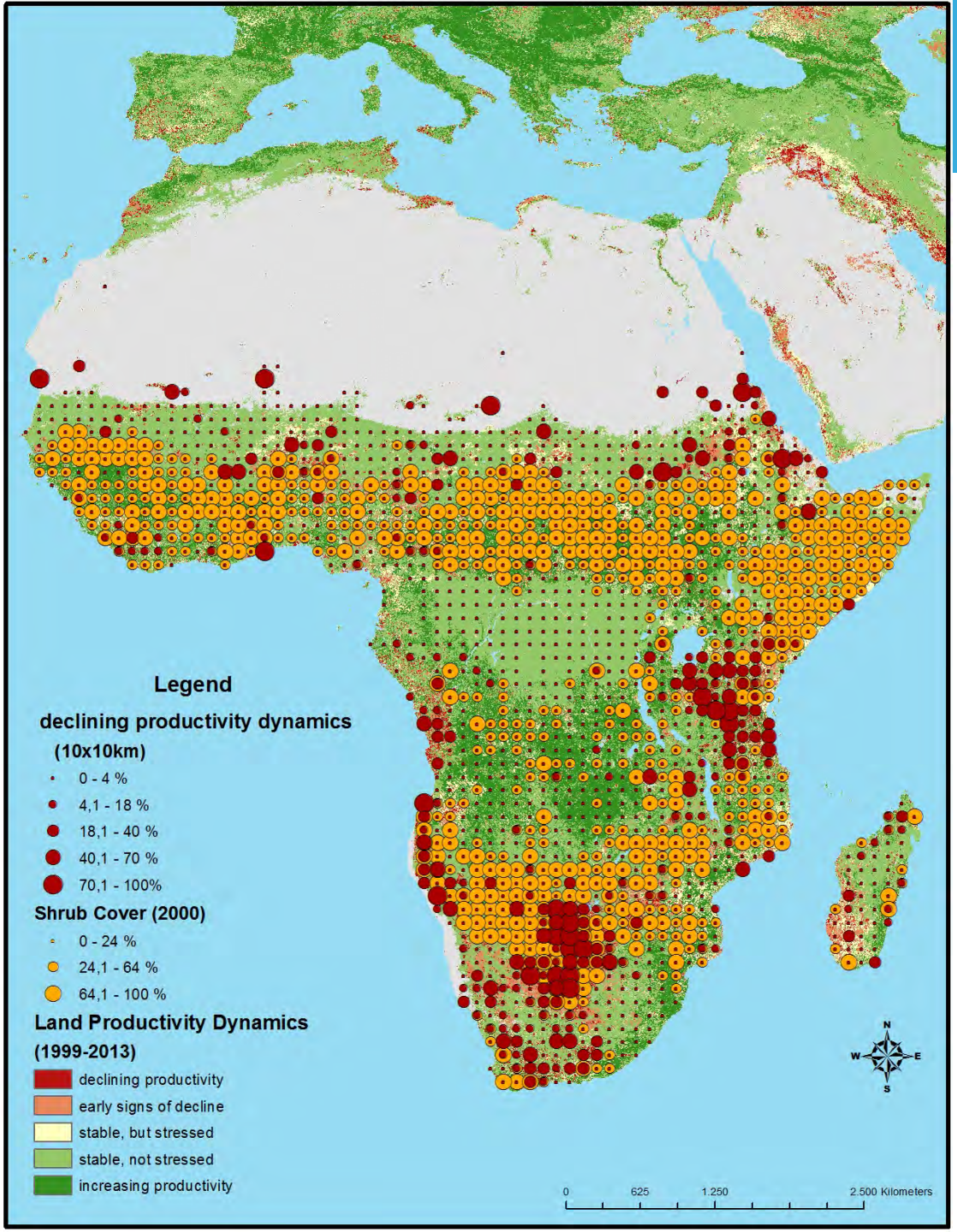


Source A. Brink , C. Bodart et al. JRC


Legend
Land Productivity Dynamics
(1999-2013)
declining productivity
early signs of decline
stable, but stressed
stable, not stressed
increasing productivity
N
W
E
S
0
625
1.250
2.500 Kilometers

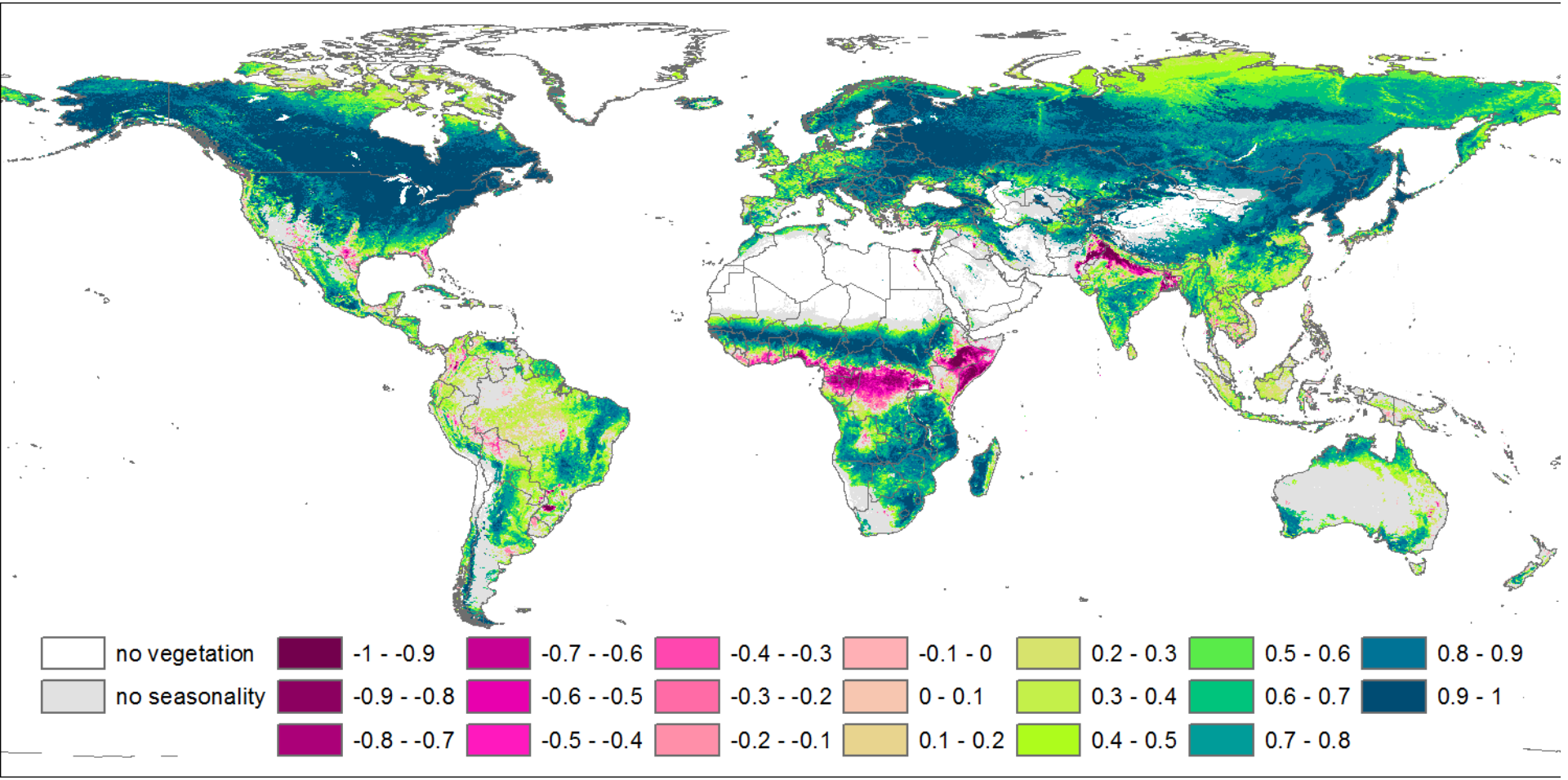

Legend
declining productivity dynamics
(10x10km)
0 - 4 %
4,1 - 18 %
18,1 - 40 %
40,1 - 70 %
70,1 - 100%
Land Productivity Dynamics
(1999-2013)
declining productivity
early signs of decline
stable, but stressed
stable, not stressed
increasing productivity
N
W
E
S
0
625
1.250
2.500 Kilometers


Legend
declining productivity dynamics
(10x10km)
0 - 4 %
4,1 - 18 %
18,1 - 40 %
40,1 - 70 %
70,1 - 100%
Forest Cover (2000)
0 - 10 %
10,1 - 33 %
33,1 - 58 %
58,1 - 83 %
83,1 - 100 %
Land Productivity Dynamics
(1999-2013)
declining productivity
early signs of decline
stable, but stressed
stable, not stressed
increasing productivity
N
W
E
S
0
625
1.250
2.500 Kilometers


Legend
declining productivity dynamics
(10x10km)
0 - 4 %
4,1 - 18 %
18,1 - 40 %
40,1 - 70 %
70,1 - 100%
Shrub Cover (2000)
0 - 24 %
24,1 - 64 %
64,1 - 100 %
Land Productivity Dynamics
(1999-2013)
declining productivity
early signs of decline
stable, but stressed
stable, not stressed
increasing productivity
N
W
E
S
0
625
1.250
2.500 Kilometers

Land use & change

European Commission

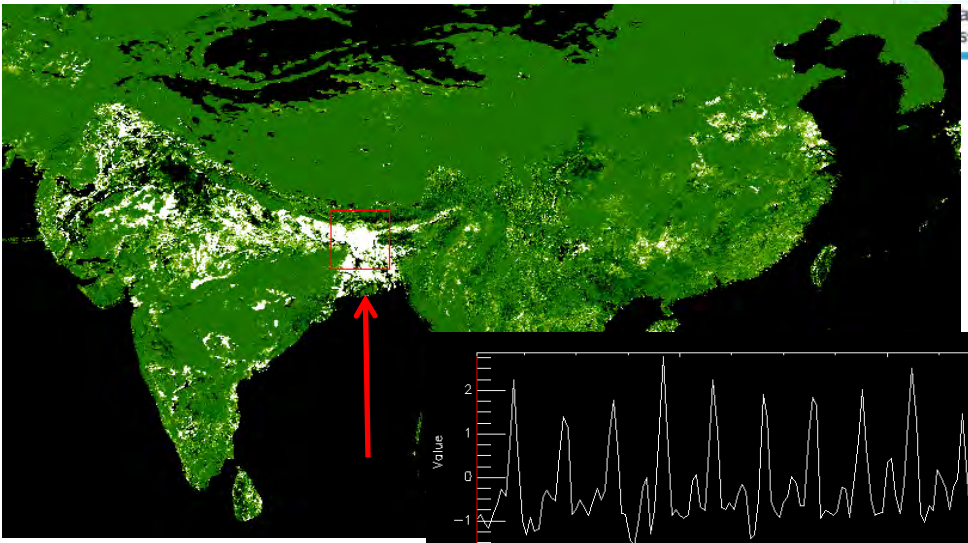


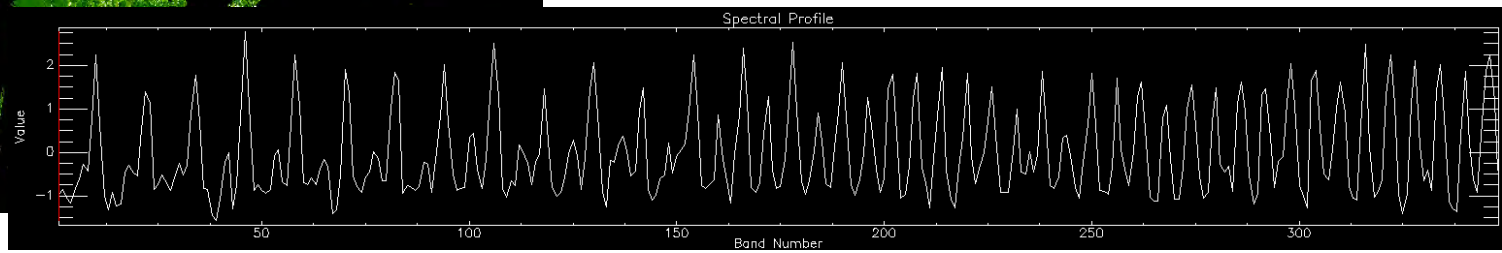
Double growing seasons

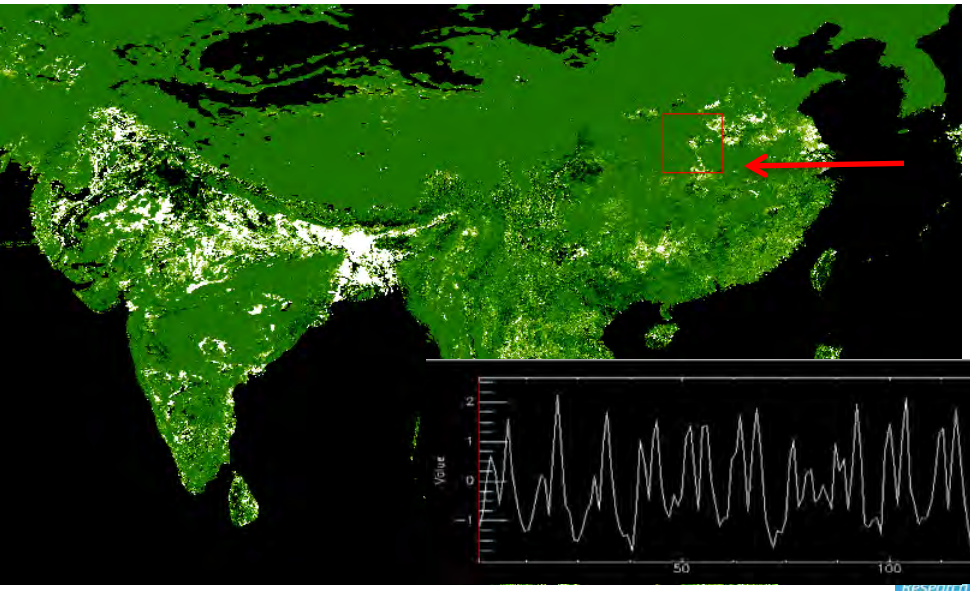
Joint Research Centre

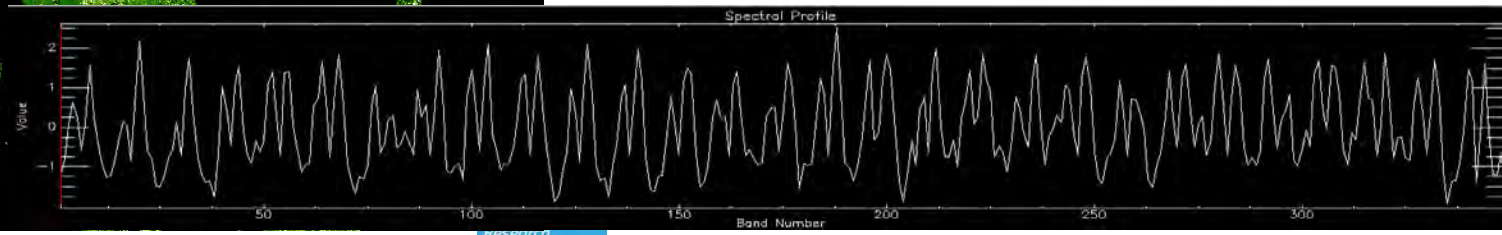
Single growing seasons

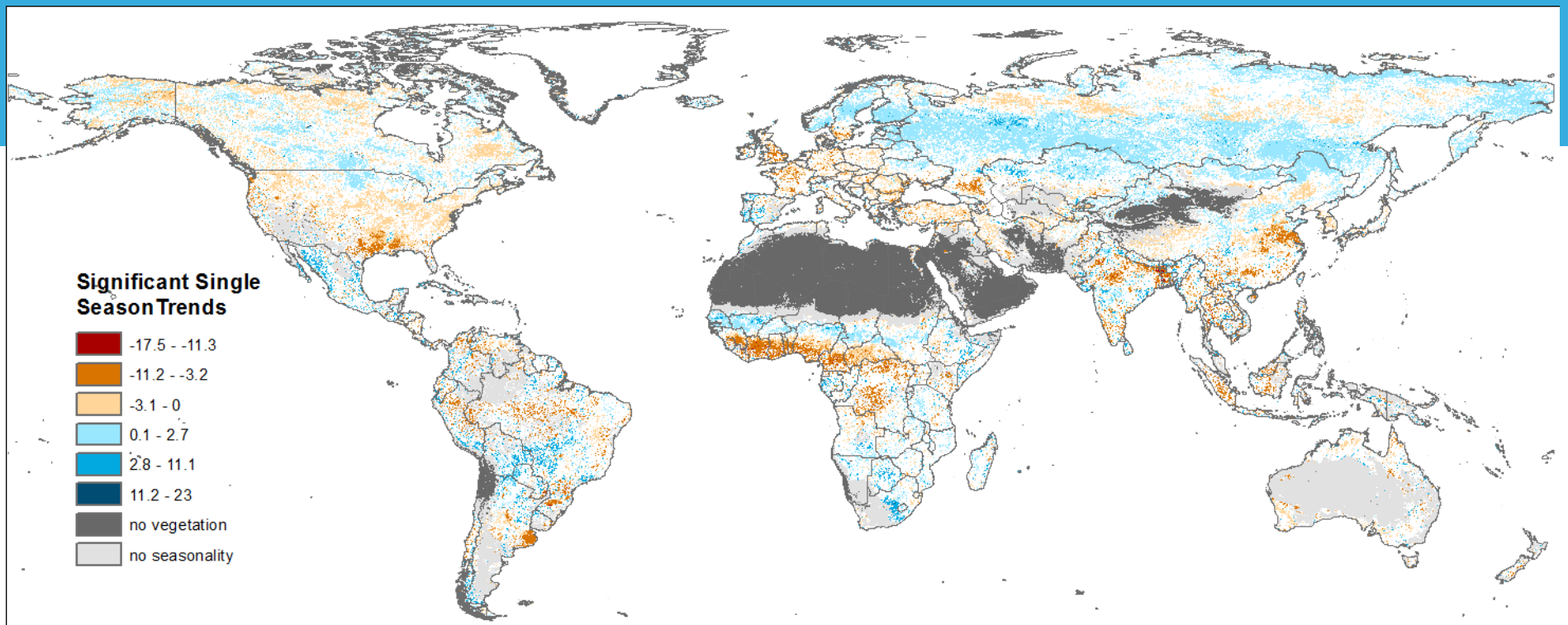
Land use & change

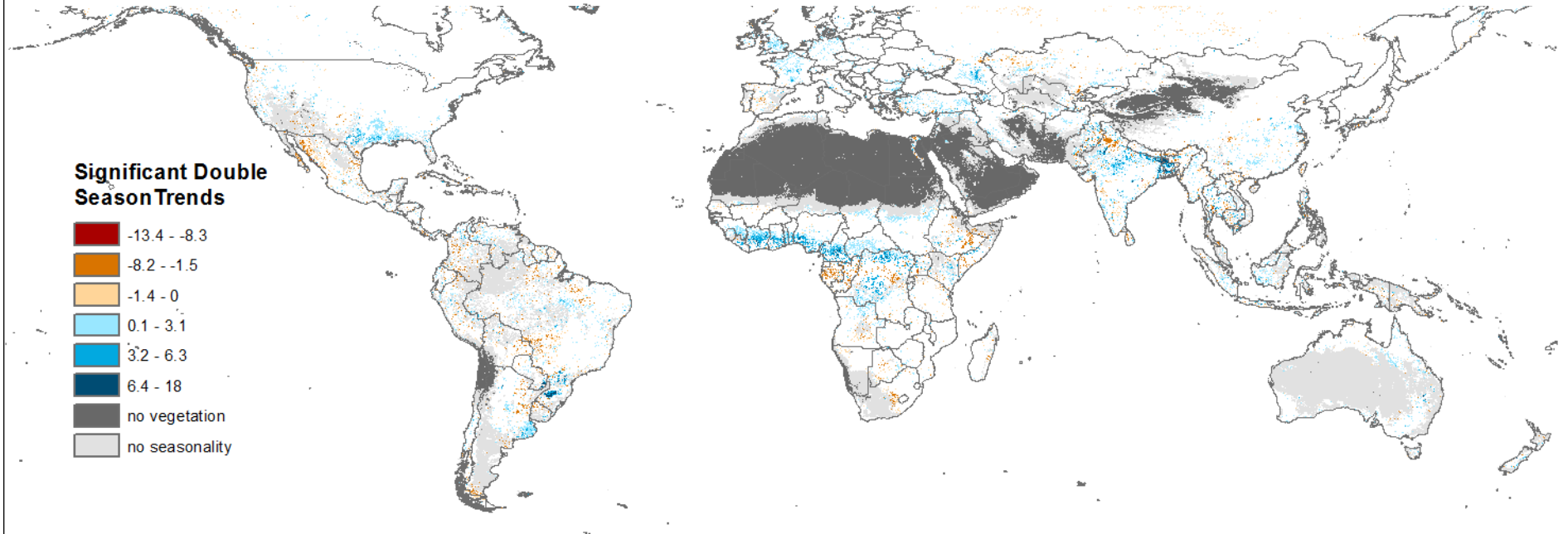


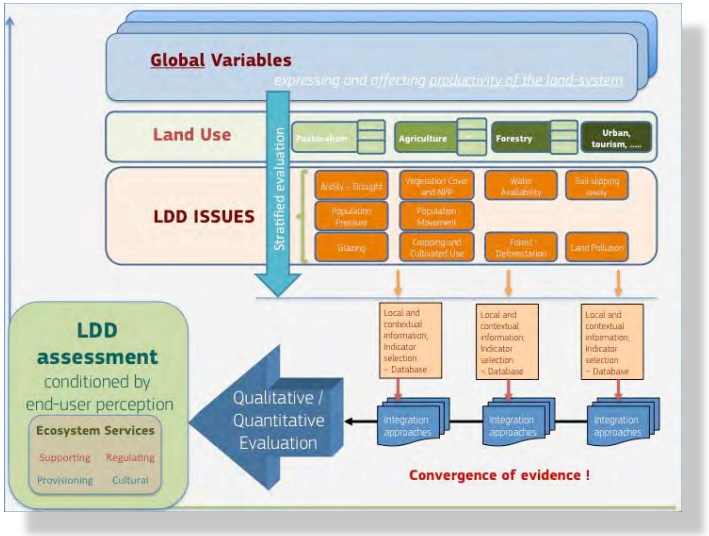


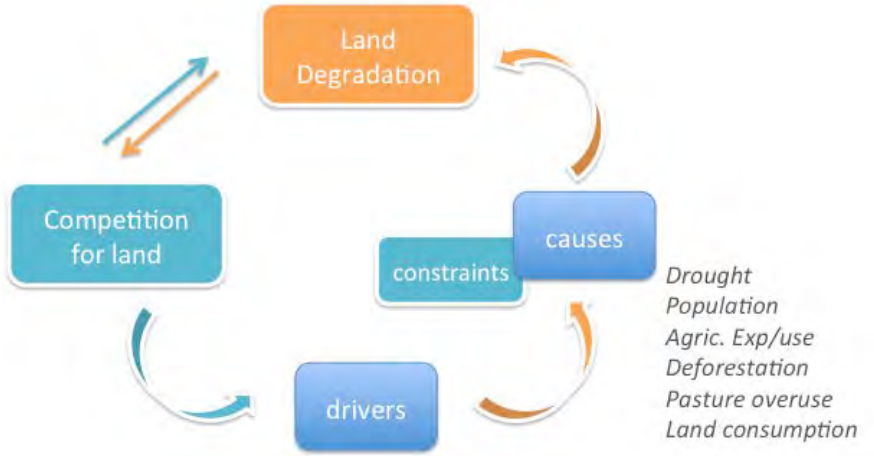




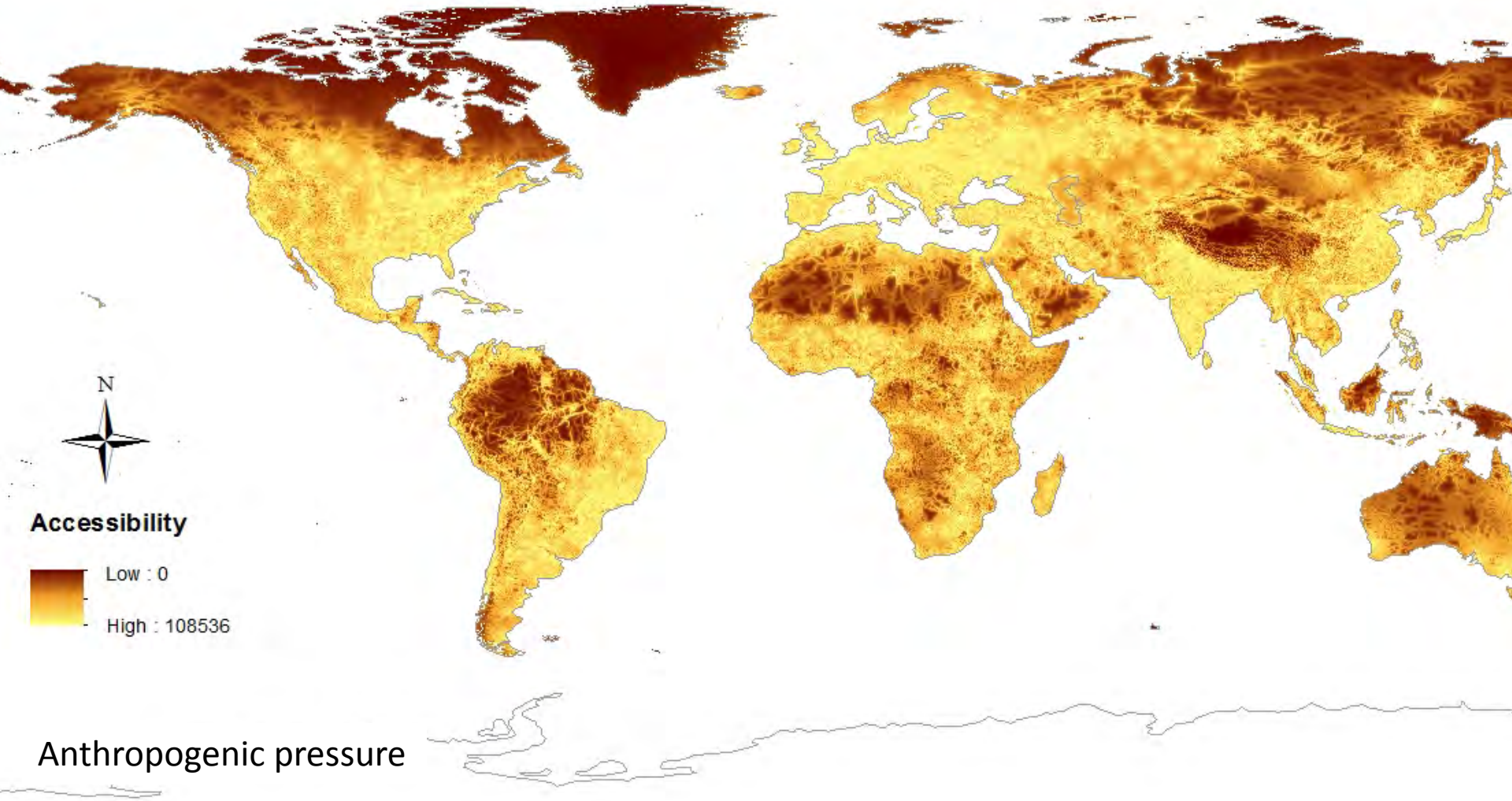

Significant Single Season Trends
-17.5 - -11.3
-11.2 - -3.2
-3.1 - 0
0.1 - 2.7
2.8 - 11.1
11.2 - 23
no vegetation
no seasonality


Significant Double Season Trends
-13.4 - -8.3
-8.2 - -1.5
-1.4 - 0
0.1 - 3.1
3.2 - 6.3
6.4 - 18
no vegetation
no seasonality

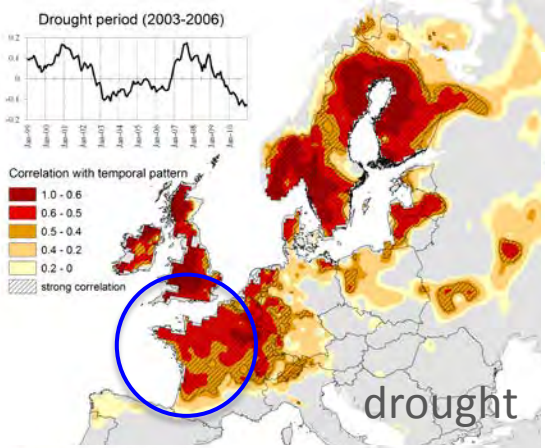




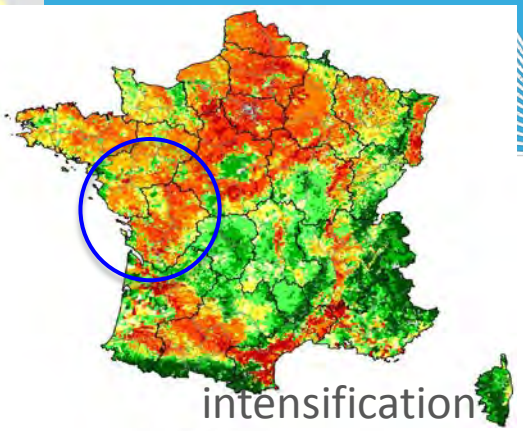
Looking at causal pathways: population



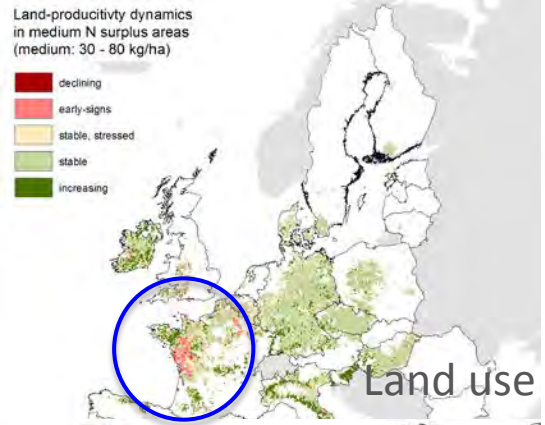
Anthropogenic pressure



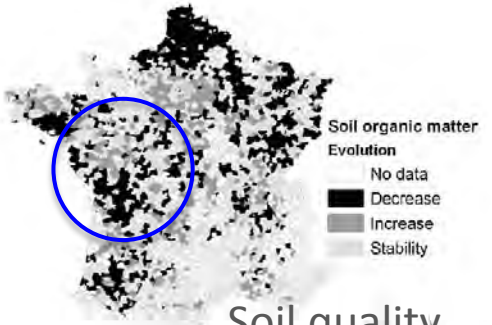
drought



intensification

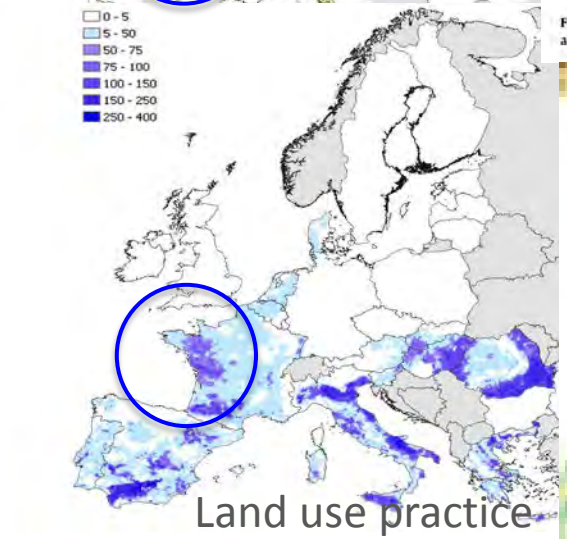


Land use

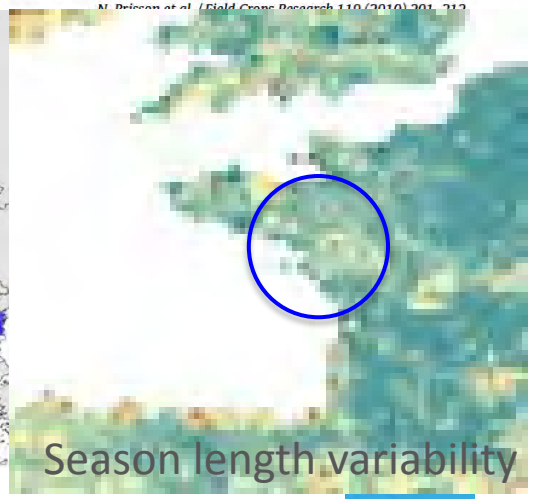


Soil quality

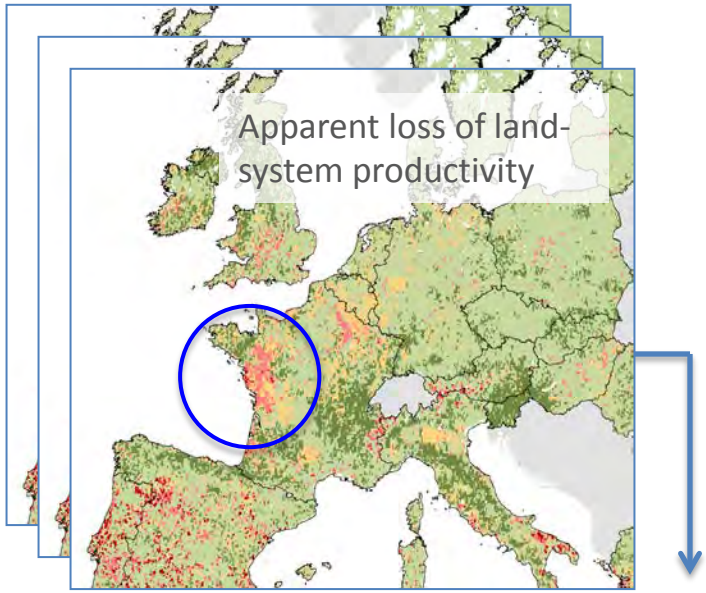
Fig. 8. Soil organic matter (organic C in g kg $^{-1}$) evolution between 1990 and 1994 and 2000 and 2004 periods. Source: INRA



Land use practice



Season length variability

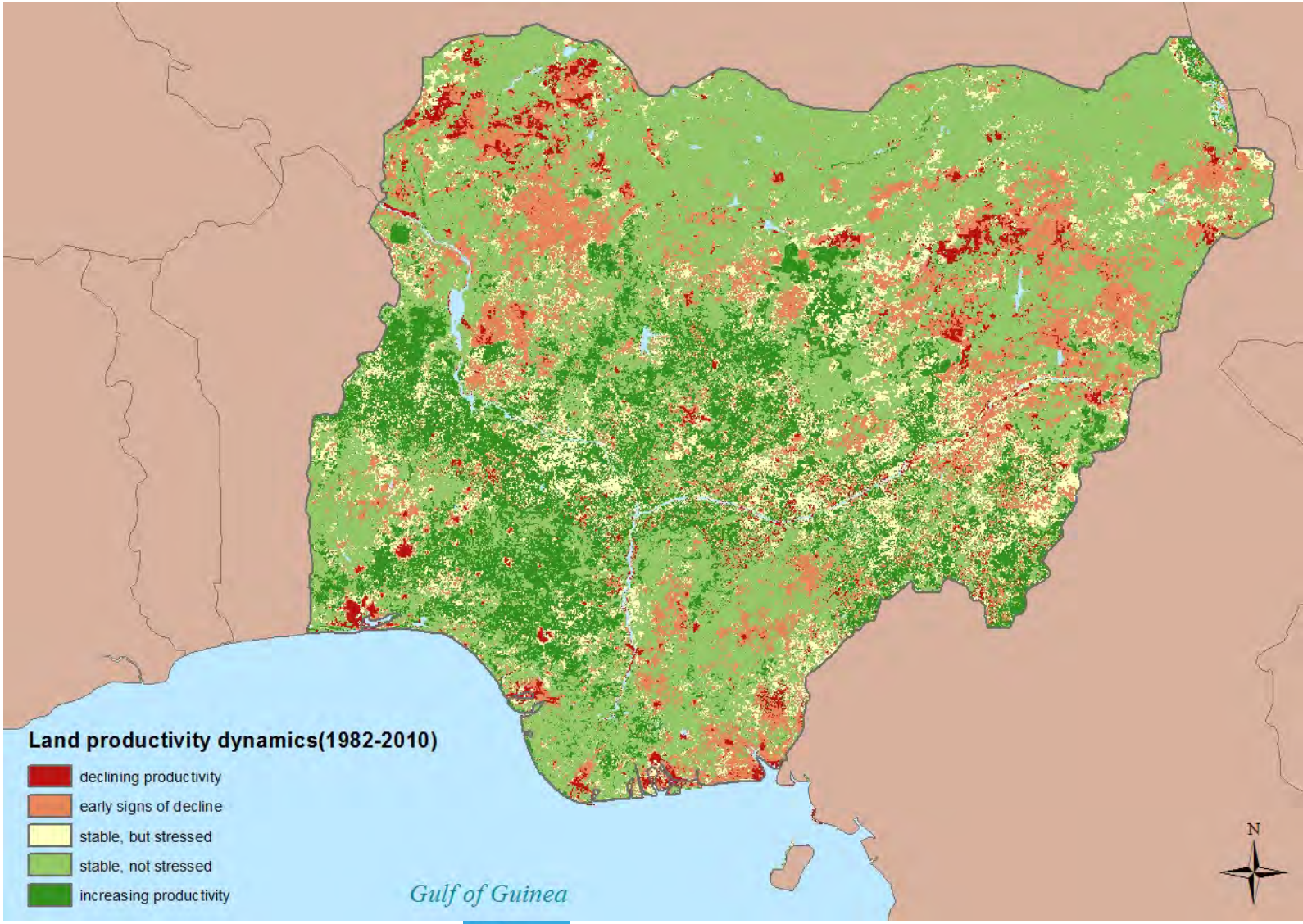


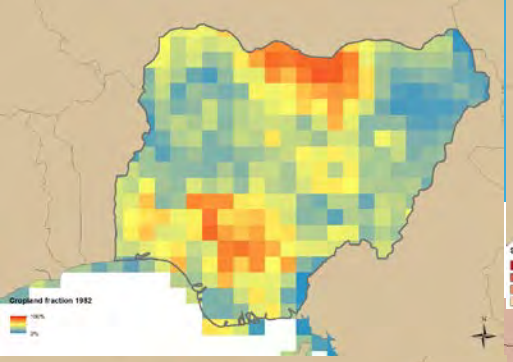
Convergence of evidence

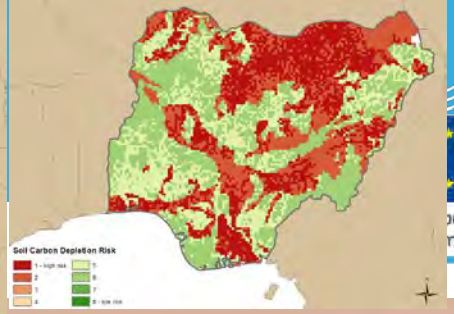
Degradation = in need of Sustainable Land Management

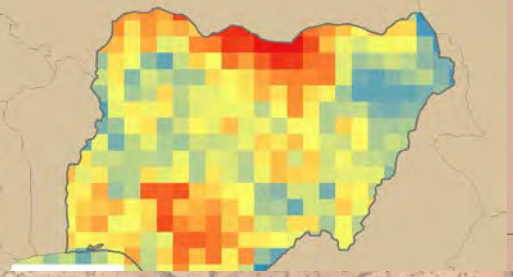
Impacts of issues >> trade-offs

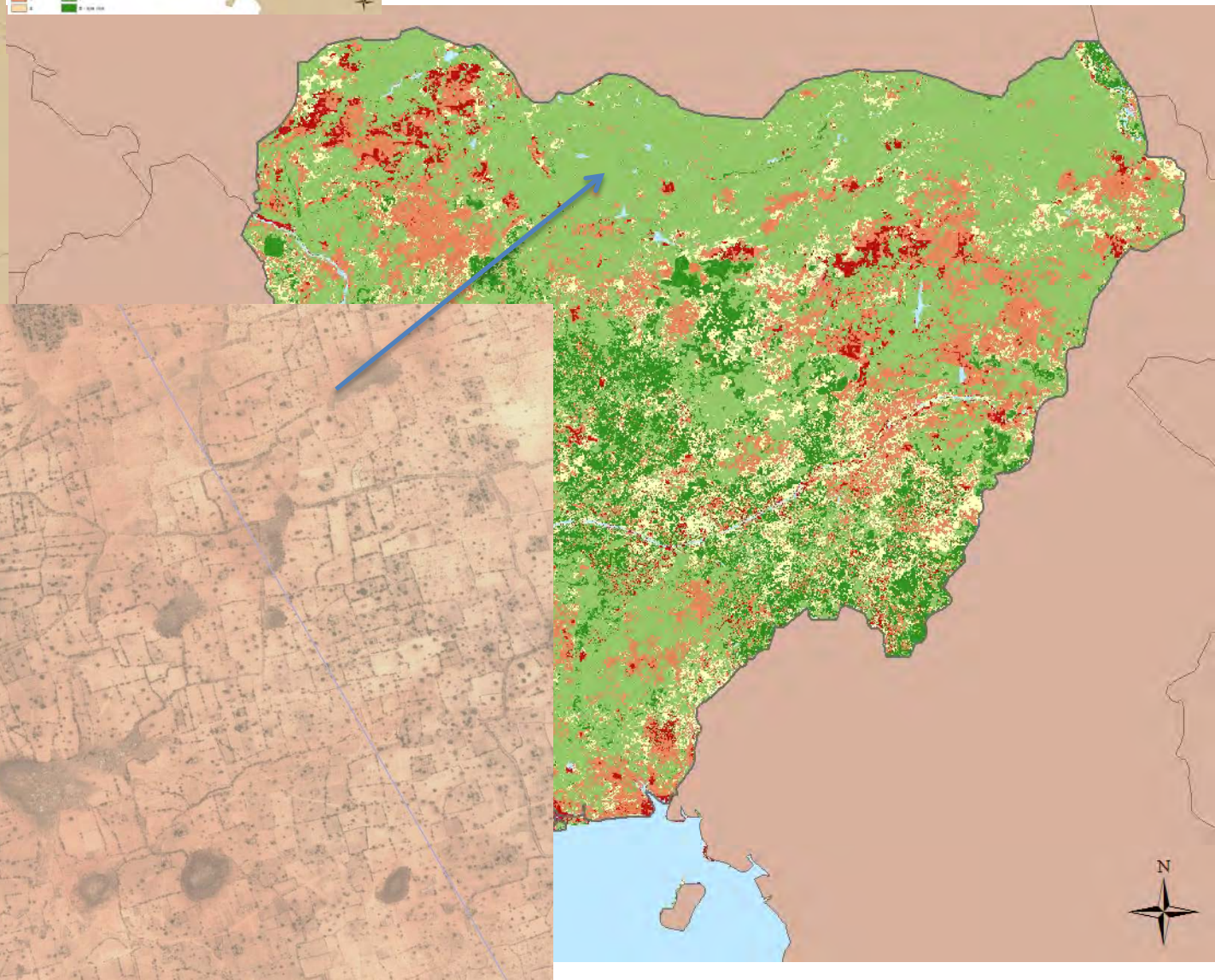
Some details (Nigeria)

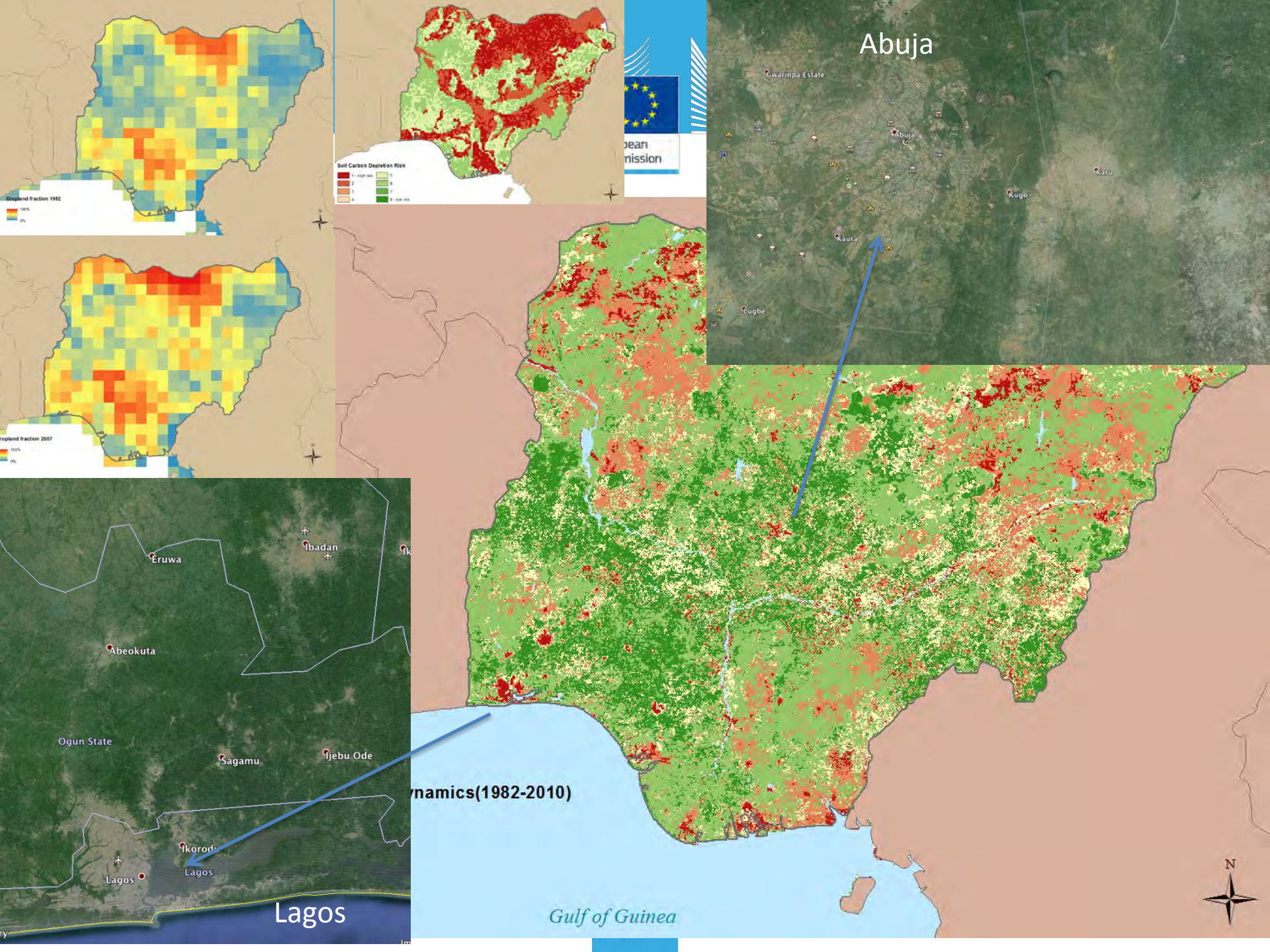

Land productivity dynamics(1982-2010)
declining productivity
early signs of decline
stable, but stressed
stable, not stressed
increasing productivity
Gulf of Guinea
N

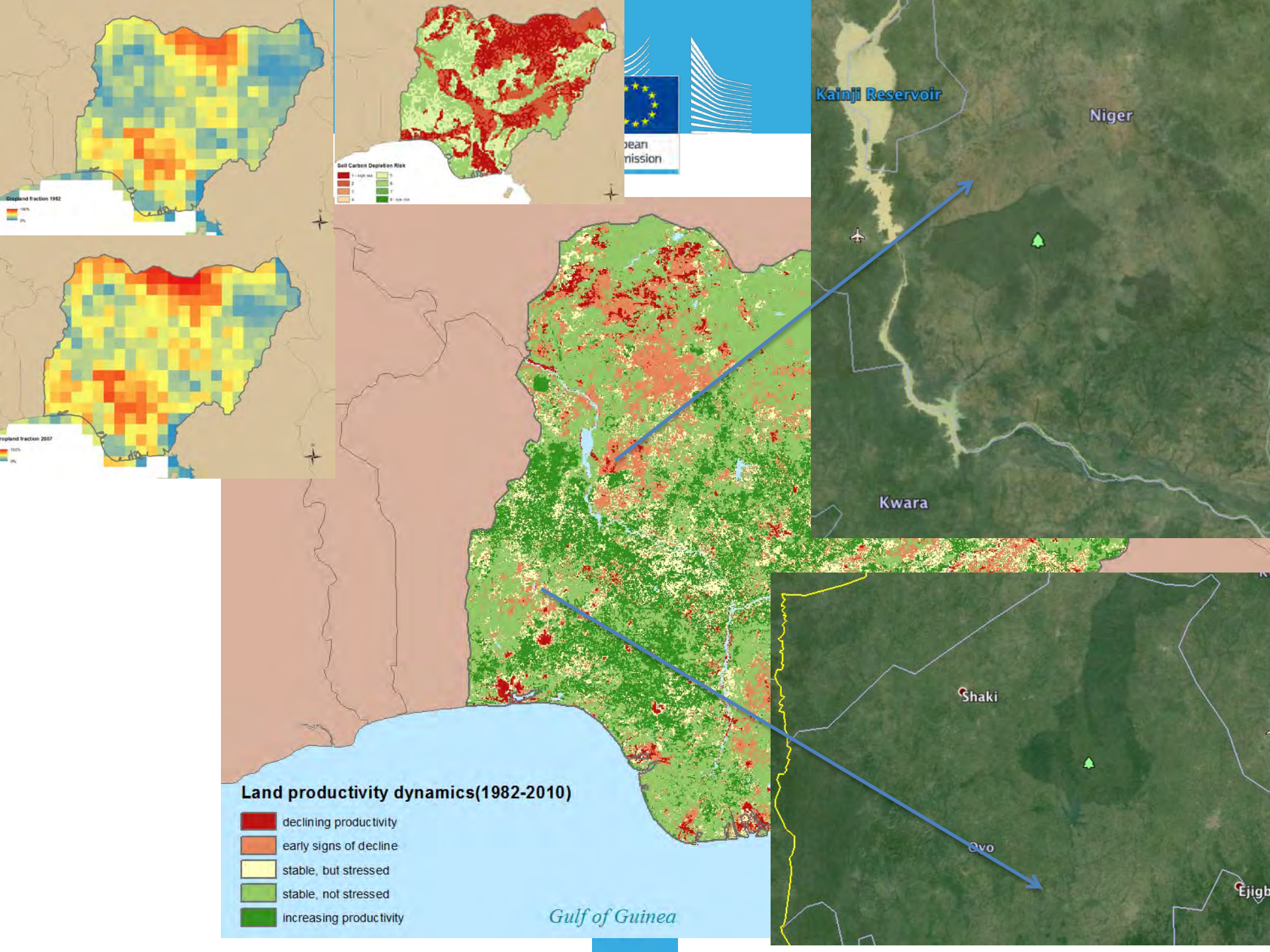

Cropland fraction 1992

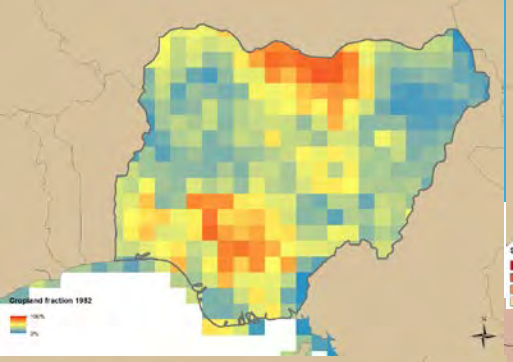

Soil Carbon Depletion Risk

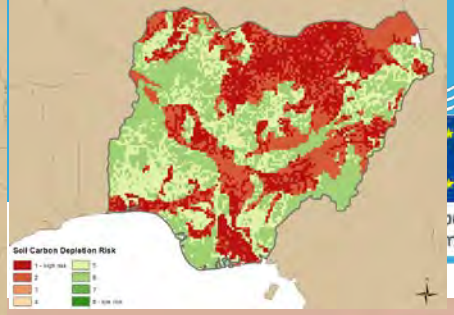


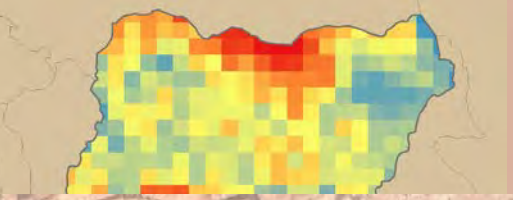

N

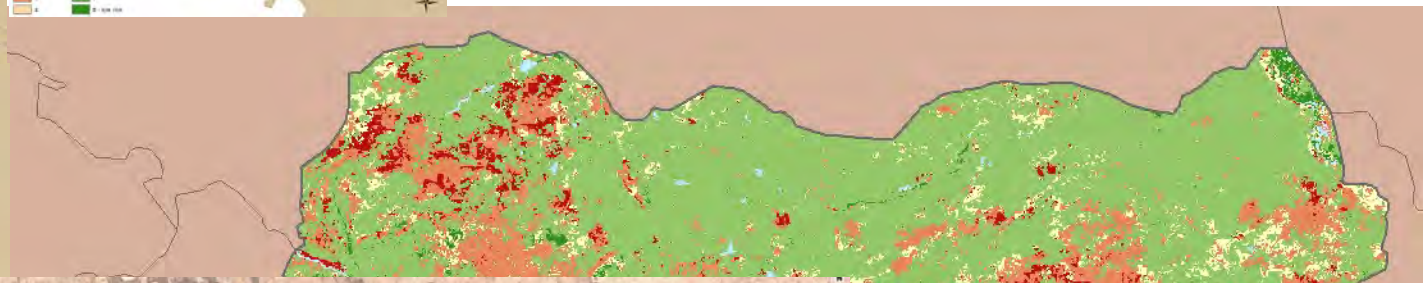

Abuja
Gwarinpa Estate
Abuja
Karu
Kugo
Kaura
Lugbe
Soil Carbon Depletion Risk
Eruwa
Ibadan
Abeokuta
Ogun State
Sagamu
Ijebu Ode
Ikorodu
Lagos
Lagos
namics(1982-2010)
Gulf of Guinea
N

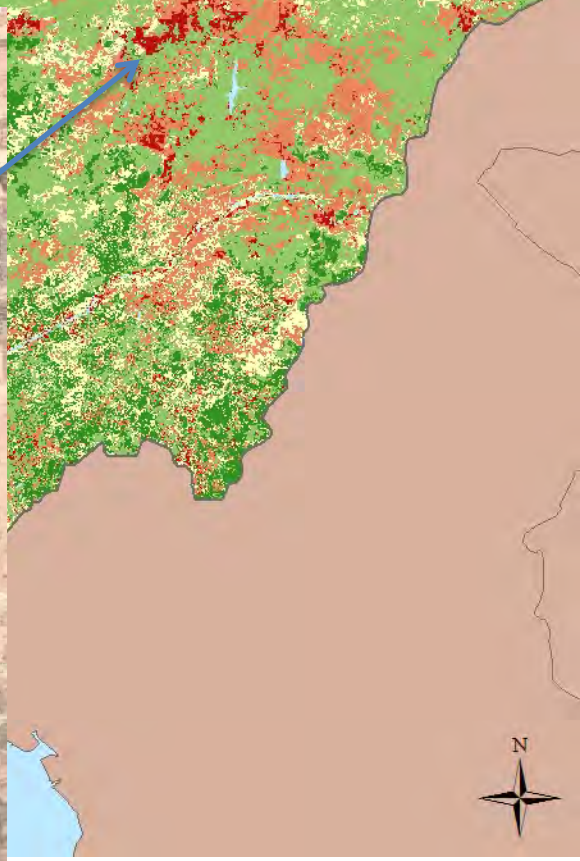

Kainji Reservoir
Niger
Kwara
Shaki
Land productivity dynamics(1982-2010)
declining productivity
early signs of decline
stable, but stressed
stable, not stressed
increasing productivity
Gulf of Guinea

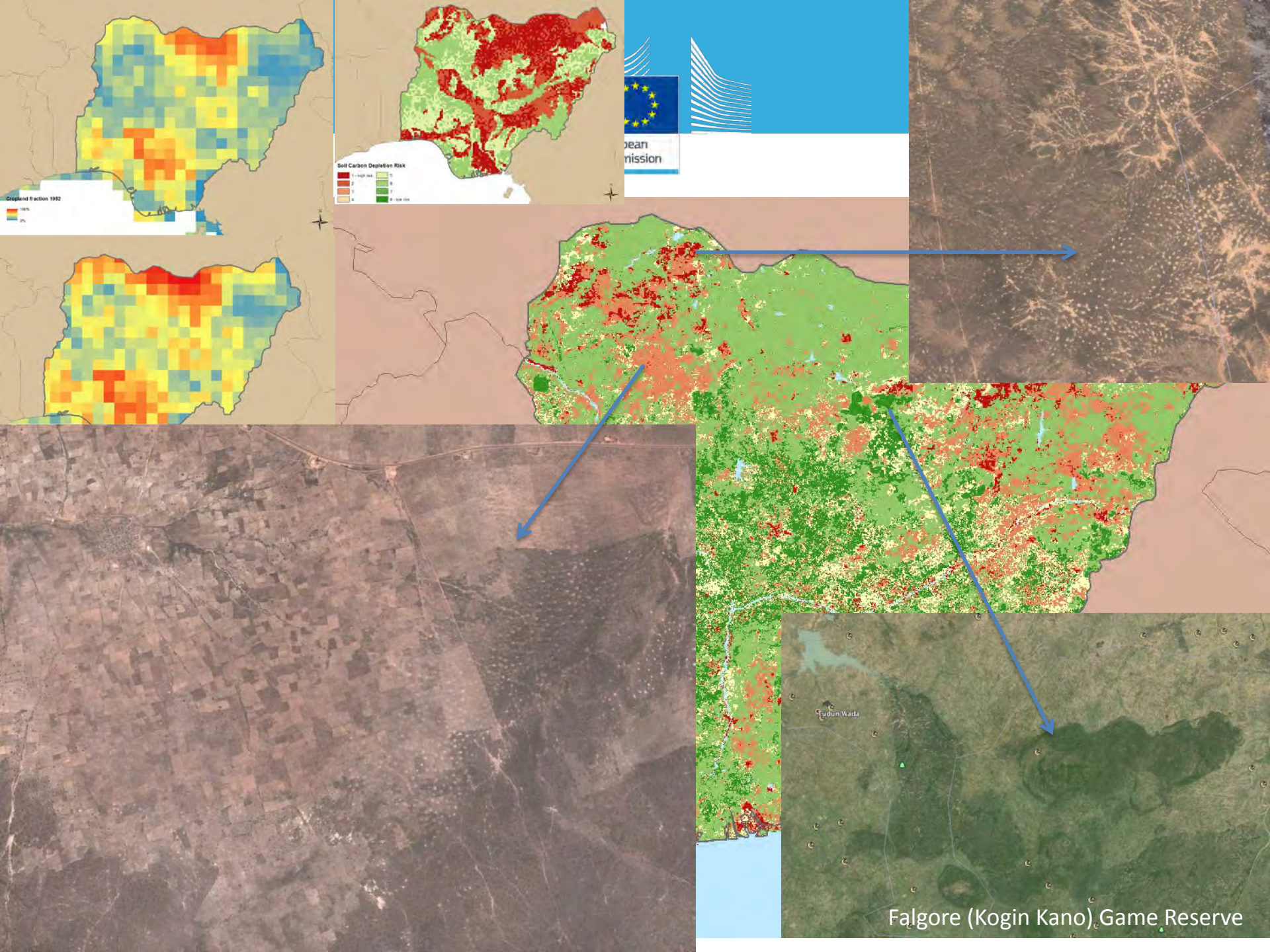

Cropland fraction 1992


Soil Carbon Depletion Risk





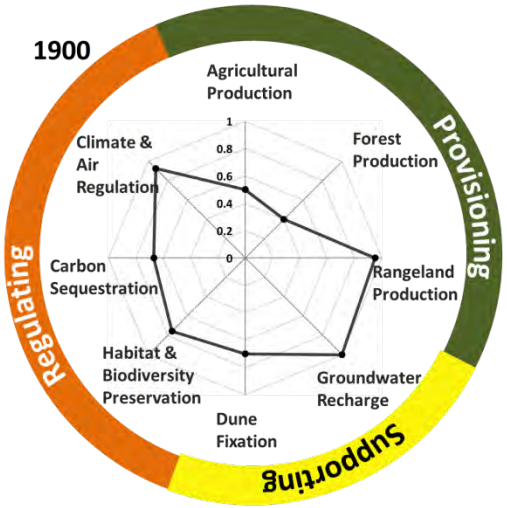

N

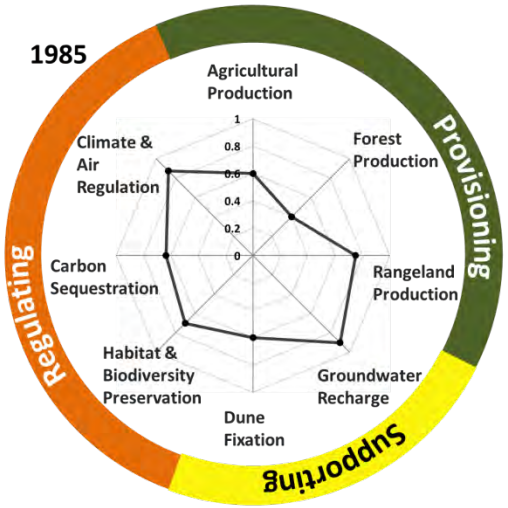

Cropland fraction 1992
Soil Carbon Depletion Risk
Falgore (Kogin Kano) Game Reserve

Linking to ecosystem Services

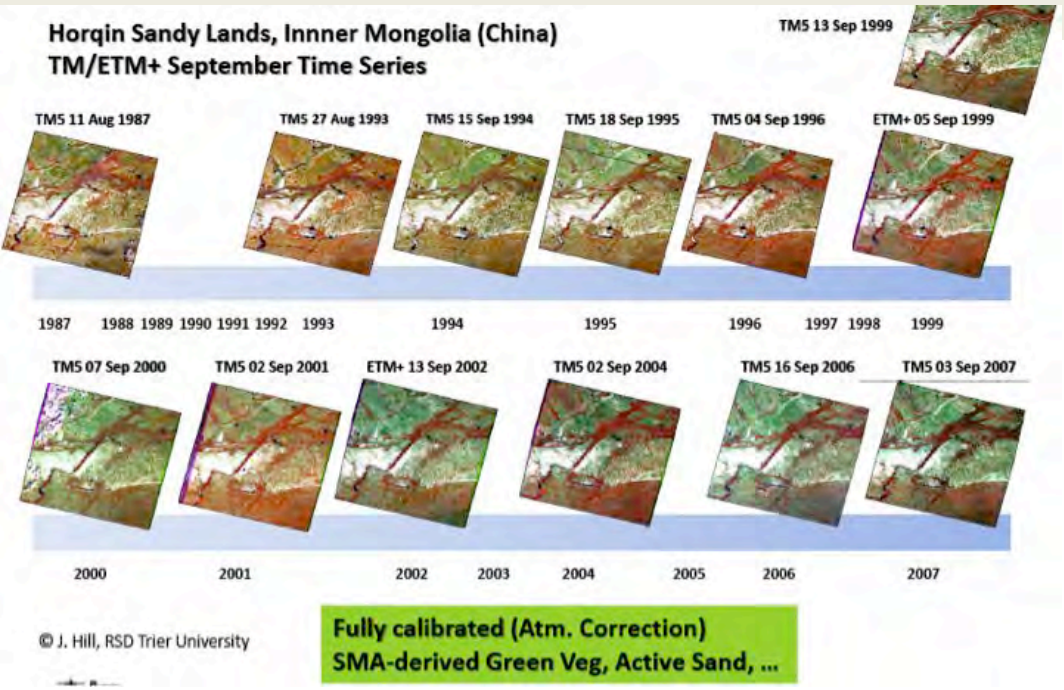
‘quantitative’ linking to Ecosystem Services

Land use system	Provisioning ESS	Regulating/Supporting ESS
Agriculture (IA,RA)	• Agricultural Production • Forest Production	• Climate & Air Regulation • Carbon Sequestration • Habitat & Biodiversity Preservation • Groundwater Recharge • Dune Fixation
Rangelands (R1-R3)	• Rangeland Production • Forest Production	
Rangeland/Agriculture (R/A)	• Agricultural Production • Forest Production • Rangeland Production	

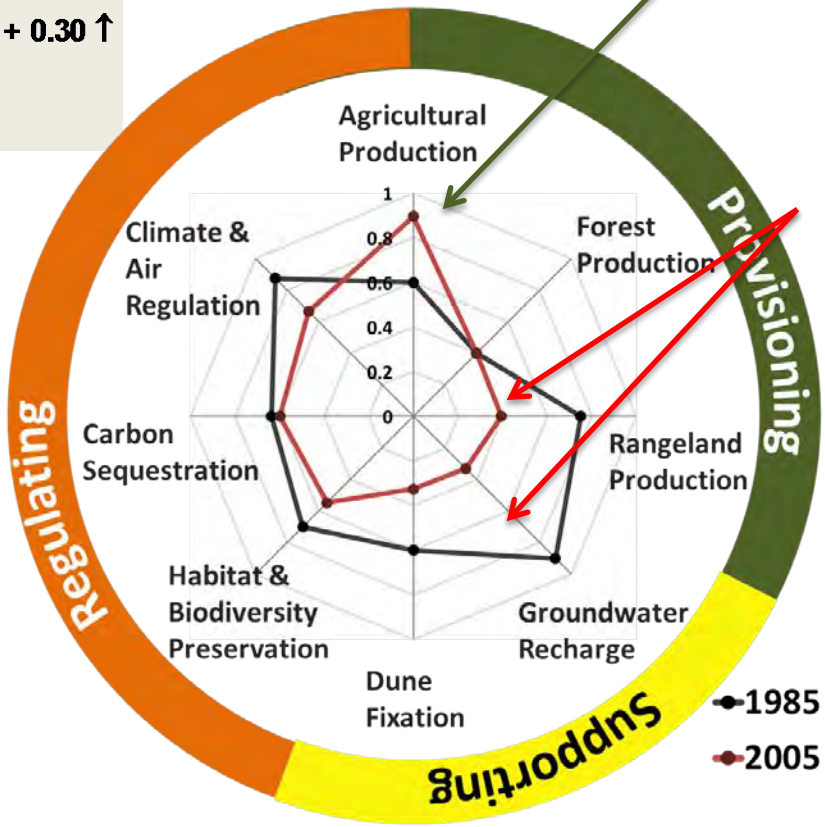




ESS	Descriptive Indicator	Proportional Change in Abundance and Stratum		ESS Indicator Length Adjustment
Groundwater Recharge	total area covered by water (ponds, lakes, rivers)	**- 63.20 %**		**0.90 – 0.57 ↓**
Dune Fixation	SMA-derived abundance of "Mobile Sand" within strata R1-R3	R1: +38.86 % R2: +48.40 % R3: +29.06 %	**39.23 %**	**0.70 – 0.27 ↓**
Range Productivity	SMA-derived abundance of „Green Vegetation" within strata R1-R3	R1: -38.41 % R2: -43.92 % R3: -49.38 %	**-44.52%**	**0.80 – 0.36 ↓**
Crop Productivity	SMA-derived abundance of „Green Vegetation" within strata IA and RA	IA: + 44.82 % RA: + 46.12 %	**45.49 %**	**0.65 + 0.30 ↑**



Solutions options strategies



4. Status and needs

Land degradation is process:	time sequence – repetitive observations needed
Land degradation is a local phenomenon:	high enough detail (resolutions ok, but time span…)
Land degradation is of global importance:	scale <> detail <> time span
Satellite time series data = observations:	all ok, available, but do we believe them?
“Field’ data:	multiple sources, no spatial continuum, frequency? But we tend to believe them!

Land degradation assessment:

Now:

- ✓ agreed concept
- ✓ global variables (processing and valuation)
- ✓ stratifications (global scales, some are 'rough', some themes are missing)
- ✓ start to implement the stratified analysis
- ✓ case studies to show integration of local data
- ✓ start to link to economic valuations

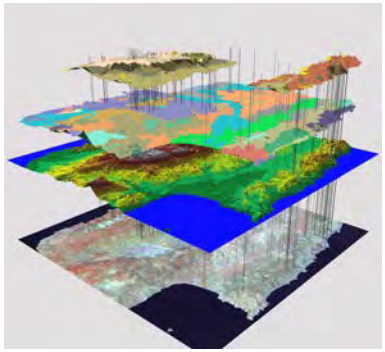
Future:

- ➢ complete analysis
- ➢ model cause-effect relations
- ➢ link to models of function losses and climate change
- ➢ link to biodiversity issues

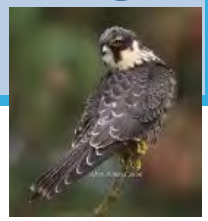
Need:

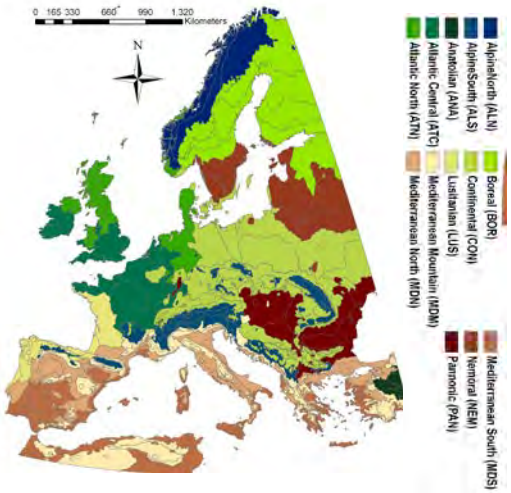
- global land use/change data at adequate scales
- agreed method(s) – for comparability – for satellite based or other source
- agreed sources for socio-economic information (onsite and off-site)
- in-situ monitoring efforts for validation and hotspots / accessibility of data

- Allow to fully document process interactions > better modeling > anticipation
- "need for SLM" rather than LD

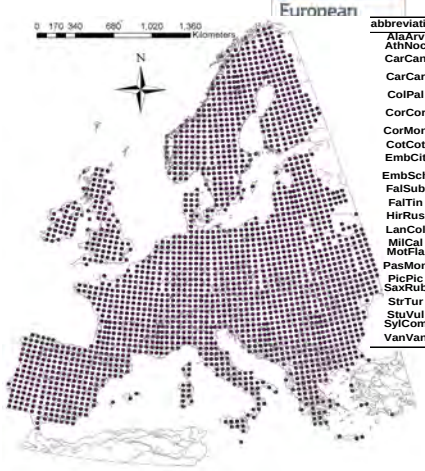


Distribution of European Farmland Birds assessed by remote sensing derived phenology and productivity and relationship to climate



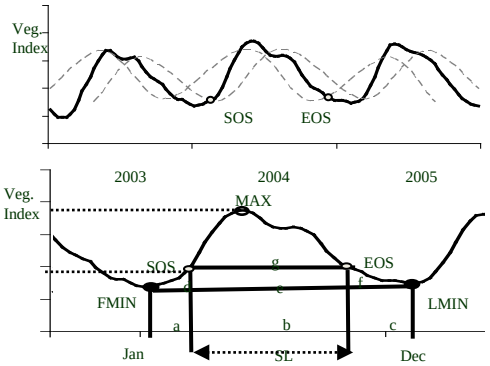


Environmental classification



EBCC data

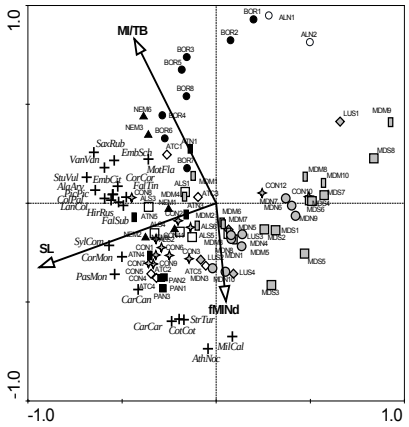
abbreviation	species name	common name
AlaArv	Alauda arvensis	Skylark
AthNoc	Athene noctua	Little Owl
CarCan	Carduelis cannabina	Linnet
CarCar	Carduelis carduelis	Goldfinch
ColPal	Columba palumbus	Woodpigeon
CorCor	Corvus corone	Carrion Crow
CorMon	Corvus monedula	Jackdaw
CotCot	Coturnix coturnix	Quail
EmbCit	Emberiza citrinella	Yellow Hammer
EmbSch	Emberiza schoeniclus	Reed Bunting
FalSub	Falco subbuteo	Hobbz
FalTin	Falco tinnunculus	Common Kestrel
HirRus	Hirundo rustica	Swallow
LanCol	Lanius collurio	Red-backed Shrike
MilCal	Miliaria calandra	Corn Bunting
MotFla	Motacilla flava	Yellow Wagtail
PasMon	Passer montanus	Tree Sparrow
PicPic	Pica pica	Magpie
SaxRub	Saxicola rubetra	Stonechat
StrTur	Streptopelia turtur	Turtle Dove
StuVul	Sturnus vulgaris	Starling
SylCom	Sylvia communis	Whitethroat
VanVan	Vanellus vanellus	Lapwing



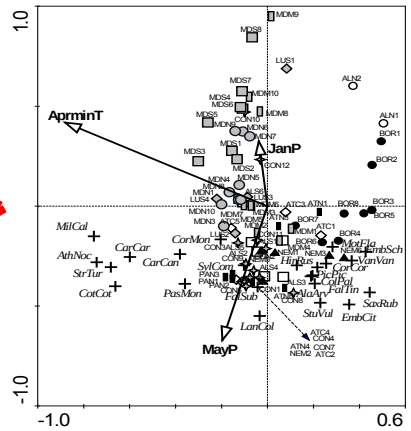
Phenological and biophysical variables significantly structuring farmland bird community composition. Variance explained (Λ) is calculated in addition to all other variables in the model (conditional effect).

Partial RDA with climatic parameters and log area as covariables **Variable names and codes**	Λ	F-ratio	P
minimum April temperature (AprminT)	0.15	25.8	0.001
January mean precipitation (JanP)	0.05	10.9	0.001
May mean precipitation (MayP)	0.03	8.15	0.001
Partial RDA with phenological parameters and log area as covariables **Variables names and code**	Λ	F-ratio	P
Mean Seasonal Length (SL)	0.26	31.2	0.001
Mean MI/TB ratio (MI/TB)	0.12	21.5	0.001
temporal maximum of first MIN day (fMINd))	0.01	3.43	0.025

Significance calculated with Monte Carlo test running 999 permutations.



RDA triplot constraining the species matrix on Phenology.



RDA triplot constraining the species matrix on climate.

RDA with farmland bird community composition in Europe constrained on the significant phenological indices and on the significant climatic variables.

	P Axis 1	P Axis 2	C Axis1	C Axis2
Eigenvalues	0.251	0.120	0.172	0.122
Species-environment correlations	0.756	0.750	0.937	0.533
Cumulative % of variance of species data	31.8 %	47.0 %	21.8 %	37.2 %
Cumulative % of variance of species environment relation	66.2 %	97.9 %	56.6 %	96.6 %
Sum of all canonical eigenvalues		37.9 %		30.4 %
F-ratio / significance		21.8 / 0.001		14.8 / 0.001

P: Phenology C: Climate

Alpine North Alpine South Atlantic Central Atlantic North Boreal Continental Nemoral
Lusitanian Mediterranean Mountains Mediterranean North Mediterranean South Pannonic

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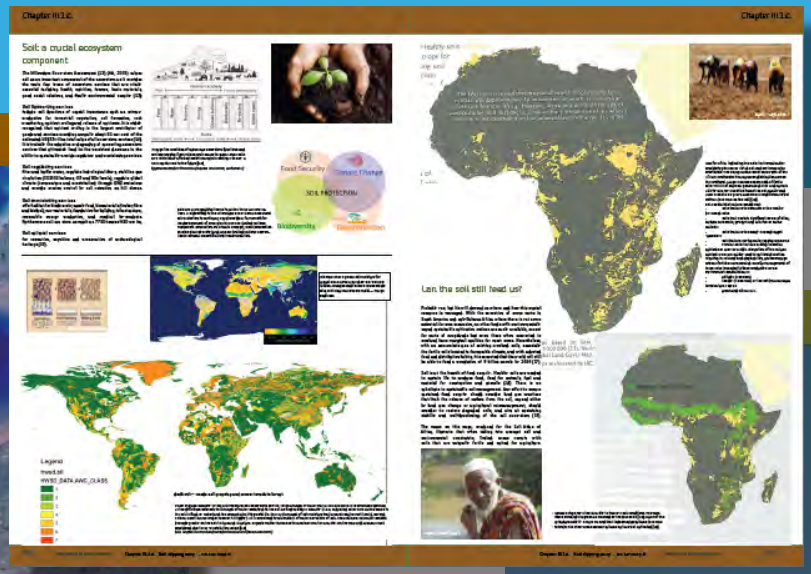
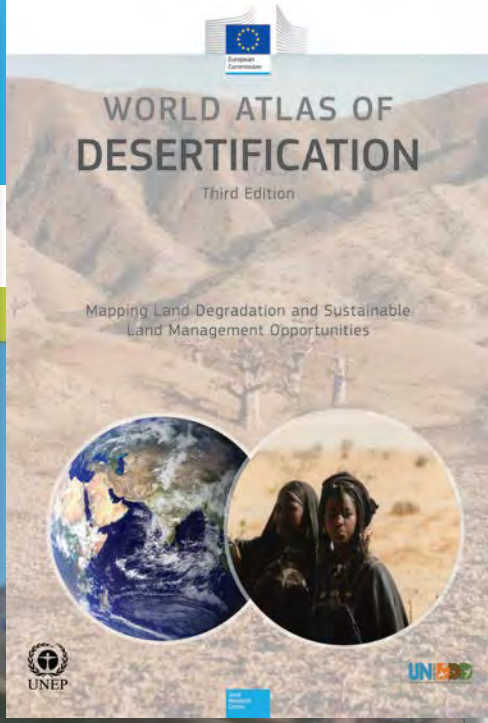
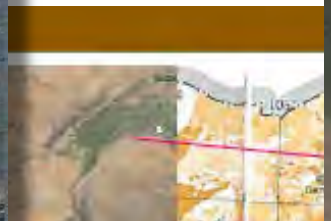
Soil slipping away
.... we can stop it


Soil: a crucial ecosystem component
Can the soil still feed us?


WORLD ATLAS OF
DESERTIFICATION
Third Edition
Mapping Land Degradation and Sustainable Land Management Opportunities
UNEP



Thank you!


Rangelands
grazing pressure and marginalisation
Chapter III.3.a. Rangelands, grazing pressure and marginalisation
World Atlas of Desertification
161

European Commission

opernicus
The European Earth Observation Programme

GMES
Observing our planet for a safer world

Michael Cherlet
Alan Belward
DG JRC

Michel Massart
DG ENTR

- Copernicus is the Earth Observation flagship of the European Union

- An integrated Earth Observation system which combines space-based and in-situ data with Earth System Services

- A source of information for policymakers, scientists, business and the public at large

- A user-driven programme of services for environment and security

The objective of Copernicus is to develop operational services, following the example of meteorology, but for other domains such as:

- Emergency management
- Air quality monitoring
- Land monitoring
- Ocean & sea monitoring …

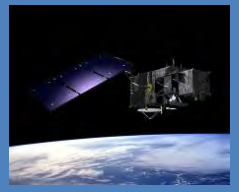
In addition, science is needed to create and continuously improve operational services

Sentinel 1 – SAR imaging
All weather, day/night applications, interferometry

2014

Sentinel 2 – Multispectral imaging
Land applications: urban, forest, agriculture,..
Continuity of LANDSAT, SPOT, …

2015

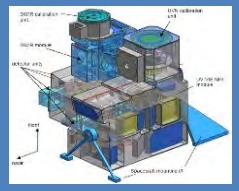


Sentinel 3 – Ocean and global land monitoring :
ocean color, vegetation, sea/land surface temperature, altimetry

2015

Sentinel 4 – Geostationary atmospheric
Atmospheric composition monitoring,
trans-boundary pollution

2017



Sentinel 5 – Low-orbit atmospheric
Atmospheric composition monitoring
(S5 Precursor launch in 2014)

2014, 2019+

COPERNICUS Overview

European Commission

USERS

Policy makers & **Public** & **Private, commercial**

Different Needs

Farming | Oil Spills | Air quality | Flood | Surveillance | Ice levels

Examples

Land | Marine | Atmosphere | Emergency | Security | Climate Change

Information Services

Space Infrastructure & **In-situ Infrastructure**

Sustainable information

OBSERVATIONS

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COPERNICUS Core Services

European Commission

opernicus
The European Earth Observation Programme

Services monitoring Earth systems

Land

Marine

Atmosphere

Horizontal services

Emergency

Security

Climate Change

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Value added of an Operational Core Service

- Long term and reliable provision of products and services
- Sustainability of the provision for downstream applications
- Delivery of fully validated products and services
- Centralized services leading to Scale Economies

Data Policy

- COPERNICUS: a public good. The goal is to provide free and open access to data and information with minimum restrictions

- Need to distinguish between data policy for Sentinel satellite, Contributing missions, and Copernicus service products

- Security restrictions may apply

Land Service - Global

Objective:

Support to specific EU policies at international level and support to EU commitments under international treaties and conventions

Support to GMES-Africa

Sentinel 2

graphic courtesy USGS

Land Service - Global

Objective: supporting specific EU policies at international level and supporting EU commitments under international treaties and convention

Monitoring in Near Real time global systematic biophysical parameters

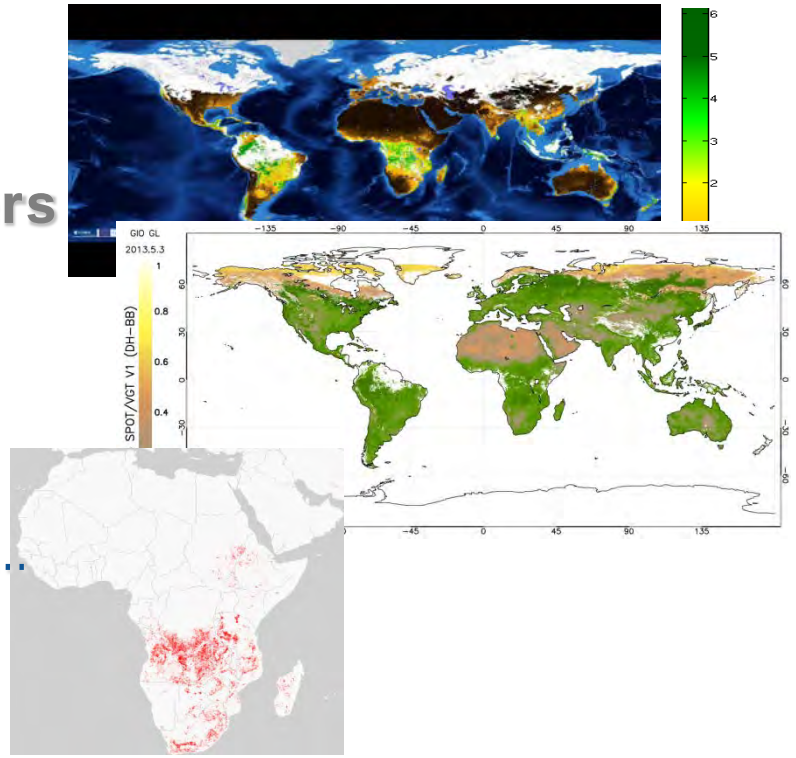
Sentinel 2

graphic courtesy USGS

Land Service - Global

Objective: supporting specific EU policies at international level and supporting EU commitments under international treaties and convention

Monitoring in Near Real time
global
systematic biophysical parameters



- **Vegetation Dynamics**
  LAI,FaPAR, Dry Mapper Product ...
- **Energy Budget**
  Albedo, Land Surface Temperature ...
- **Detection Products**
  Water bodies, Burnt Areas ...

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Land Service
Current Portfolio

Variable	Temporal Coverage	Temporal resolution	Spatial coverage	Spatial resolution	Sensor	Timeliness
LAI/FAPAR/FCover	1999 – present	10 days	Global	1km	SPOT/VGT	3 days
NDVI/VCI/VPI	1999 – present	10 days	Global	1km	SPOT/VGT	3 days
Dry Matter Productivity	2009 – present	10 days	Global	1km	SPOT/VGT	3 days
Burnt Area	1998 – present	1 day	Global	1km	SPOT/VGT	3 days
TOC Reflectance	2013 – present	10 days	Global	1km	SPOT/VGT	3 days
Surface Albedo	1999 – present	10 days	Global	1km	SPOT/VGT	3 days
Land Surface Temperature	2009 – present	1 hour	Global	0.05°	ΣGeo	1 day
Soil Water Index	2007 – present	1 day	Global	0.1°	Metop / ASCAT	1 day
Water bodies	1999 – present	10 days	Global*	1km	SPOT/VGT	3 days

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The European Earth Observation Programme

Implementation of a Hot Spot monitoring component

- Objective : To support development projects and specific monitoring
- Portfolio : i.e. Land cover and land use mapping …
- Sector : Biodiversity conservation (protected areas and national parks, Rural development (land administration – land degradation), Infrastructure (road network – impact assessment) …
- Implementation on request from EU institutions




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The European Earth Observation Programme

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Copernicus, previously known as GMES (Global Monitoring for Environment and Security), is the European Programme for the establishment of a European capacity for Earth Observation.

The views expressed on this website are those of the authors and do not necessarily represent those of the European Commission.

European Commission

(Credits: UNHCR / ESA–S. Corvaja)

WHAT'S NEW

05 Jun 2014 :
Earth Observation
Space up your app with satellite data

05 Jun 2014 :
Environmental Protection
Today is the World Environment Day

03 Jun 2014 :
Greenhouse Gases
EU reports lowest greenhouse gas emissions on record

02 Jun 2014 :
Sentinels
Bringing Sentinel-2 into focus

FOCUS EVENT

European Space Expo
07 June 2014 - 15 June 2014
Prague, Czech Republic

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Copernicus Land Monitoring Services

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Copernicus - The European Earth Observation Programme

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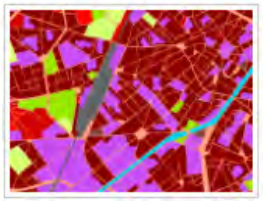
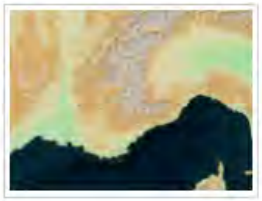

The Copernicus programme comprises satellite-borne earth observation, in-situ data and a services component that combines these in order to provide value added information essential for monitoring the earth's environment.

The Copernicus land monitoring service provides geographical information on land cover/land use and on variables related to vegetation state and the water cycle. It supports applications in a variety of domains, such as spatial planning, forest management, water management and agriculture and consists of the above four main components.

User corner

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- EAGLE Working Group
- Events
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Partners

European Commission

EEA

http://land.copernicus.eu

Joint Research Centre

Thank you !

Joint Research Centre

Michael.cherlet@jrc.ec.europa.eu