# European-scale assessment from remote sensing

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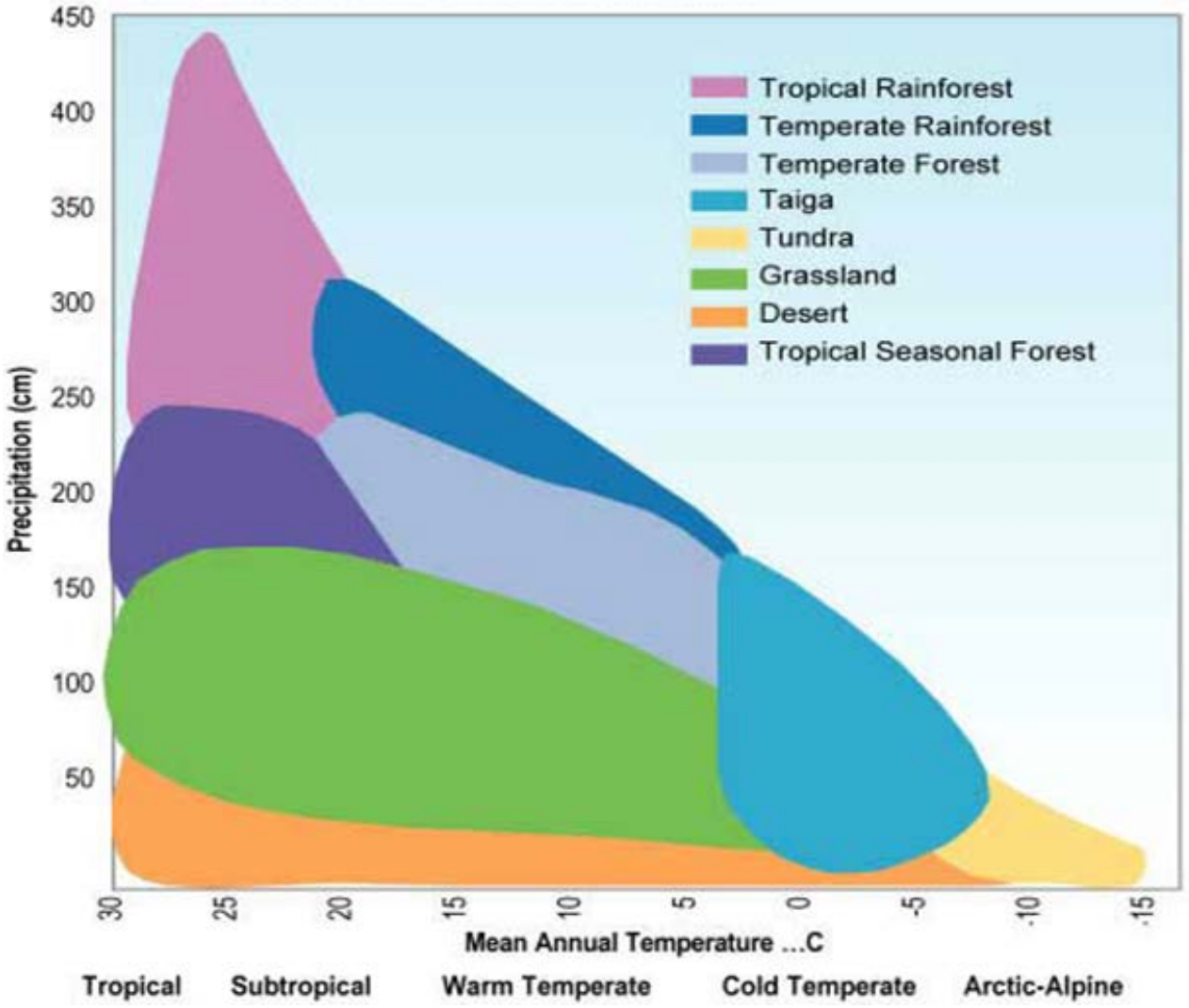
# Distribution of Plant Communities

Both temperature and precipitation limit the distribution of plant communities




http://www.climateimpacts.org/us-climate-assess-2000/synthesis-reports/overview/2IntroB.pdf

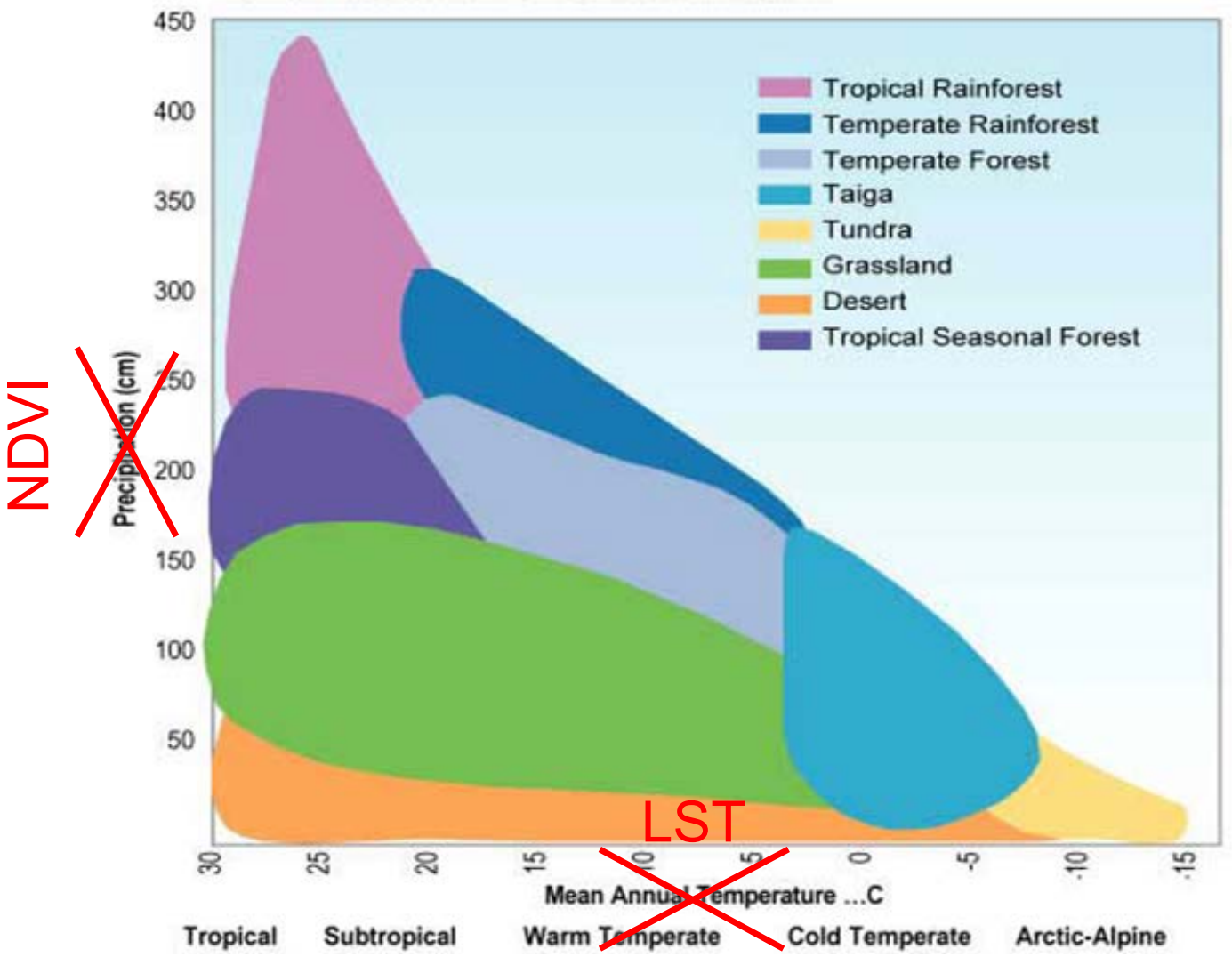
**New Project:**
Implementing climatic growth-limiting factors over Europe

**Base on prior knowledge and literature review:**

1. Precipitation, temperature, and radiation are the main climatic growth-limiting factors.
2. These factors are spatially distributed in continental and global scales;
3. These factors affect the land cover and biomes;
4. These factors affect the vegetation differently along the year;
5. They can be observed and quantified by earth observation.

# Distribution of Plant Communities

Both temperature and precipitation limit the distribution of plant communities




http://www.climateimpacts.org/us-climate-assess-2000/synthesis-reports/overview/2IntroB.pdf

Aim:

To upscale ground/point climatic measurements in PAs to pan-European scale by extracting climatic growth-limiting factors from Earth observation systems (e.g., MODIS, Meteosat, Sentinel);

Data – Monthly means, MODIS-derived NDVI and LST for 2000-2017, over Europe

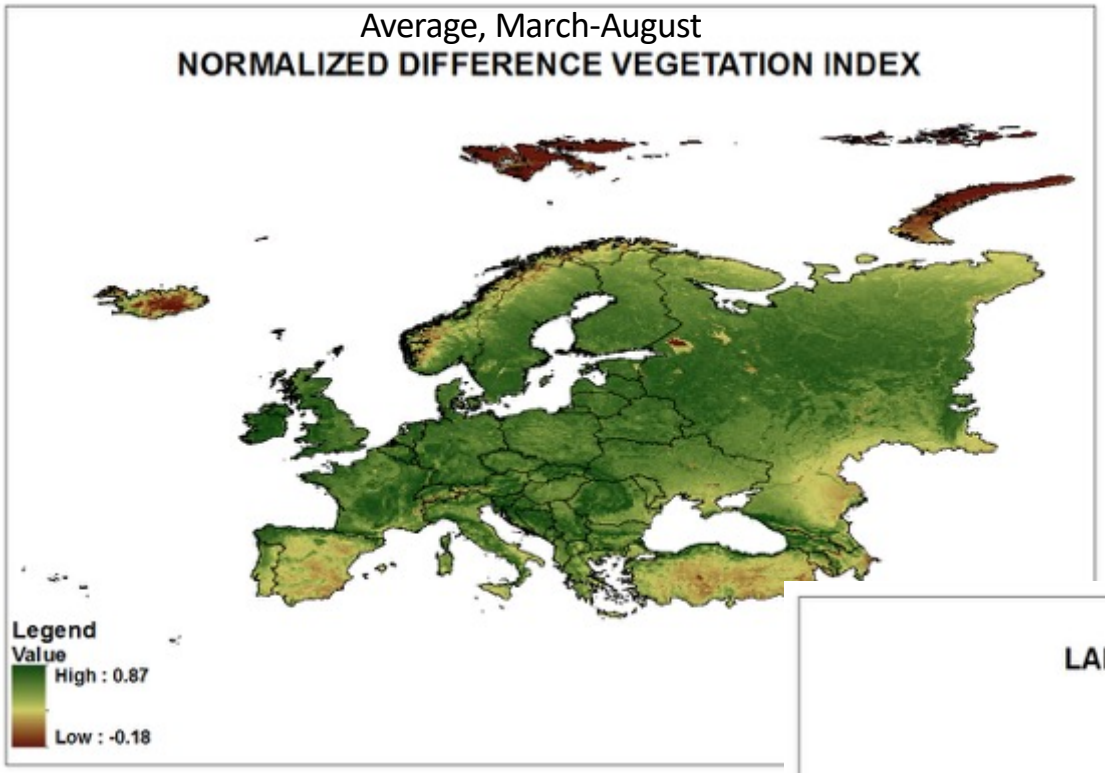
Period and sub-periods of the growing season –

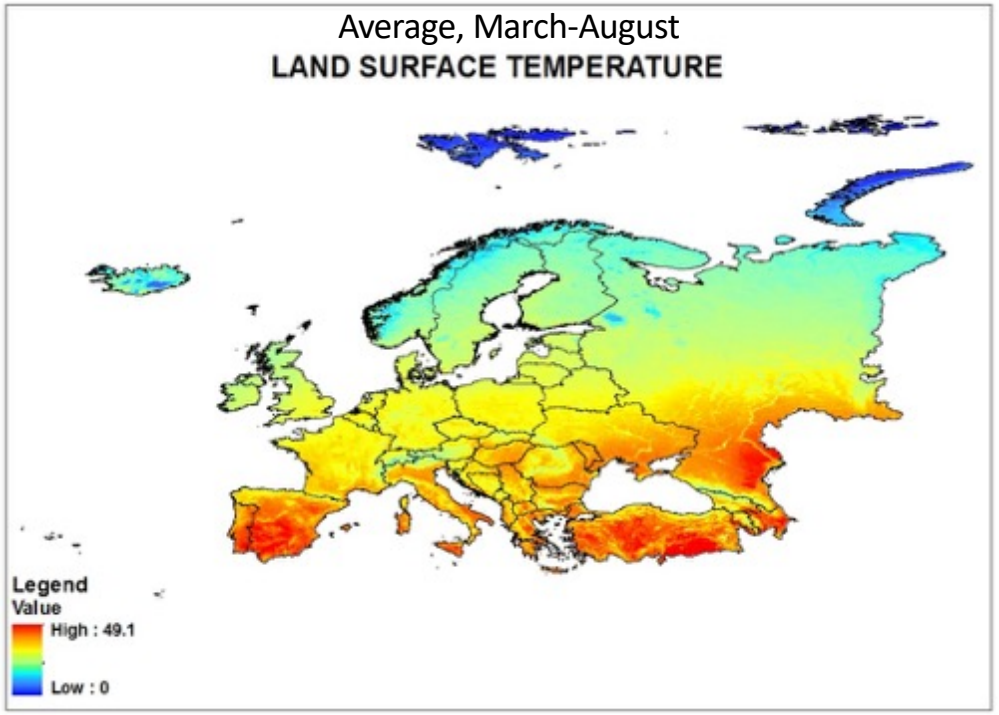
Mach-August – Entire growing season

March-May – Beginning of the growing season

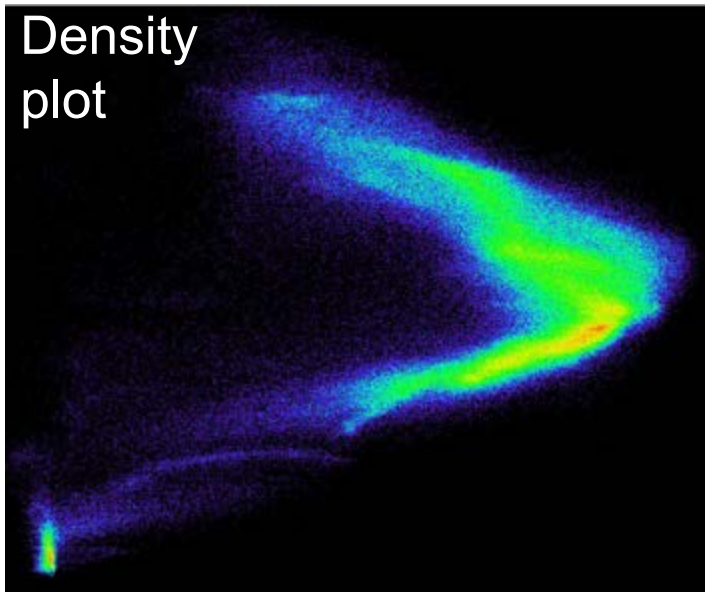
June-August – Middle of the growing season

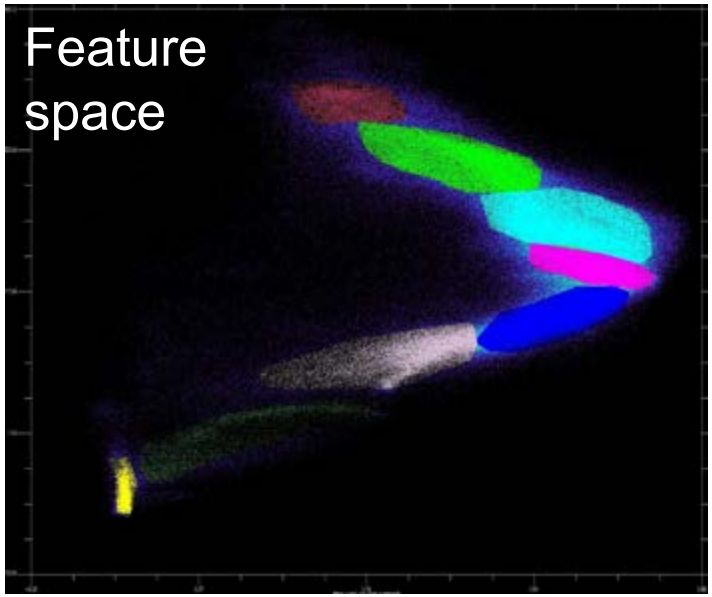
# European Long-term NDVI, LST

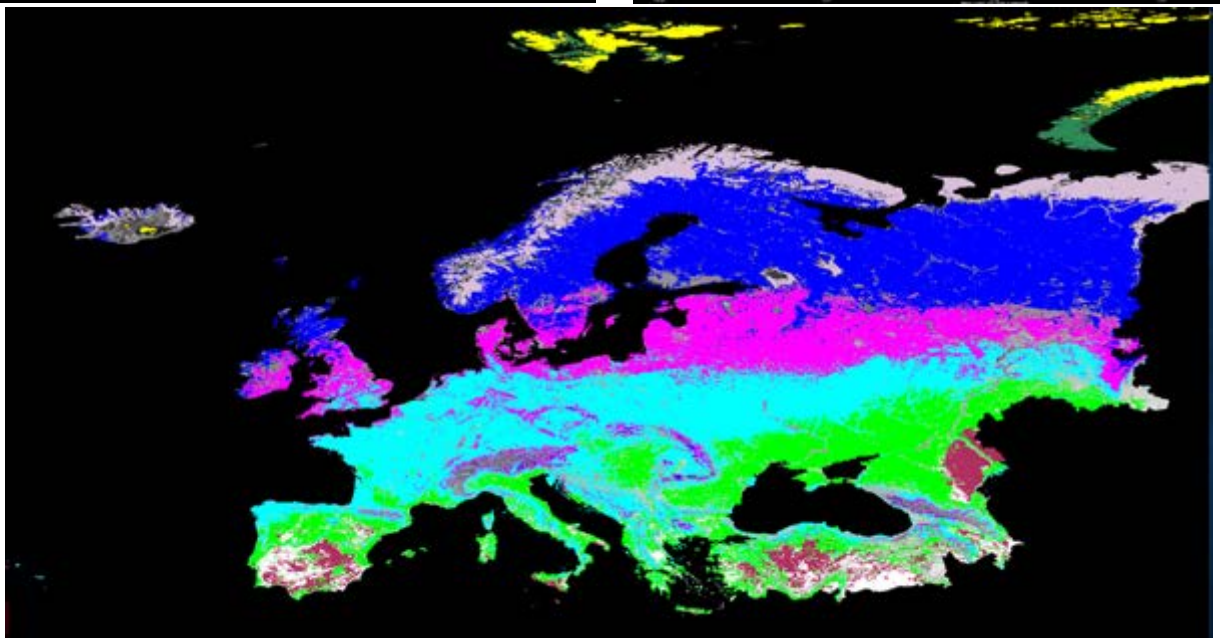


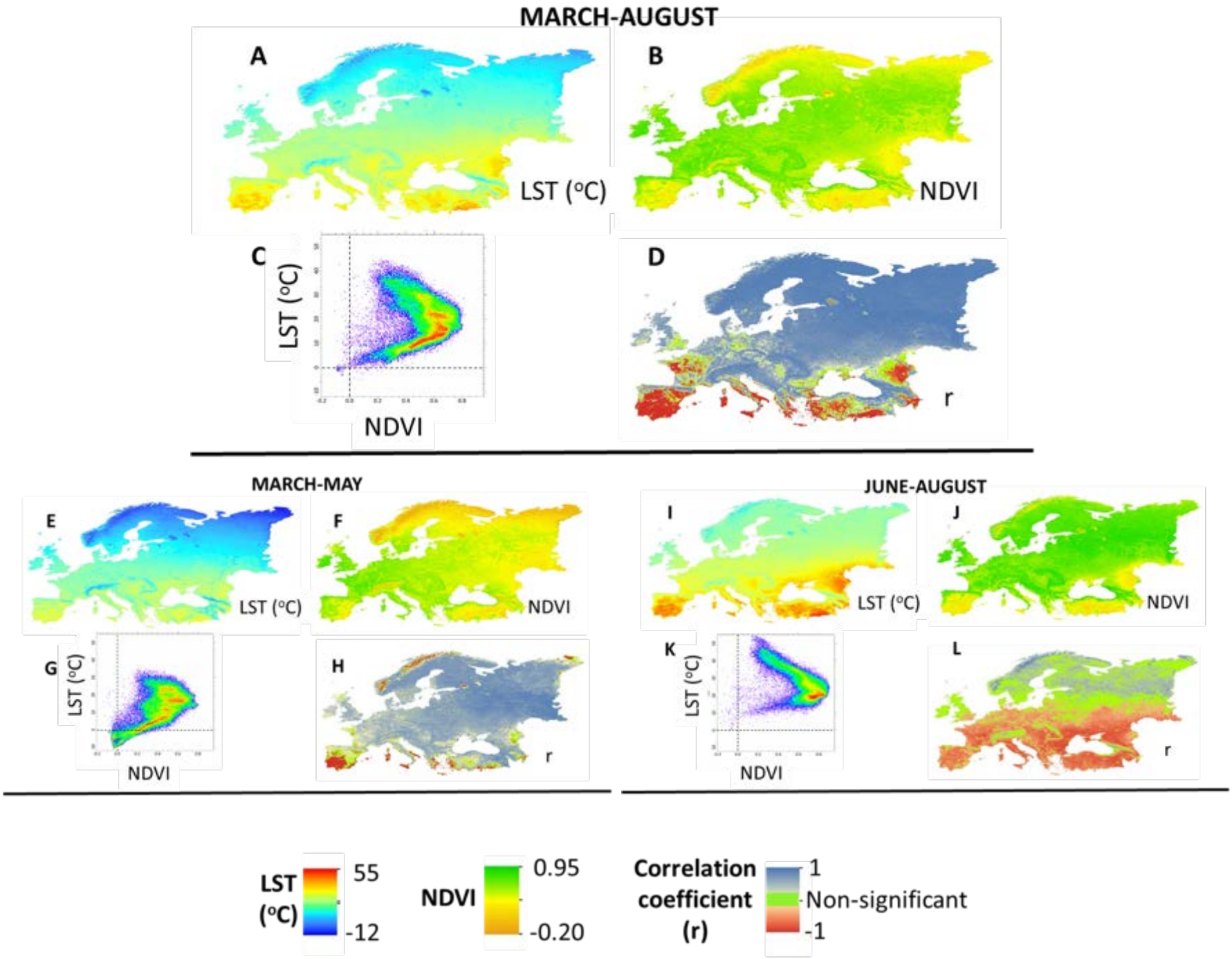



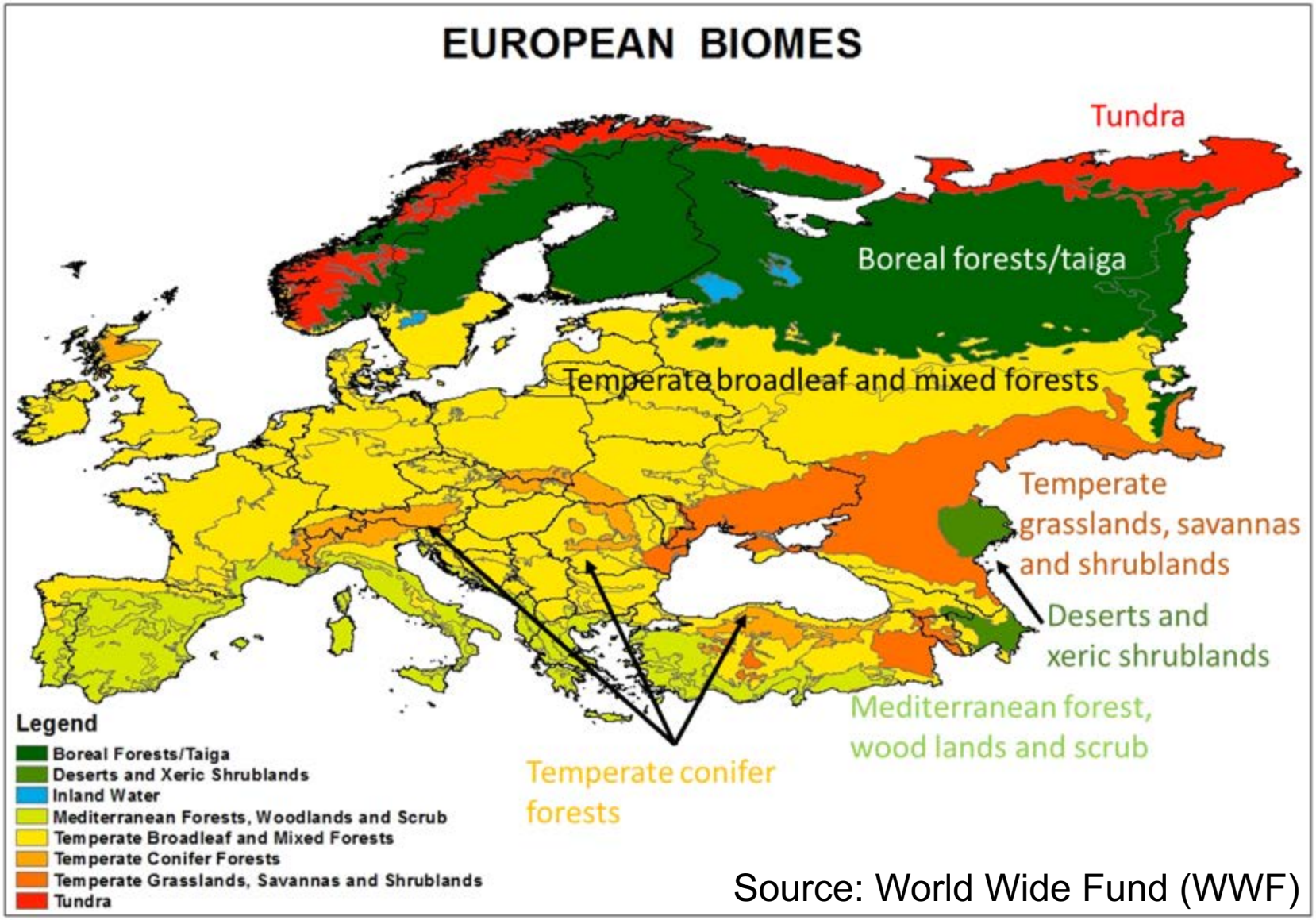
# Density/Feature space Plots



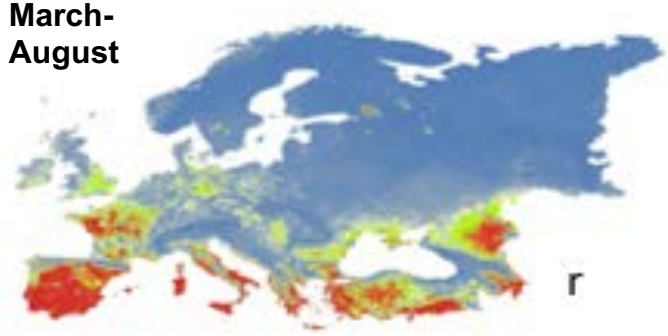

MARCH-AUGUST
A
LST (°C)
B
NDVI
C
LST (°C)
NDVI
D
r
MARCH-MAY
E
LST (°C)
F
NDVI
G
LST (°C)
NDVI
H
r
JUNE-AUGUST
I
LST (°C)
J
NDVI
K
LST (°C)
NDVI
L
r
LST (°C)
55
-12
NDVI
0.95
-0.20
Correlation coefficient (r)
1
Non-significant
-1



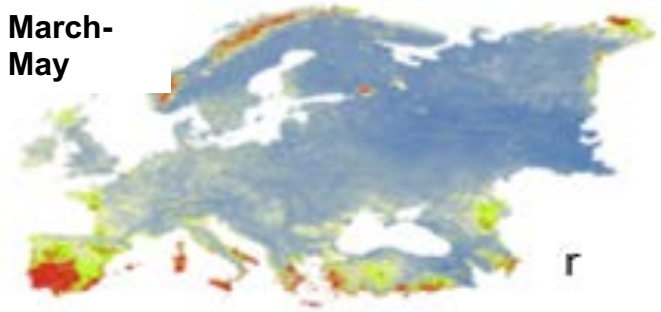

Source: World Wide Fund (WWF)

# r Over Biomes

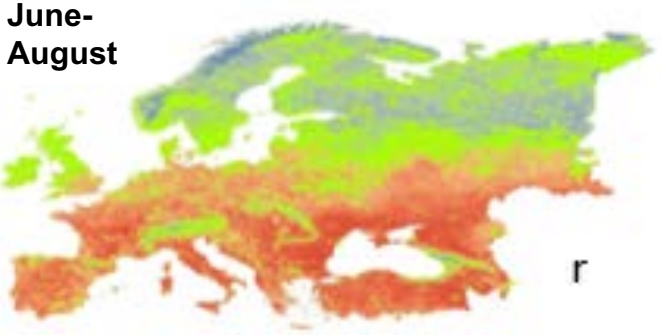
March-August




March-May




June-August




| | Positive correlation (%) | Negative correlation (%) | Non-significant pixels (%) |
|---|---|---|---|
| **March-August** | | | |
| Tundra | 96 | 4 | 0 |
| Boreal forest/taiga | 100 | 0 | 0 |
| Temperate broadleaf and mixed forest | 89 | 5 | 6 |
| Temperate conifer forests | 92 | 4 | 4 |
| Temperate grasslands, savannas, and shrublands | 75 | 9 | 16 |
| Mediterranean forests, woodlands, and scrubs | 24 | 66 | 11 |
| Desert and xeric shrublands | 16 | 70 | 13 |
| | | | |
| **March-May** | | | |
| Tundra | 74 | 15 | 10 |
| Boreal forest/taiga | 99 | 0 | 0 |
| Temperate broadleaf and mixed forest | 97 | 1 | 2 |
| Temperate conifer forests | 96 | 1 | 3 |
| Temperate grasslands, savannas, and shrublands | 96 | 1 | 3 |
| Mediterranean forests, woodlands, and scrubs | 44 | 32 | 24 |
| Desert and xeric shrublands | 52 | 10 | 38 |
| | | | |
| **June-August** | | | |
| Tundra | 57 | 4 | 39 |
| Boreal forest/taiga | 60 | 1 | 40 |
| Temperate broadleaf and mixed forest | 5 | 64 | 31 |
| Temperate conifer forests | 13 | 41 | 45 |
| Temperate grasslands, savannas, and shrublands | 0 | 97 | 3 |
| Mediterranean forests, woodlands, and scrubs | 0 | 94 | 6 |
| Desert and xeric shrublands | 1 | 88 | 11 |

# Vegetation Health Index (VHI)

**Vegetation Condition Index (VCI):**

$$VCI = (NDVIi - NDVImin)/(NDVImax - NDVImin)$$

**Temperature Condition Index (TCI):**

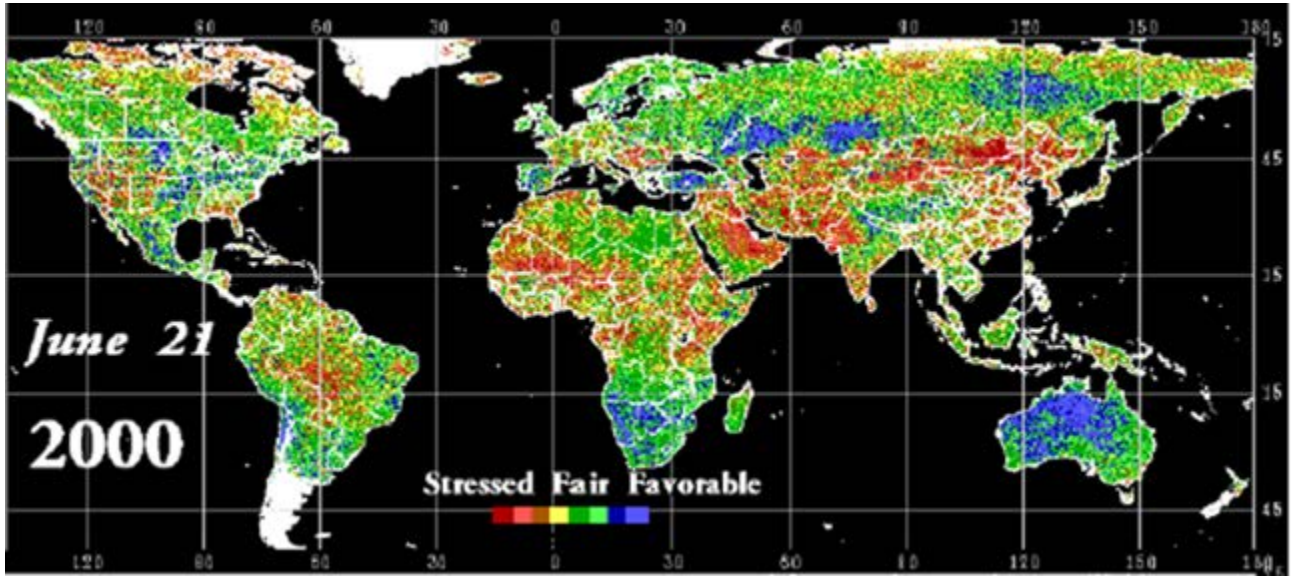
$$TCI = (BTmax - BTi)/(BTmax - BTmin)$$

**Vegetation Health Index (VHI):**

$$VHI = r1*VCI + r2*TCI$$

where r1 and r2 are VCI and TCI weights, respectively.

Usually r1 = r2 = 0.5




KOGAN, F.N., 1997, Global drought watch from space. *Bulletin of the American Meteorological Society*, **78**, 621-636.

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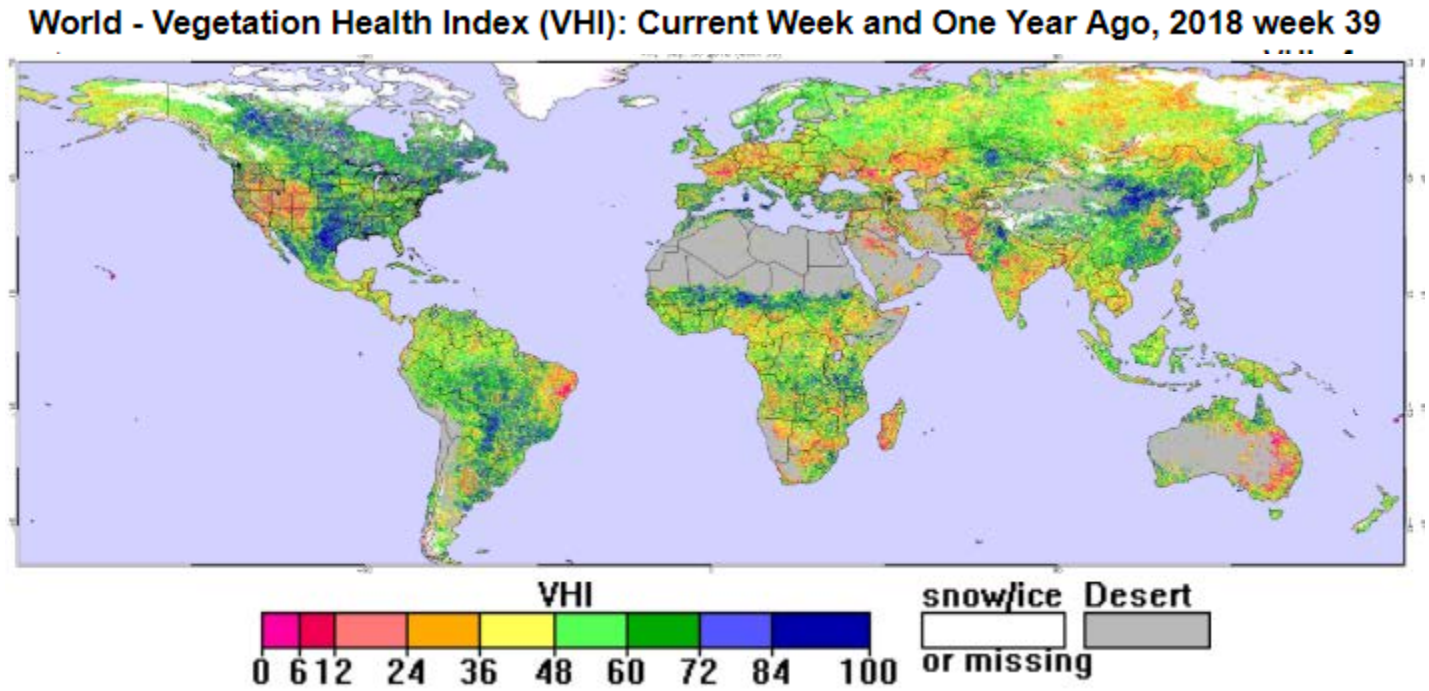
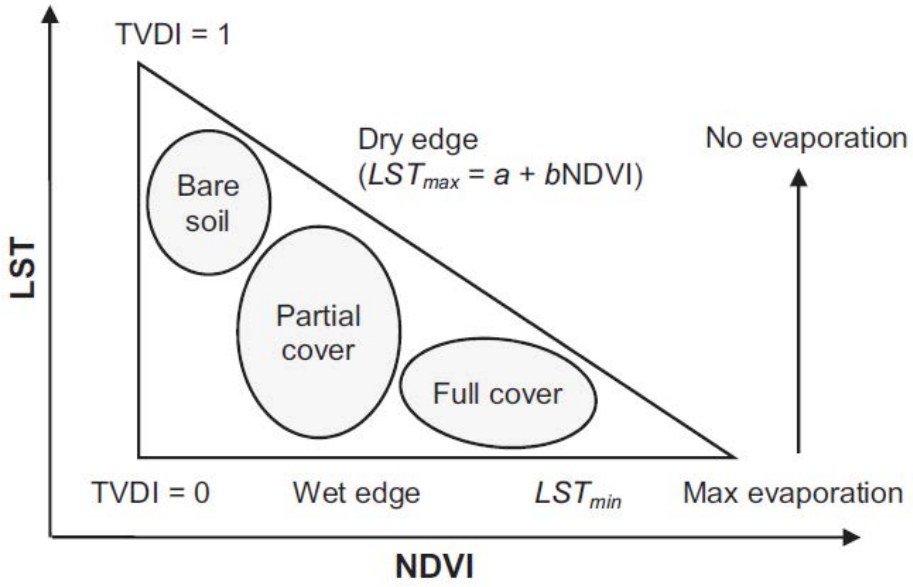


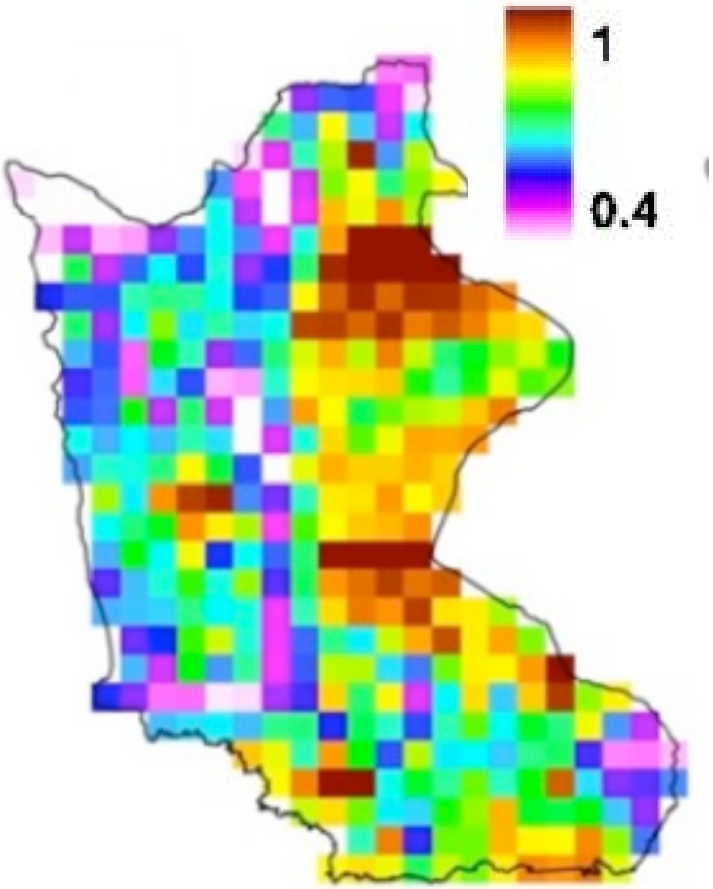

https://www.star.nesdis.noaa.gov/smcd/emb/vci/VH/vh_browse.php

# Temperature Vegetation Dryness Index (TVDI)




$$TVDI \frac{LST - LST_{\min}}{a + bNDVI - LST_{\min}}$$

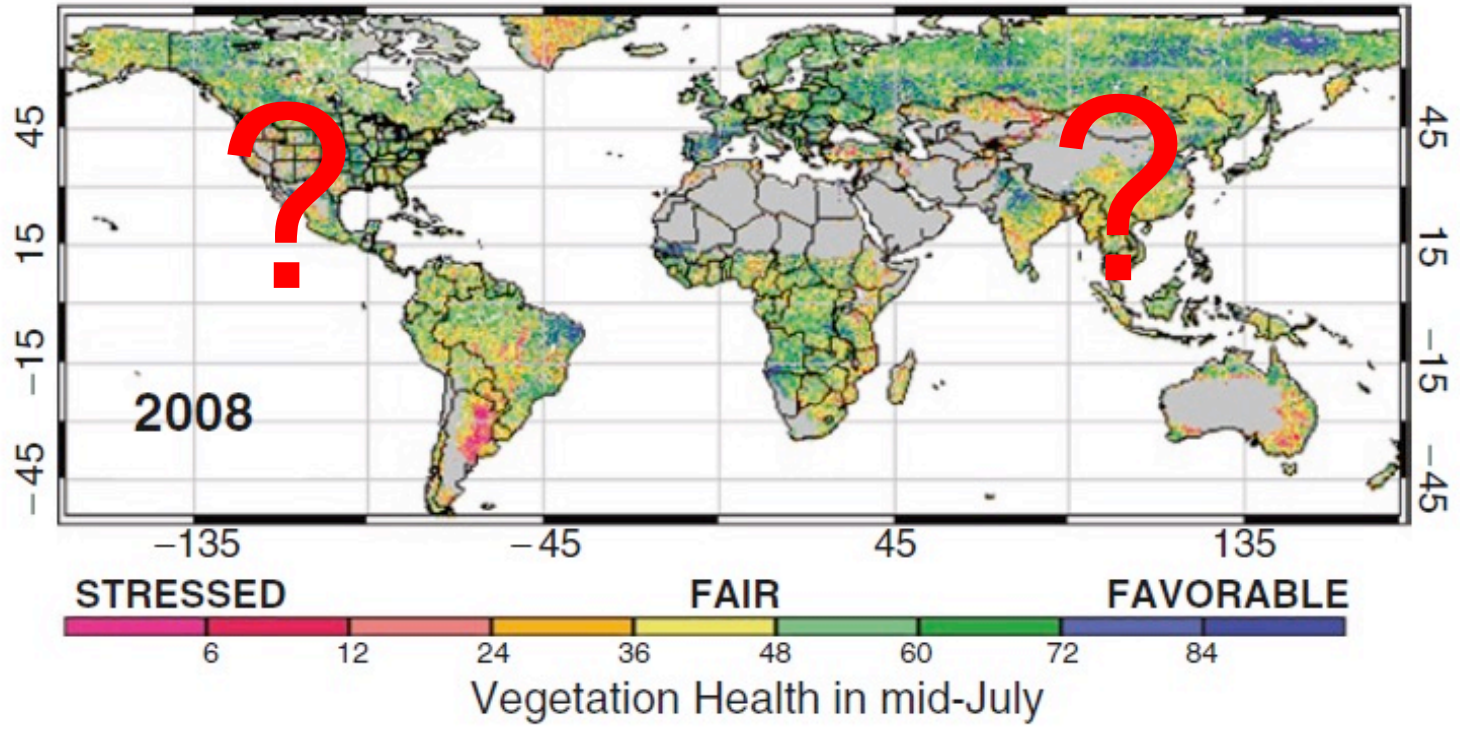
MODIS-derived TVDI for the Lower Mekong Delta




Sandholt et al., 2002

## One take home conclusion:

The accepted assumption on the negative relation between LST and NDVI, with respect to droughts, is not universal and should be examined for specific location and time of the year. In any case, this relation should be used with caution.



# Thank You!

# Questions?