FAO - WOCAT
LAND PRODUCTIVITY DYNAMICS

WOCAT

WOCAT

World Overview of Conservation Approaches and Technologies

www.wocat.net

FAO

Food and Agriculture Organization of the United Nations

www.fao.org

Sustainable Land Management:

A holistic approach to preserve the vital functions and services provided by land in a long-term, sustainable productive capacity, by integrating biophysical, socio-cultural and economic needs and values.

WOCAT

Food and Agriculture Organization of the United Nations

MOTIVATION

Need to map degradation in a meaningful way to make decisions and prioritize sites of interventions

Regional assessments: i.e. Overview of LDN in Central Asia and Eastern Europe

GEF funded LDN Projects - ILUP

Requests of support from countries

Countries and experts often find that the LPD maps do not represent the reality

Central Asia and Turkey in CACILM2 project: e.g. declining trends in deserts lead to overestimation

Argentina: previous experience with PRAIS 3 (Teich et al. 2019) comparing LPD maps

Colombia, Uruguay, Ecuador, etc: high discrepancies with national estimations

STRATEGY

Build on previous efforts and lessons learnt

Use the “official” legend of 5 categories

Produce a flexible approach were users can easily modify parameters

Open code & FAIR data & easy access

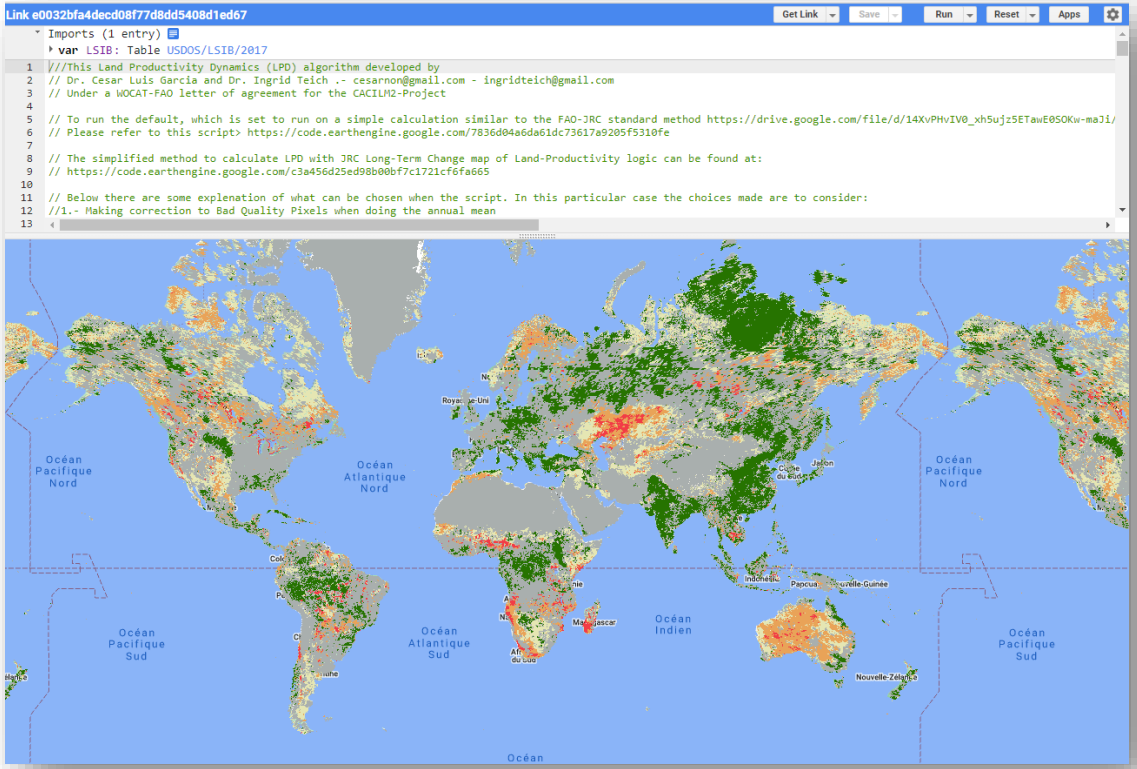
Base the development on the JRC simplified GEE code produced by FAO

Integrate ideas implemented of Trends.Earth approach

Co-development with countries and capacity building

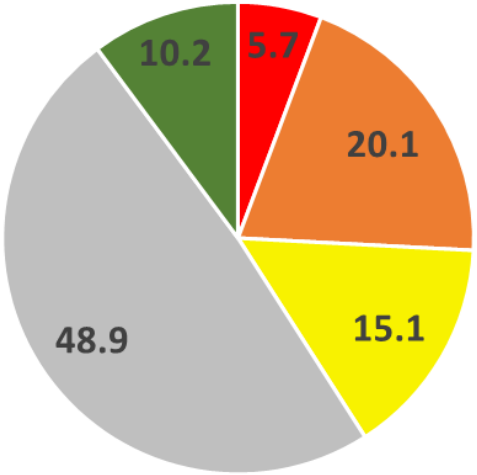
SCRIPT IN GEE

https://code.earthengine.google.com/e0032bfa4decd08f77d8dd5408d1ed67

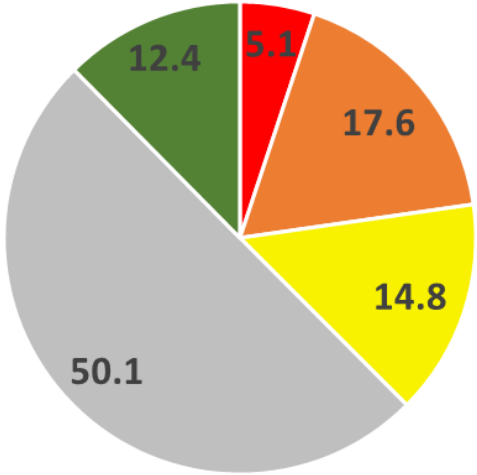


GLOBAL RESULTS
of the previous script for different periods

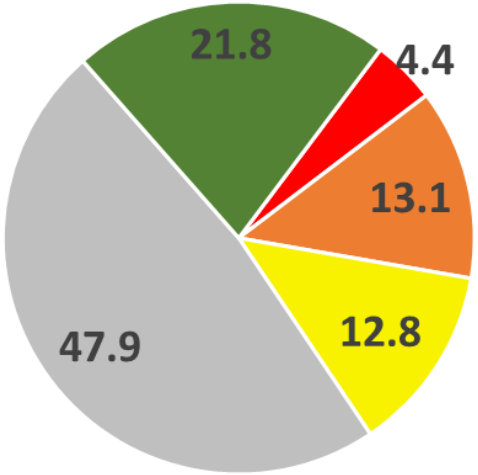
Baseline Period
2001 - 2015



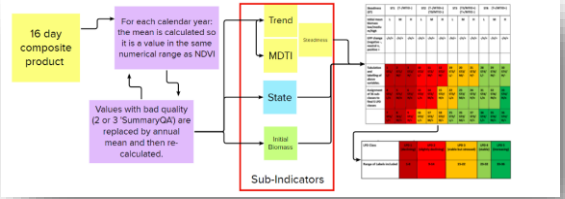
Reporting Period
2005 - 2019



Long-Term
2001 - 2021



HOW IS IT CALCULATED?



01 DATA

NDVI time series from MOD13Q1.006 Terra Vegetation Indices 16-Day Global 250m

02 SUB-INDICATORS

Steadiness (trend + MTID), initial biomass, State

03 CLASSIFICATION

36 categories groups in 5 LPD categories (see table)

04 MASKS

Deserts and water

01 DATA

Deprecated

This dataset has been superseded by MODIS/061/MOD13Q1

Dataset Availability

2000-02-18T00:00:00 -

Dataset Provider

NASA LP DAAC at the USGS EROS Center

Collection Snippet

```
ee.ImageCollection("MODIS/006/MOD13Q1")
```

See example

Tags

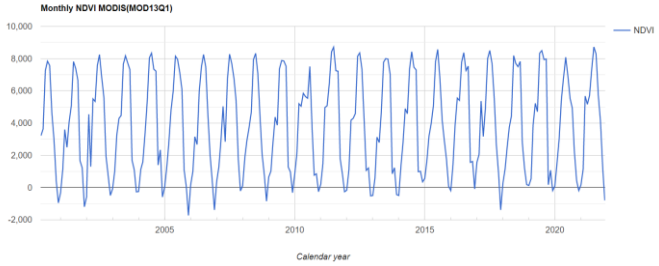
16-day evi global mod13q1 modis nasa ndvi terra usgs vegetation

DESCRIPTION | BANDS | TERMS OF USE | CITATIONS | DOIS

	reflectance				- 2155nm
ViewZenith	View zenith angle	0	18000	Degrees	0.01
SolarZenith	Solar zenith angle	0	18000	Degrees	0.01
RelativeAzimuth	Relative azimuth angle	-18000	18000	Degrees	0.01
DayOfYear	Julian day of year	1	366		0
SummaryQA	Quality reliability of VI pixel				0
SummaryQA Bitmask	• Bits 0-1: VI quality (MODLAND QA Bits) ○ 0: Good data, use with confidence ○ 1: Marginal data, useful but look at detailed QA for more information ○ 2: Pixel covered with snow/ice ○ 3: Pixel is cloudy				

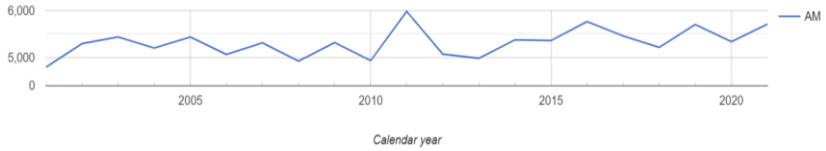
CLOSE IMPORT

Quality correction QC: Pixels with SummaryQA of 2 and 3 are replaced by the anual mean value



Annual means re calculated after QC

Seasonality is removed by calculating the anual means



02 SUB-INDICATORS: STEADINESS

TREND

The significance is considered
Mann Kendall (α=0.05)

3 categories :
1: Negative trend – Significative
2: No significative Trend
3: Positive trend - Significative

MTID

Multi Temporal Image Differencing

Multi Temporal Image Differencing (MTID) using Last 3 years mean

2 categories :
1: Negative MTID
2: Positive MTID

STEADINESS

Combinations categorized in 4 types of steadiness
(MTDI helps when there is no significance)

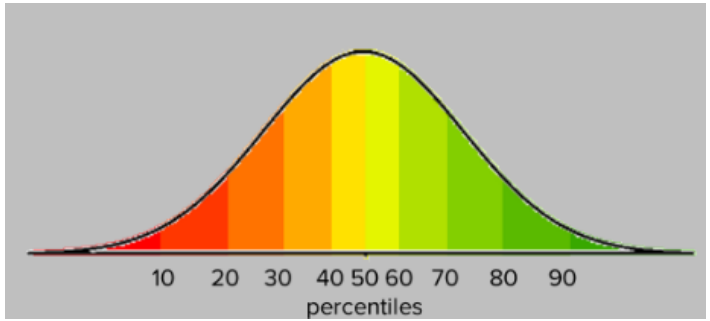
```
////-------------------------------------------------------------------
//// Calculate steadiness
//-------------------------------------------------------------------
// Calculate the 4 value steadiness index  based on the a combination of Mann
//where MTDI helps when there is no significance

var steadiness = ee.Image(0)
  .where(finalTrend.eq(1).and(MTDIcode.eq(1)),1) // T- MTDI-
  .where(finalTrend.eq(1).and(MTDIcode.eq(2)),2) // T- MTDI+
  .where(finalTrend.eq(2).and(MTDIcode.eq(1)),2) // T 0 MTDI-
  .where(finalTrend.eq(2).and(MTDIcode.eq(2)),3) // T 0 MTDI+
  .where(finalTrend.eq(3).and(MTDIcode.eq(1)),3) // T+ MTDI-
  .where(finalTrend.eq(3).and(MTDIcode.eq(2)),4) // T+ MTDI+
  //.where(waterMask.eq(1),0);
```

02 SUB-INDICATORS: STATE (GPP Change)

Baseline: 15 years

1



2

Locate the position of this values

Time 1: Mean of First 4 years

Time 2: Mean of last 4 years

3

Threshold is a percentile jump lager than 2 positions:

Class 1: Negative – Time 2 more than 2p **Lower** than Time 1
Class 2: Neutral – percentile jump less than 2
Class 3: Positive – Time 2 more than 2p **Higher** than Time 1

02 SUB-INDICATORS: INITIAL BIOMASS

NDVI of 3 first years
3 CATEGORIES

Higher RESILIENCE in areas with higher levels biomass

Low : < 0.4
Medium: 0.4 – 0.7
High: > 0.7

Each country can change these parameters using for example their mean and the SD

03 CATEGORIZATION:

Steadiness (ST)	ST1 (T-/MTID-)			ST2 (T-/MTID+) (T0/MTID-)			ST3 (T0/MTID+) (T+/MTID-)			ST4 (T+/MTID+)		
Initial mean biomass low/medium/high	L	M	H	L	M	H	L	M	H	L	M	H
GPP change (negative -, neutral n, positive +	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+
Tabulation and labelling of above variables.	1 ST1/ L/-	2 ST1/ M/-	3 ST1/ H/-	10 ST2/ L/-	11 ST2/ M/-	12 ST2/ H/-	19 ST3/ L/-	20 ST3/ M/-	21 ST3/ H/-	28 ST4/ L/-	29 ST4/ M/-	30 ST4/ H/-
Assignment of 36 sub-classes to final 5 LPD classes	4 ST1/ L/n	5 ST1/ M/n	6 ST1/ H/n	13 ST2/ L/n	14 ST2/ M/n	15 ST2/ H/n	22 ST3/ L/n	23 ST3/ M/n	24 ST3/ H/n	31 ST4/ L/n	32 ST4/ M/n	33 ST4/ H/n
	7 ST1/ L/+	8 St1/ M/+	9 ST1/ H/+	16 ST2/ L/+	17 ST2/ M/+	18 ST2/ H/+	25 ST3/ L/+	26 ST3/ M/+	27 ST3/ H/+	34 ST4/ L/+	35 ST4/ M/+	36 ST4/ H/+

```
////-------------------------------------------------------------------------
//// Calculate steadiness
//-------------------------------------------------------------------------
// Calculate the 4 value steadiness index  based on the a combination of Mann
//where MTDI helps when there is no significance

var steadiness = ee.Image(0)
  .where(finalTrend.eq(1).and(MTDIcode.eq(1)),1) // T- MTDI-
  .where(finalTrend.eq(1).and(MTDIcode.eq(2)),2) // T- MTDI+
  .where(finalTrend.eq(2).and(MTDIcode.eq(1)),2) // T 0 MTDI-
  .where(finalTrend.eq(2).and(MTDIcode.eq(2)),3) // T 0 MTDI+
  .where(finalTrend.eq(3).and(MTDIcode.eq(1)),3) // T+ MTDI-
  .where(finalTrend.eq(3).and(MTDIcode.eq(2)),4) // T+ MTDI+
  //.where(waterMask.eq(1),0);
```

LPD Class	LPD 1 (declining)	LPD 2 (slightly declining)	LPD 3 (stable but stressed)	LPD 4 (stable)	LPD 5 (increasing)
Range of Labels included	1-8	9-14	15-22	23-32	33-36

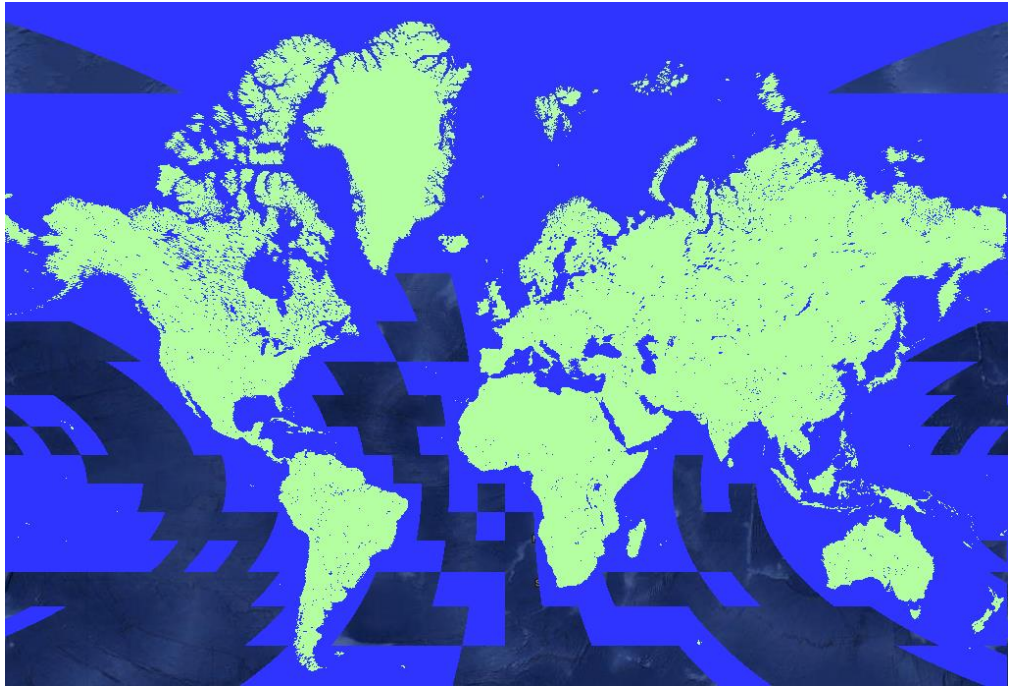
04 MASKS: WATER MASK

250m Yearly MOD44W Land/Water time series

If water is present in a pixel for more than 12 years

Permanent Water

NoData



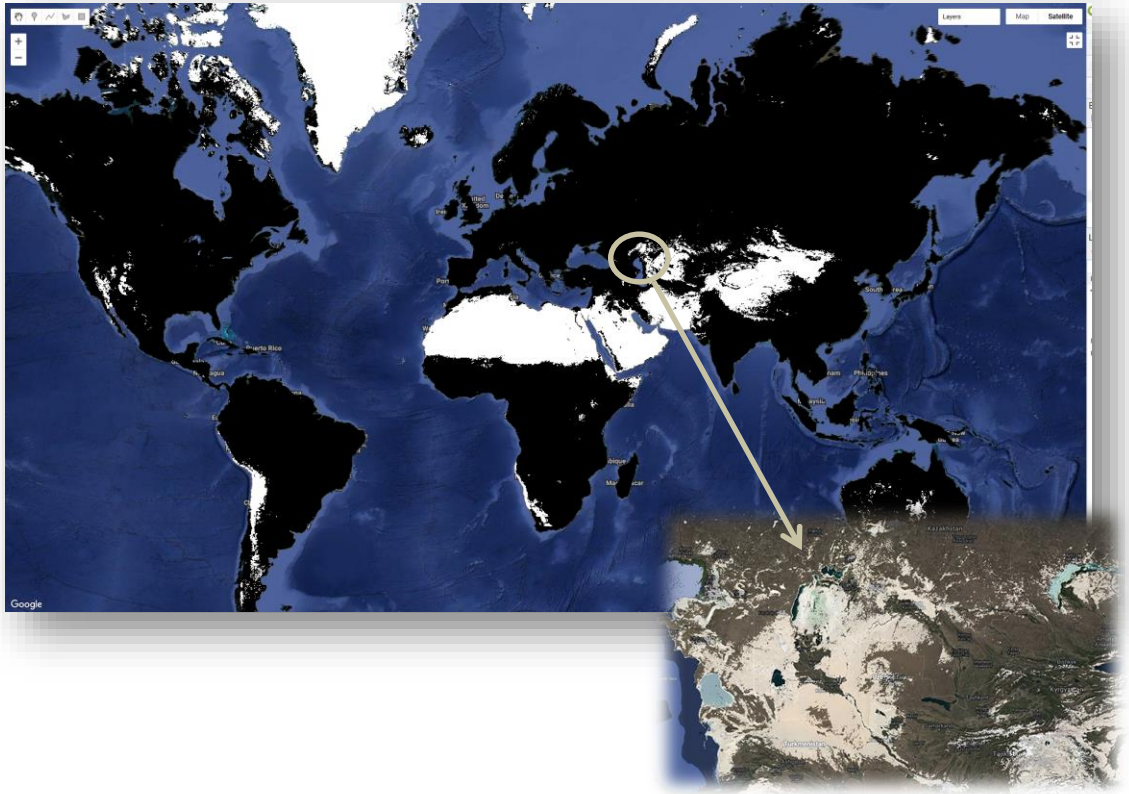
04 MASKS: DESERTS

16-days NDVI time series

If NDVI is always below 0.25

Masked as desert

STABLE



WHERE HAS IT BEEN USED/TESTED?

https://doi.org/10.4060/cb7986en

https://wocatapps.users.earthengine.app/

https://projectgeffao.users.earthengine.app/

01

REU-LDN Overview

Eastern Europe and Central Asia

02

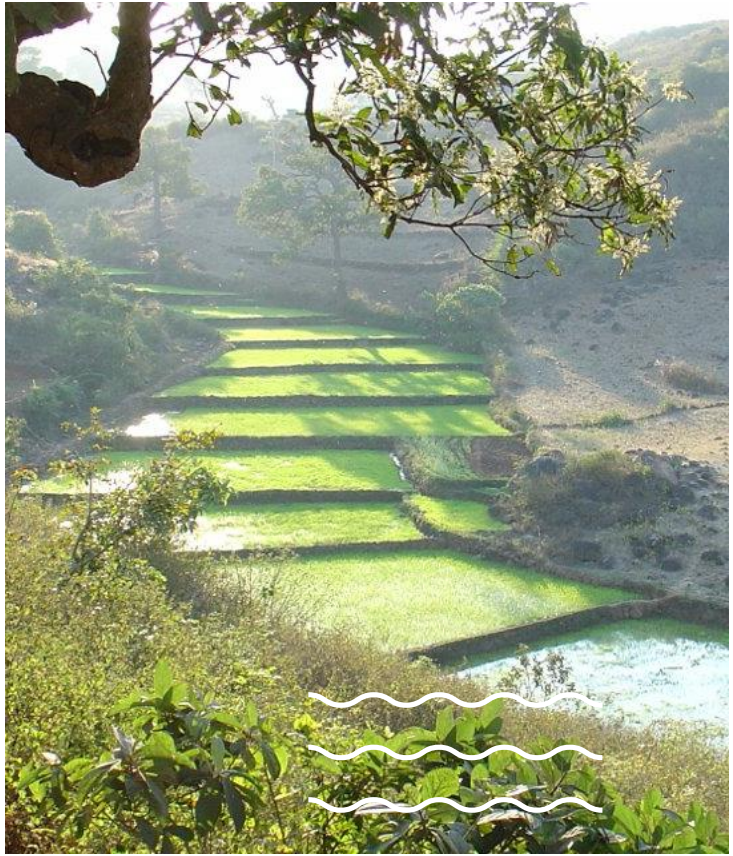
PROJECTS

Uruguay, Cabo Verde, Brasil, Kazakhstan, Colombia, Panamá, Madagascar, Sri Lanka, Ecuador, Turkey, Bosnia & Herzegovina, and more...

03

PRAIS4

Colombia, Panamá, Ecuador, Turkey, Bosnia & Herzegovina, Bhutan



THANKS!

For more info please contact

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