



Land Monitoring

Copernicus Global Land Cover complementary to Pan-European layers

Bruno Smets





Global Land Operations

Who am I ?



Platforms



UAV



AIRBORN

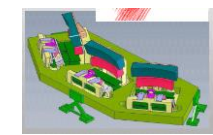
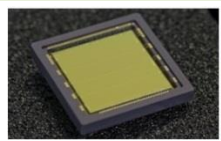


HALE UAV



SATELLITE

Sensors



Value Added Services & Information Products



Markets



Agriculture



Landuse & Biodiversity



Climate



Water & Coast



Infrastructure



Security



Global 100m dynamic land cover maps



Leaf Area Index
Fraction of Absorbed Photosynthetically Active Radiation (FAPAR)
Fraction of vegetation cover (FCOVER)
Normalized Difference Vegetation Index (NDVI)
Vegetation Condition Index
Vegetation Productivity Index
Dry Matter Productivity
Burnt Area
Greenness Evolution Index
Phenology metrics
Moderate Yearly Land Cover

A systematic SERVICE providing a
DYNAMIC, YEARLY, USER- ORIENTED, GLOBAL
Land Cover map @ 100m resolution
from 2015 onwards

- Complementary to
the Ad-Hoc HOT-SPOT (Protected zones) Service
the PAN-EURO (Corine) Service
- Open and free product distribution
- Full validation of the product, incl. spatial accuracy

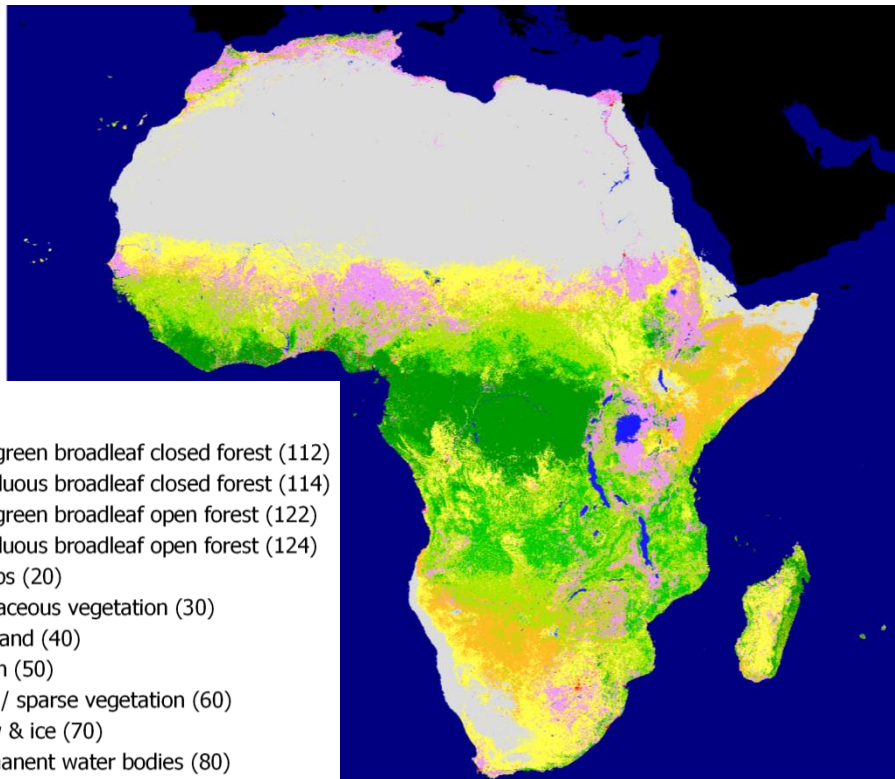


LC international communities

	Land cover types	Related land change processes	UNFCCC	UNCCD	OECD	SEEA/FAO	SDGs
1	Urban/built-up areas	Urbanization	✓	✓	✓	✓	✓
2	Cropland	Crop expansion	✓	✓	✓	✓	✓
3	Cropland and other vegetation	Land abandonment	✓	✓	✓	✓	✓
4	Forest	Deforestation	✓	✓	✓	✓	✓
5	Forest	Reforestation	✓	✓	✓	✓	✓
6	Wetland	Wetland degradation	✓	✓	✓	✓	✓
7	Water body	Expansion of water surface			✓	✓	✓
8	Water body	Reduction of water surface			✓	✓	✓
9	Bare areas	Desertification		✓	✓	✓	✓

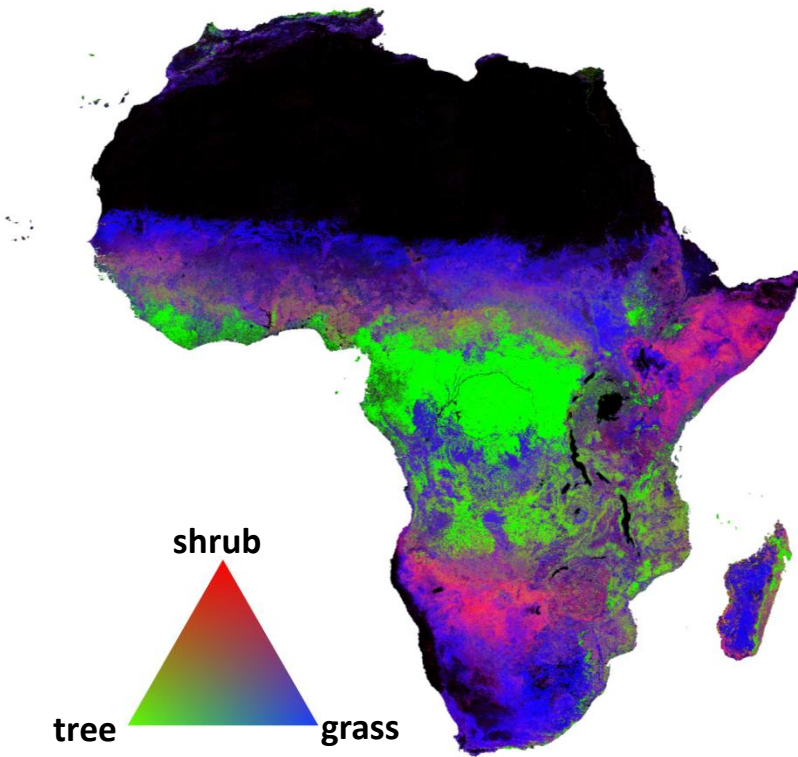
*Usefulness of information on land cover and land cover change processes for different international actions and programmes
(Source: CGLOPS land cover updated user assessment)*

Figure courtesy of M. Herold



Legend

- evergreen broadleaf closed forest (112)
- deciduous broadleaf closed forest (114)
- evergreen broadleaf open forest (122)
- deciduous broadleaf open forest (124)
- shrubs (20)
- herbaceous vegetation (30)
- cropland (40)
- urban (50)
- bare / sparse vegetation (60)
- snow & ice (70)
- permanent water bodies (80)
- temporary water bodies (81)
- herbaceous wetland (90)

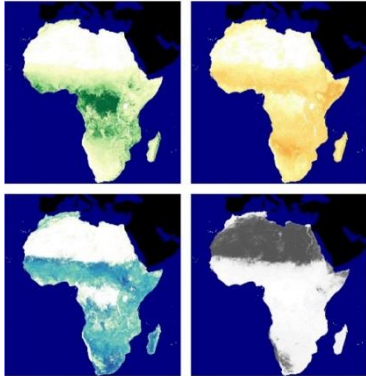




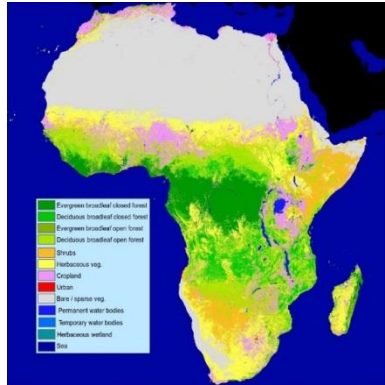
Global Land
Operations

Customize to your application

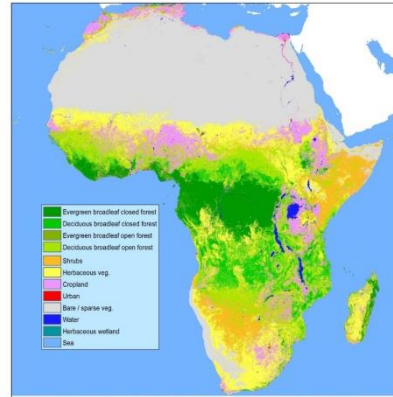
Fraction cover:
trees, shrubs, grass and bare



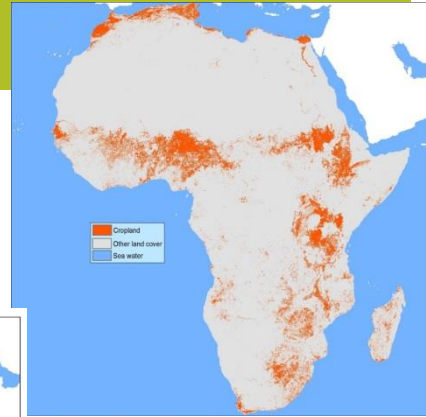
Discrete map



Biodiversity



Crop monitoring



Forest Monitoring

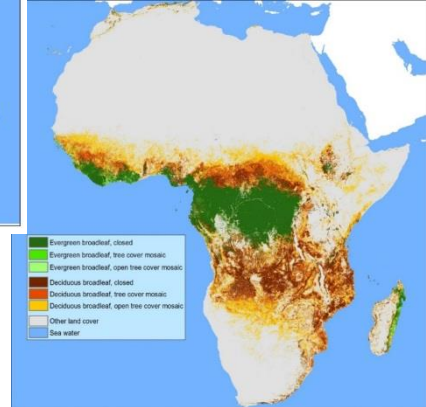


Figure courtesy
of N. Tsendbazar



LC100 custom example

USING REMOTE SENSING IN SUPPORT OF SOLUTIONS TO REDUCE AGRICULTURAL WATER PRODUCTIVITY GAPS

Project components:

1. Database
2. Water and land productivity assessment
3. Water accounting
4. Capacity development

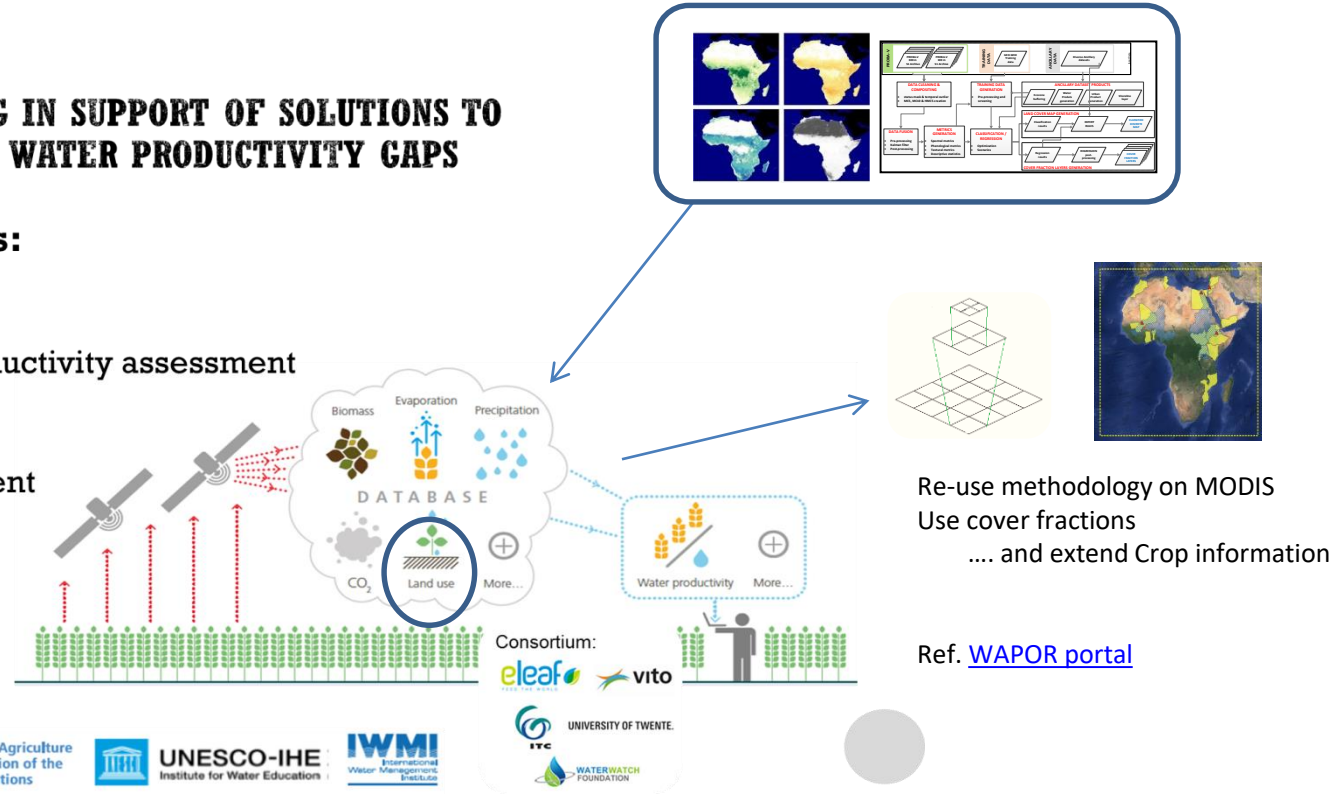


Figure courtesy of J. Hoogeveen



Global Land
Open

Validation

https://land.copernicus.eu/global/sites/cgls.vito.be/files/products/CGLOPS1_VR_LC100m-V1_I1.10.pdf

		Reference class									Correct proportion	Total proportion	User's accuracy	Confidence interval +/-
		Closed forest	Open forest	Shrubs	Herbaceous veg.	Croplands	Urban	Bare/Sparse veg.	Water	Wetland				
Mapped class	Closed forest	12.38	1.43	0.22	0.14	0.20	0	0	0.04	0.1	12.38	14.50	85.3	2.6
	Open forest	1.57	10.96	1.60	1.51	1.13	0	0.03	0.03	0.47	10.96	17.30	63.4	3.9
	Shrubs	0.08	1.61	4.04	0.75	0.39	0.03	0.08	0	0.06	4.04	7.04	57.3	6.1
	Herbaceous veg.	0.27	1.83	1.49	10.42	0.88	0.03	0.43	0.09	0.30	10.42	15.75	66.2	4.1
	Croplands	0.17	0.92	0.46	1.43	6.65	0.02	0.10	0.15	0.1	6.65	10.00	66.5	4.6
	Urban	0	0.03	0.002	0.03	0.005	0.17	0.001	0.001	0	0.17	0.25	70.4	5.7
	Bare/Sparse veg.	0	0.11	0.88	3.31	0.66	0	28.72	0.44	0	28.72	34.14	84.1	4.1
	Water	0	0.01	0.01	0.01	0.01	0	0.003	0.87	0.03	0.87	1	93.3	2.8
	Wetland	0	0.003	0	0.00	0.002	0.0003	0	0.01	0.07	0.07	0.09	78.0	5.1
Correct proportion		12.38	10.96	4.04	10.42	6.65	0.17	28.72	0.87	0.07	74.3			
Total proportion		14.47	16.91	8.70	17.61	9.92	0.26	29.36	1.63	1.12		100		
Producer's accuracy		85.5	64.8	46.4	59.2	67.0	67.6 (97.8) ¹	97.8	53.4 (84.8) ¹	6.0 (80.9) ¹		74.3	1.8	
Confidence interval +/-		2.8	3.2	5.3	4.5	5.2	24.8	0.9	15.2	1.8				

After area bias correction, the producer's accuracies of urban, water and wetland classes are decreased significantly. This is mainly due to confusions of a few sample sites in large-area classes such as herbaceous vegetation and bare sparse vegetation which carried larger area weighted errors. The producer's accuracy of these classes before area bias correction is shown in brackets.

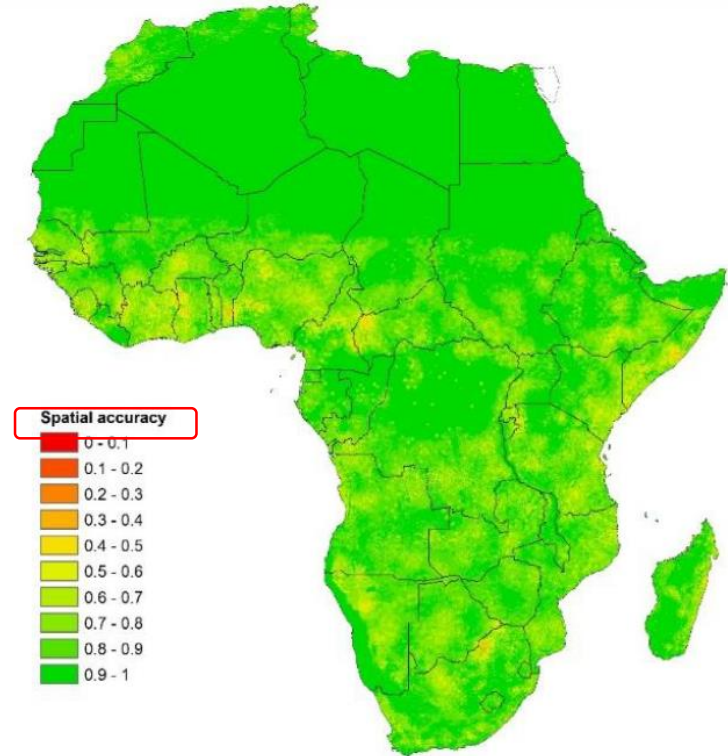
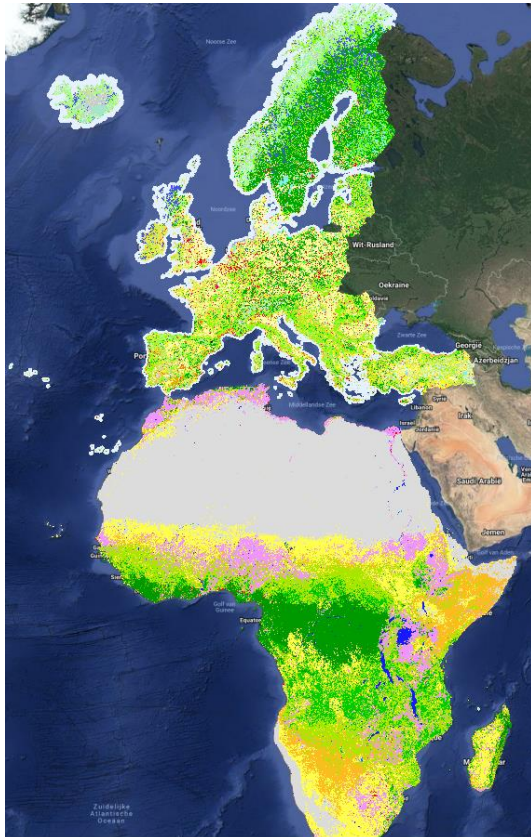


Figure courtesy of N. Tsendbazar



Looking outside Europe



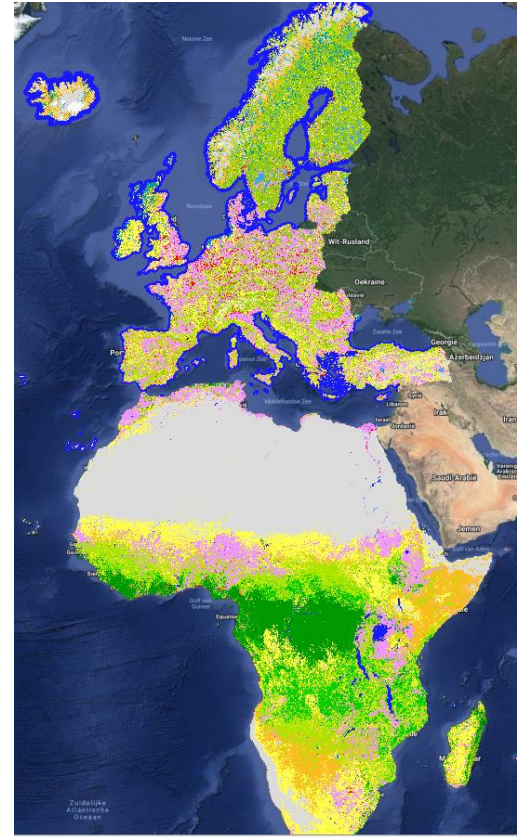
44 LC/LU classes

Corine land cover classes	
1. Artificial surfaces	2. Forest and semi-natural areas
1.1 Urban fabric	2.1 Forest
1.2 Suburban fabric	2.2 Broadleaved forest
1.3 Dispersed urban fabric	2.3 Coniferous forest
1.4 Industrial, commercial and transport sites	2.4 Mixed broadleaved and coniferous forest
1.5 Land in agricultural production	2.5 Pasture
1.6 Agricultural areas of high natural value	2.6 Herbaceous vegetation associations
1.7 Pasture of high natural value	2.7 Shrubland
1.8 Pasture of low natural value	2.8 Sclerophyllous vegetation
1.9 Pasture	2.9 Shrubland and sclerophyllous vegetation
1.10 Pasture	2.10 Open areas with little or no vegetation
1.11 Pasture	2.11 Open areas with little or no vegetation
1.12 Pasture	2.12 Bare soil
1.13 Pasture	2.13 Bare soil
1.14 Pasture	2.14 Bare soil
1.15 Pasture	2.15 Bare soil
1.16 Pasture	2.16 Bare soil
1.17 Pasture	2.17 Bare soil
1.18 Pasture	2.18 Bare soil
1.19 Pasture	2.19 Bare soil
1.20 Pasture	2.20 Bare soil
1.21 Pasture	2.21 Bare soil
1.22 Pasture	2.22 Bare soil
1.23 Pasture	2.23 Bare soil
1.24 Pasture	2.24 Bare soil
1.25 Pasture	2.25 Bare soil
1.26 Pasture	2.26 Bare soil
1.27 Pasture	2.27 Bare soil
1.28 Pasture	2.28 Bare soil
1.29 Pasture	2.29 Bare soil
1.30 Pasture	2.30 Bare soil
1.31 Pasture	2.31 Bare soil
1.32 Pasture	2.32 Bare soil
1.33 Pasture	2.33 Bare soil
1.34 Pasture	2.34 Bare soil
1.35 Pasture	2.35 Bare soil
1.36 Pasture	2.36 Bare soil
1.37 Pasture	2.37 Bare soil
1.38 Pasture	2.38 Bare soil
1.39 Pasture	2.39 Bare soil
1.40 Pasture	2.40 Bare soil
1.41 Pasture	2.41 Bare soil
1.42 Pasture	2.42 Bare soil
1.43 Pasture	2.43 Bare soil
1.44 Pasture	2.44 Bare soil
1.45 Pasture	2.45 Bare soil
1.46 Pasture	2.46 Bare soil
1.47 Pasture	2.47 Bare soil
1.48 Pasture	2.48 Bare soil
1.49 Pasture	2.49 Bare soil
1.50 Pasture	2.50 Bare soil

Collapse classes → tentative

Legend	
evergreen broadleaf closed forest (112)	112
deciduous broadleaf closed forest (114)	114
evergreen broadleaf open forest (122)	122
deciduous broadleaf open forest (124)	124
shrubs (20)	20
herbaceous vegetation (30)	30
cropland (40)	40
urban (50)	50
bare / sparse vegetation (60)	60
snow & ice (70)	70
permanent water bodies (80)	80
temporary water bodies (81)	81
herbaceous wetland (90)	90

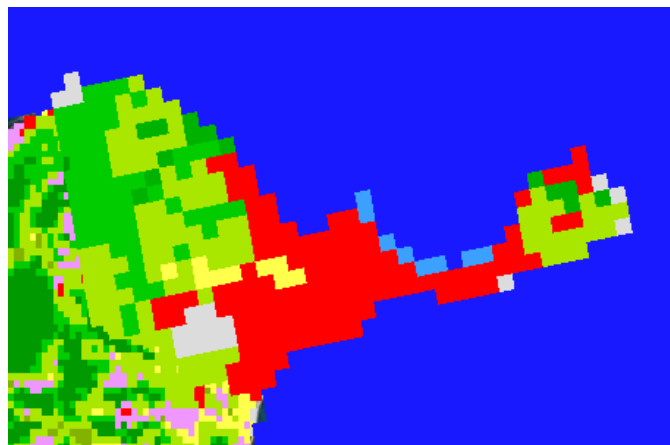
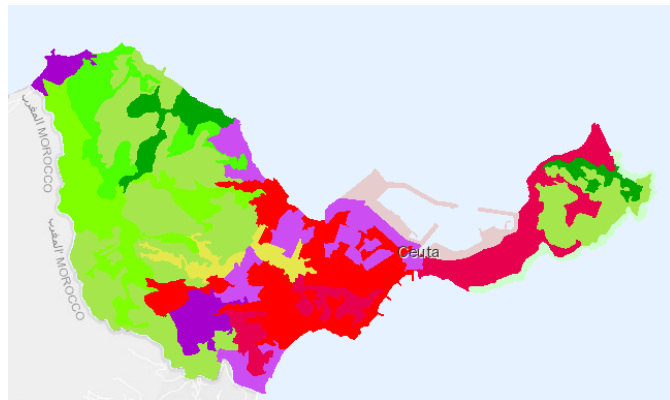
18 LC classes



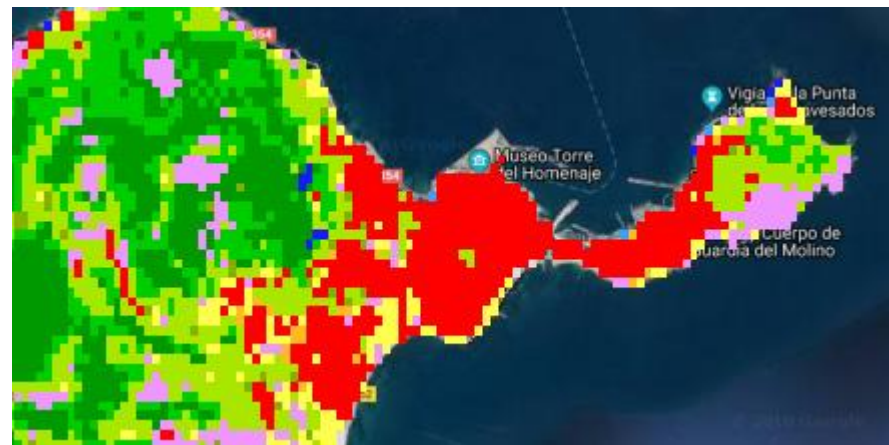


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Consistency – work in progress



CLC250 2012

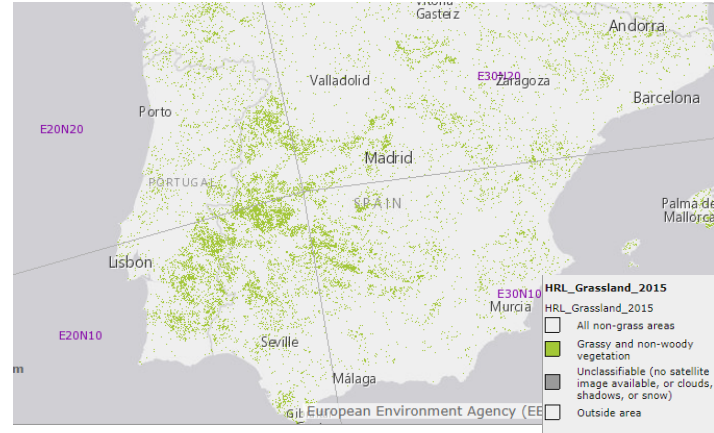
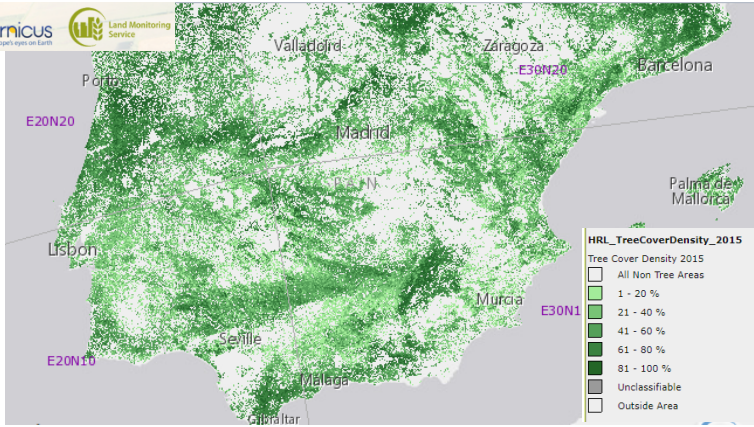


LC100 2015



Consistency – work in progress

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GEO Wiki **LAND-COVER**



LC100 Tree cover 2015



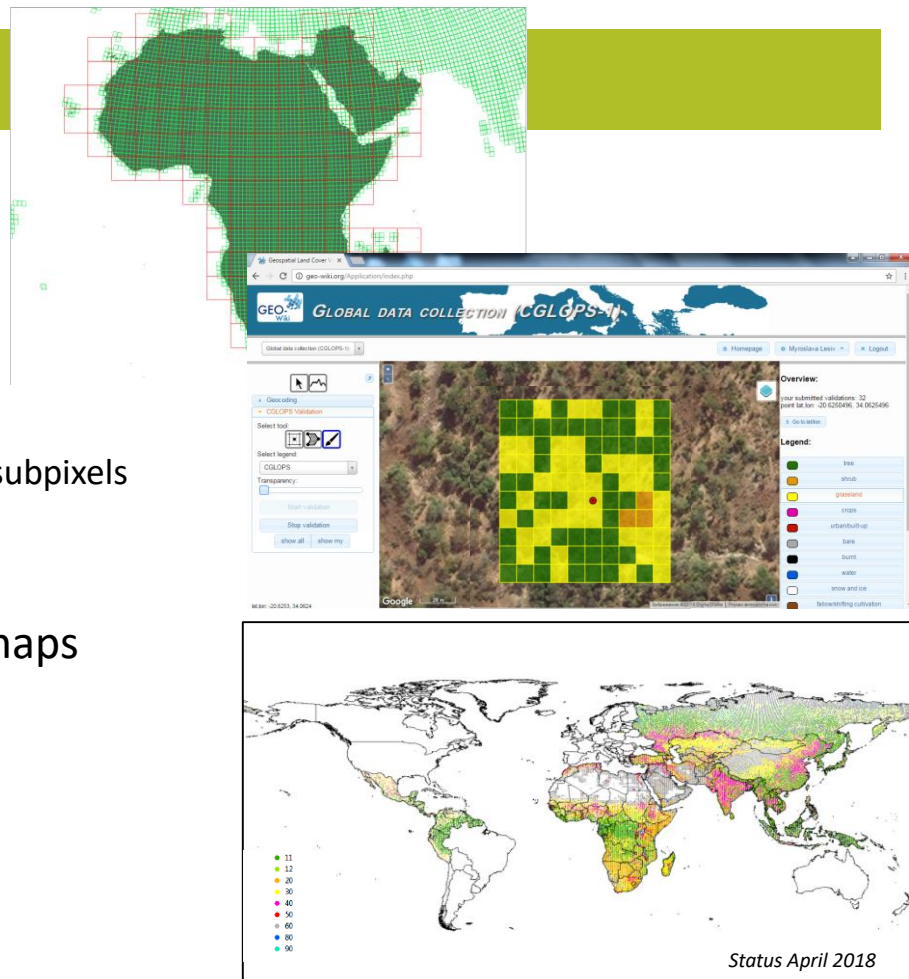
LC100 Grassland cover 2015





Next steps LC100

- UTM projection
 - Reduce distortions N. Hemisphere
 - Enable continuity
- Release Global 2015 reference map
 - Gather training/validation data 10x10m subpixels
 - Integrated phenology
 - Check consistency Pan-Euro
- Release Africa 2015 – 2016 – 2017 maps
 - Improved accuracies
 - Integrated change detection
- Regional 20m maps
 - Based Sentinel-2
 - Regions tbd (e.g. Sahel)



Status April 2018



Take away message

- **Global CLMS** biophysical parameters are used by NL
 - Includes 100m Land Cover map Africa 2015
 - With continuous cover fractions (1-100%) to customize ‘your map’
 - Fully validated with spatial accuracy map
- Ramping up **100m yearly Global Land Cover & Change** maps
 - Yearly updates (~4 months delay)
 - Classification at 100m and regional 20m
 - enabled by >100K training & > 20K validation points (each 10*10x10m)
 - Complementary to Pan-Euro layers
 - Corine remains reference in Europe
 - Provides ‘consistent’ ‘base’ information outside Europe

→ Check **<http://land.copernicus.eu/global>**



<https://2018.gstic.org/>



Geospatial data session

28 – 30 November 2018
Brussels