Session 2: Comparison of analysis of HRL grassland data with current HNV ‘map‘; review of satellite data opportunities

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ETC ULS

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European Topic Centre on Urban, Land and Soil Systems

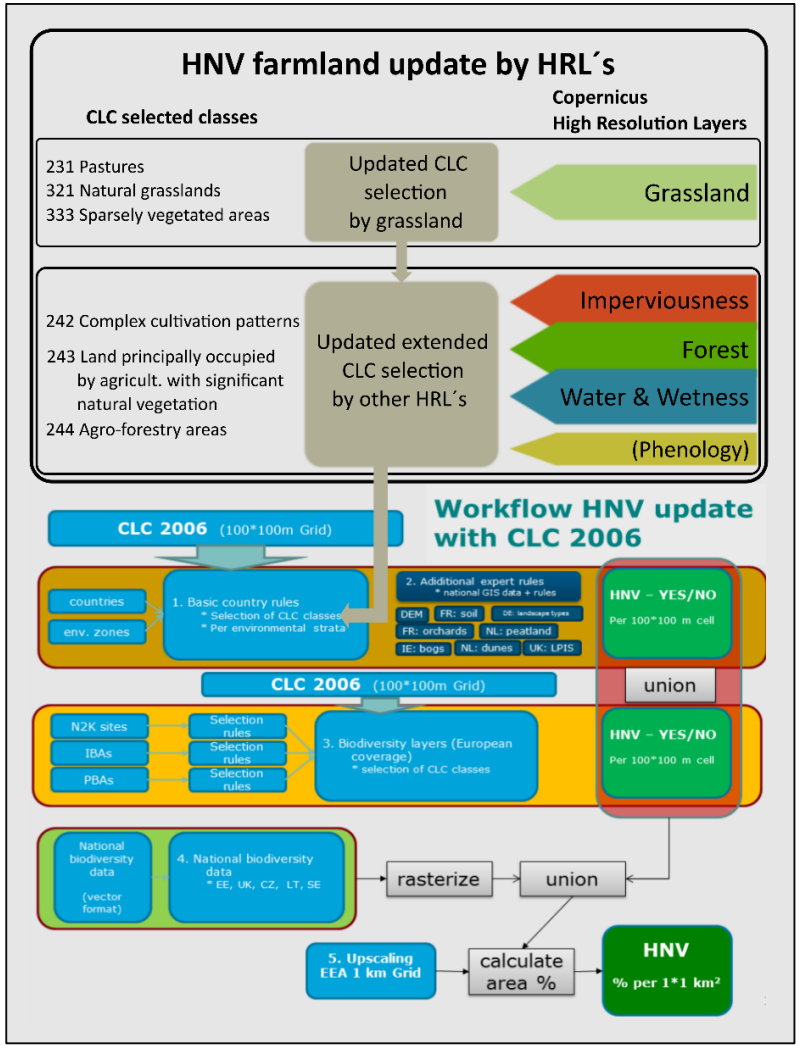
Contents

- Background
- HRLs in brief
- From concept … to implementation
- HRL vs. HNV - outcomes
- Copernicus *(and EO data)* potential - outlook
- Conclusions

Background

- Work done under ETC ULS AP2019 assignment
- Task 1.7.7.2 ‘HNV Farmland Indicator Update’
  - Consolidation of methodological options and recalculation of the JRC/EEA **HNV farmland** dataset
- Task 1.8.8.2 ‘Copernicus peri-urban and Grassland indicator proposals’
  - Based on the AP2018 results, first draft of grassland related indicators

HNV ‘map’ improvement concept using HRLs

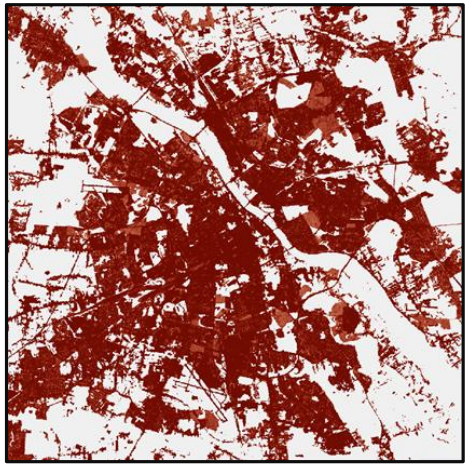


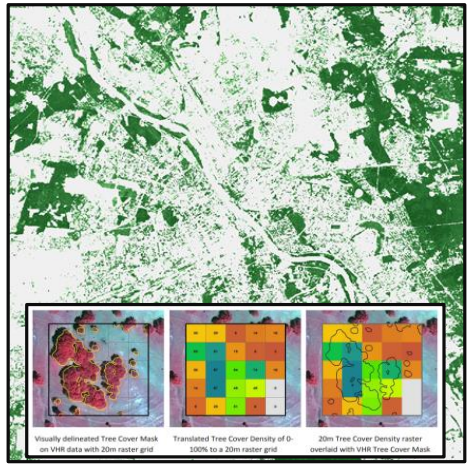
- Rationale
  - CLC is currently starting point for HNV ‘map’.
  - HRLs data are more detailed then CLC for covered land elements.
  - Is there potential for HNV ‘map’ improvement (with special focus on HRL Grassland)?
- Theoretical concept based on
  - subtraction (-) - some areas are excluded from current HNV ‘map’ based on HRLs
  - addition (+) - some areas are added to current HNV ‘map’ based on HRLs

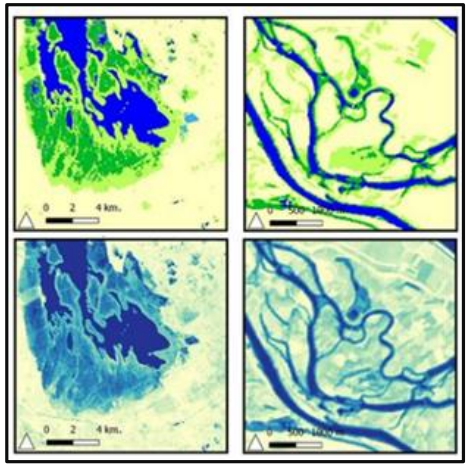
HRLs briefly

Europe-wide (EEA39) data, 100m (20m)

- ***HRL Imperviousness*** *(Soil Sealing) products: capture the percentage of soil sealing*
- ***HLR Forest****: capture the percentage of the canopy coverage of trees (forests)*
- ***HRL Water and Wetness****: product showing the occurrence of water and wet surfaces over the period from 2009 to 2015*
- ***HRL Grassland****: the main product is a binary grassland/non-grassland mask that is supposed to include the full spectrum of grassland use intensity (from natural to managed grasslands)*







HRLs 2015 at a glance

Lot	Topic	Products	Input imagery
1	**Imperviousness**	▪ Imperviousness density (IMD) ▪ Imperviousness density change (IMC) ▪ Imperviousness density change classified (IMCC)	Multi-temporal HR and VHR for calibration
2	**Forest**	▪ Tree Cover Density (TCD) ▪ Dominant Leaf Type (DLT) ▪ Forest type (FTY) ▪ Tree Cover density change (TCDC) ▪ Leaf Type change (DLTC) – Experimental Product	Multi-temporal HR and VHR for calibration
3	**Grassland**	▪ Grassland (GRA) ▪ Grassland Vegetation Probability Index (GRAVPI) - Expert Product ▪ Ploughing Indicator (PLOUGH) – Expert Product	Multi-temporal HR and VHR for calibration + SAR (S1)

4	**Water and Wetness**	▪ Wetness and water (WAW) in 4 classes:
		  ▪ Permanent water
		  ▪ Temporary water
		  ▪ Permanent wet
		  ▪ Temporary wet
		▪ Water & Wetness Probability Index (WWPI)– Expert Product
			Multi-temporal HR and VHR for calibration + SAR

5	***Small Woody Features (SWF)***	▪ *Small woody features SWF (vector, 5m and 100m raster)*	*VHR IMAGE 2015*

HRLs profiles in current HNV ‘map’

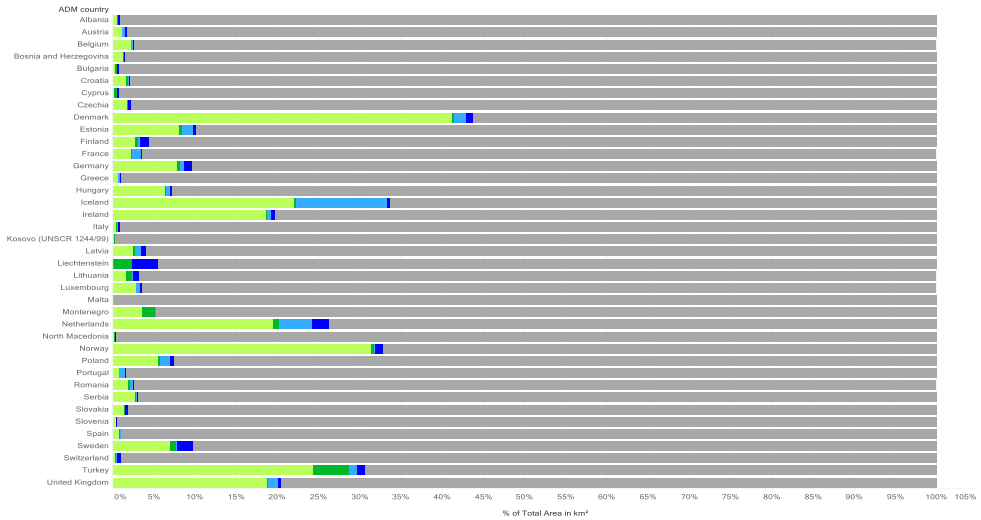
- Additional composition of overlapping areas was calculated, to target the LC structure within each strata (HNV/HRLs), utilizing the CORINE LC database. (The shares of CORINE Level 3 classes are used)

- The LC composition may indicate relevancy of each HRL strata
- The structure can be used for further stratification (to include or exclude appropriate areas)
- Roughly describes wider context (pure class as Forest or mixed class as Complex cultivation pattern)

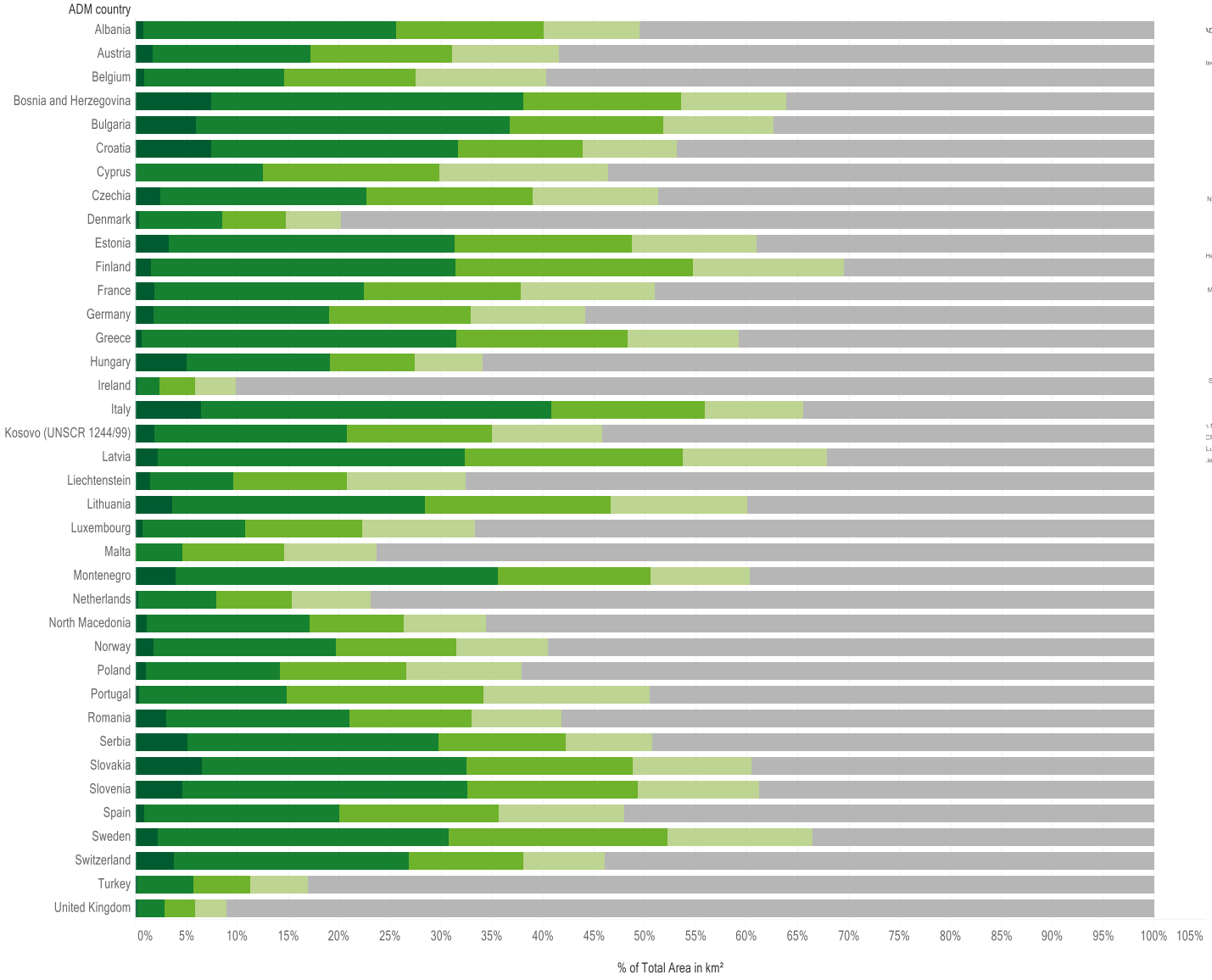
Analysis of HRL data with current HNV ‘map

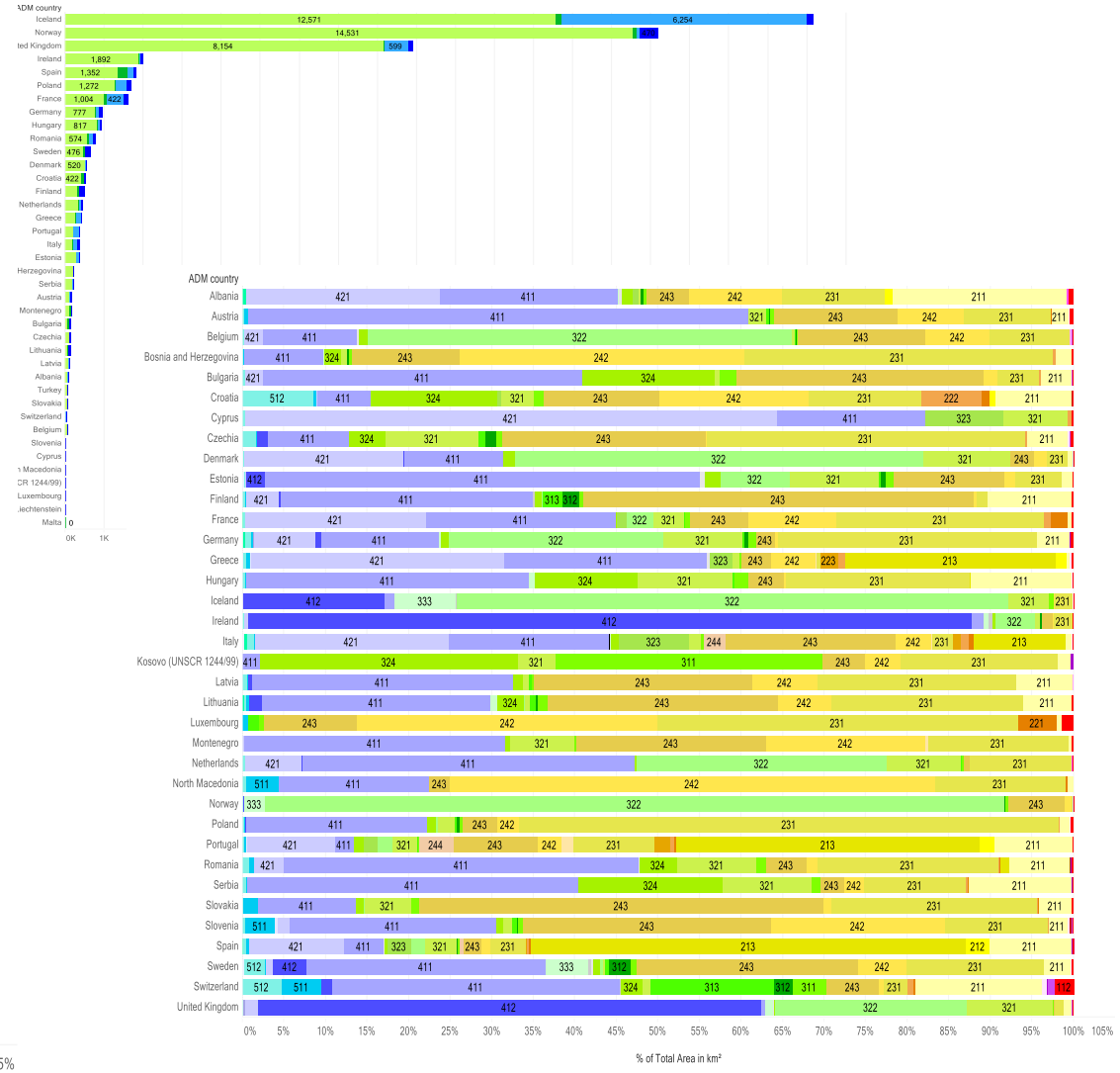
- Assessment and update of all available HRL layers (ref. Year 2012/2015)
- Assessment and update of ancillary layers (elevation data, environmental zones)
- Spatial overlay of HNV and HRL (utilizing JEDI and Tableau platform)
- Consideration of various data types (Continuous vs. Categorical, definition of density classes for complexity reduction etc.)
- Definition and elaboration of relevant thematic concepts for update outlined as:

  - HRL Water&Wetness
    - Exclusion (Permanent Waters)
    - Inclusion HRL W&W and HRL Grassland
  - HRL Forest (Tree Cover Density)
    - Exclusion (Forest)
    - Tree Cover Density structure for heterogeneous CLC classes
  - HRL Grassland
    - Possible inclusion candidates evaluation



Analysis

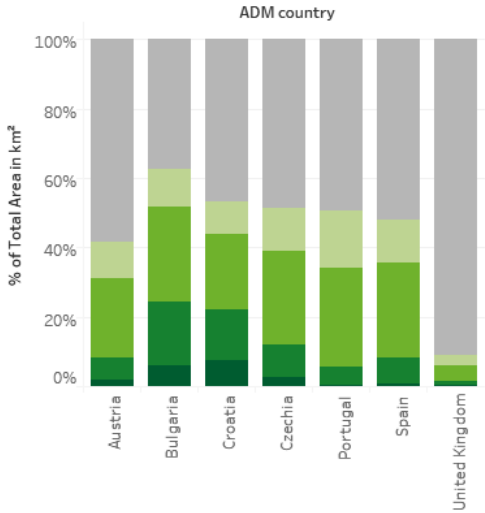

ADM country
Albania
Austria
Belgium
Bosnia and Herzegovina
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Kosovo (UNSCR 1244/99)
Latvia
Liechtenstein
Lithuania
Luxembourg
Malta
Montenegro
Netherlands
North Macedonia
Norway
Poland
Portugal
Romania
Serbia
Slovakia
Slovenia
Spain
Sweden
Switzerland
Turkey
United Kingdom
0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50% 55% 60% 65% 70% 75% 80% 85% 90% 95% 100% 105%
% of Total Area in km²


ADM country
Iceland 12,571 6,254
Norway 14,531
ted Kingdom 8,154 599
Ireland 1,892
Spain 1,352
Poland 1,272
France 1,004 422
Germany 777
Hungary 817
Romania 574
Sweden 476
Denmark 520
Croatia 422
Finland
Netherlands
Greece
Portugal
Italy
Estonia
Herzegovina
Serbia
Austria
Montenegro
Bulgaria
Czechia
Lithuania
Latvia
Albania
Turkey
Slovakia
Switzerland
Belgium
Slovenia
Cyprus
n Macedonia
CR 1244/99)
Luxembourg
.iechtenstein
Malta 0
0K 1K
ADM country
Albania
Austria
Belgium
Bosnia and Herzegovina
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Kosovo (UNSCR 1244/99)
Latvia
Lithuania
Luxembourg
Montenegro
Netherlands
North Macedonia
Norway
Poland
Portugal
Romania
Serbia
Slovakia
Slovenia
Spain
Sweden
Switzerland
United Kingdom
0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50% 55% 60% 65% 70% 75% 80% 85% 90% 95% 100% 105%
% of Total Area in km²

Analysis

Country level - Structure of TCD inside current HNV layer (CLC, HRL)

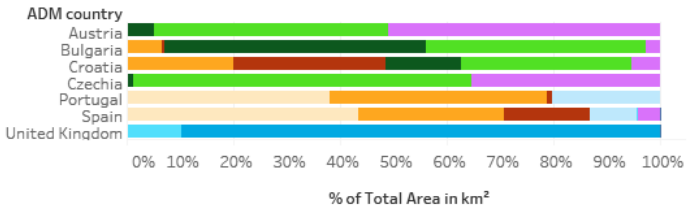
Tree Cover Density structure



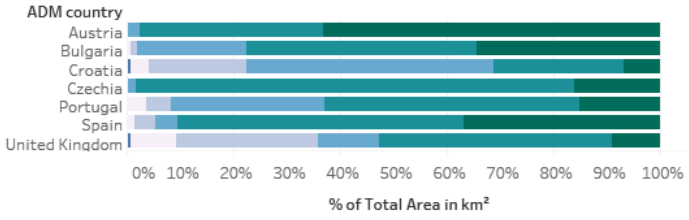
Total area (km2) - per country and CLC class

ADM country	CLC level3 c..	TCD Density Class: no TCD	TCD High D..	TCD Mediu..	TCD Low De..	TCD Lowest ..
Austria	111	0		0	0	0
	112	85	1	5	33	24
	121	4	0	0	2	2
	122	0	0	1	2	0
	123	0			0	0
	124	0				
	131	2	0	0	1	1
	132	0	0	0	0	
	133	0			0	0
	141	0		0	0	0
	142	44	0	4	16	7
	211	239	3	11	63	38
	221	321	1	4	29	21
	222	3		0	0	0
	231	3,328	92	466	1,877	902
	242	2,141	27	153	791	445
	243	698	119	316	772	285

Environmental zones stratification



Elevation stratification



ADM country
(Multiple values)

CLC level3 code
(All)

Elevation
- Mountains
- Uplands
- Inlands
- High Coasts
- Low coasts
- Null

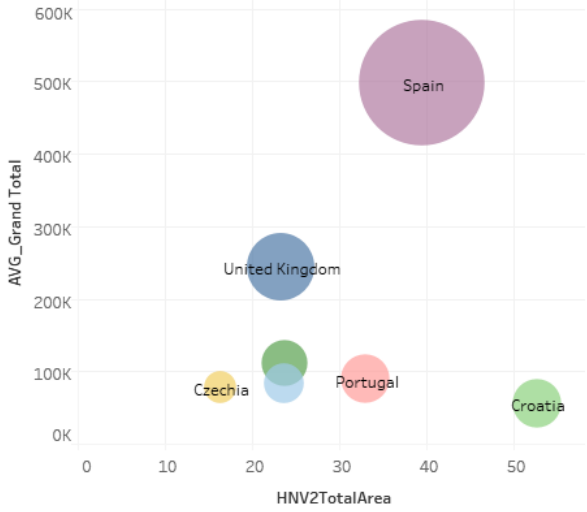
TCD Density Class
- no TCD
- TCD Lowest Density
- TCD Low Density
- TCD Medium Density
- TCD High Density

Category ENV Z
- Null
- ATN (4)
- ALS (5)
- CONT (6)
- ATC (7)
- PAN (8)
- LUS (9)
- MDM (11)
- MDN (12)
- MDS (13)

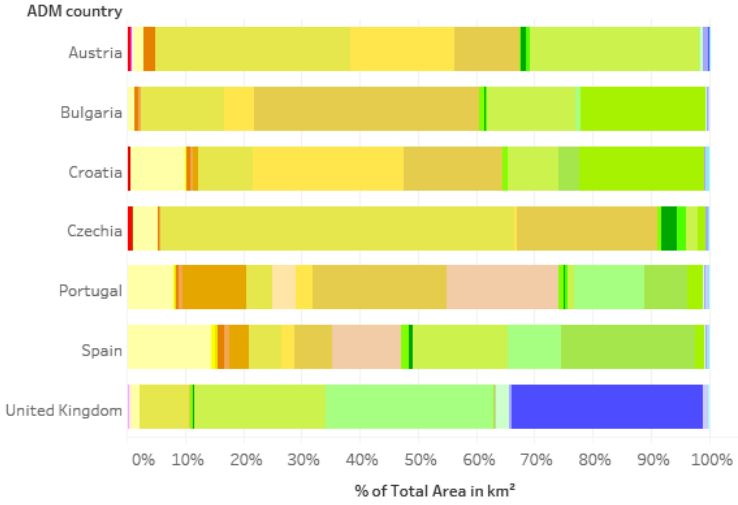
ADM country
- Austria
- Bulgaria
- Croatia
- Czechia
- Portugal
- Spain
- United Kingdom

Area in km²
12,878
50,000
100,000
150,000
196,793

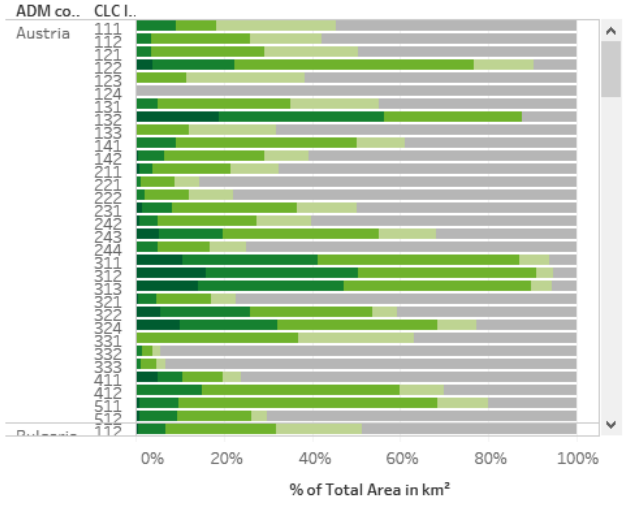
inHNV and Total area relation



Corine Land Cover composition



inHNV_sCLC_TCD_comp



Analysis

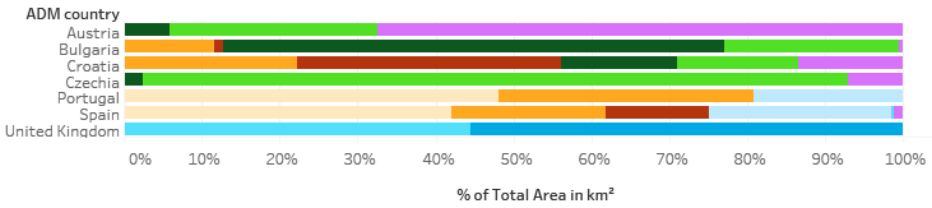
Country level - Structure of Grassland(HRL) outside current HNV layer (CLC, HRL)

Current HNV/noHNV share

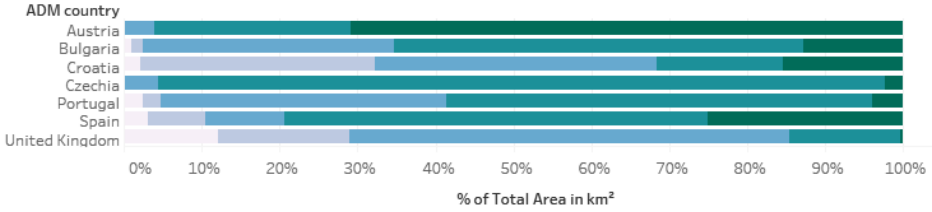
Total area (km2) - per country and CLC class

ADM country	CLC level3 c..	Category HRL G.. Grassland (1)
Austria	111	0
	112	297
	121	5
	122	1
	123	0
	124	10
	131	4
	132	1
	133	1
	141	7
	142	91
	211	833
	221	28
	222	0
	231	77
	242	17

Environmental zones stratification



Elevation stratification



ADM country
(Multiple values)

CLC level3 code
(Multiple values)

Value
- no HNV (0)
- HNV (1)

Area in km²
56,300
200,000
300,000
400,000
498,449

Category HRL GRASS
- No Grasland (0)
- Grassland (1)
- NoData (254)
- Outside Area (255)

Elevation
- Mountains
- Uplands
- Inlands
- High Coasts
- Low coasts

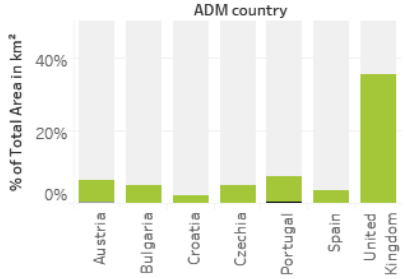
TCD Density Class
- no TCD
- TCD Lowest Densi..
- TCD Low Density
- TCD Medium Dens..
- TCD High Density

Category ENV Z
- ATN (4)
- ALS (5)
- CONT (6)
- ATC (7)
- PAN (8)

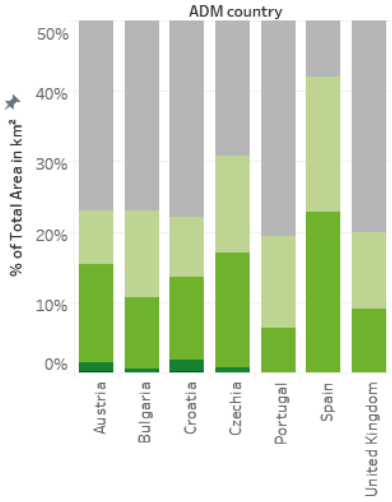
Category HRL Water
- NoData
- NoWater Wet
- Outside Area
- Permanent Water
- Permanent Wet a

Grassland outside current HNV

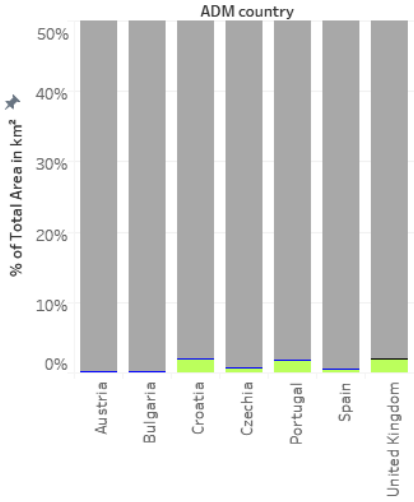
ADM country	Category HRL GRASS No Grasland (0)	Grassland (1)
Austria	60,086	3,804
Bulgaria	80,466	3,994
Croatia	26,007	599
Czechia	62,828	3,167
Portugal	55,126	4,239



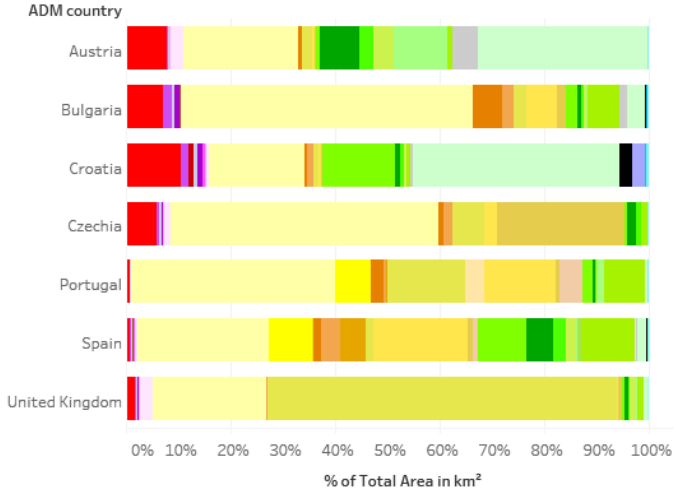
Tree Cover Density structure



Water& Wetness structure



Corine Land Cover composition



Results

- Summary table prepared comparing the most promising options for updating the JRC/EEA HNV farmland area estimate with the help of the different HRL data sets.

- For each case basic characteristics provided (total area, possible impact on current HNV), optimal threshold suggestion, suggested application/ommision

- Simple relevancy indicator included, with regard of overal impact (Negligible, Marginal, Significant)

Class	Share
Negligible	< 0.1%
Marginal	0.1 – 1%
Significant	> 1%

- Summary results are confronted (in progress) with HNV specialists

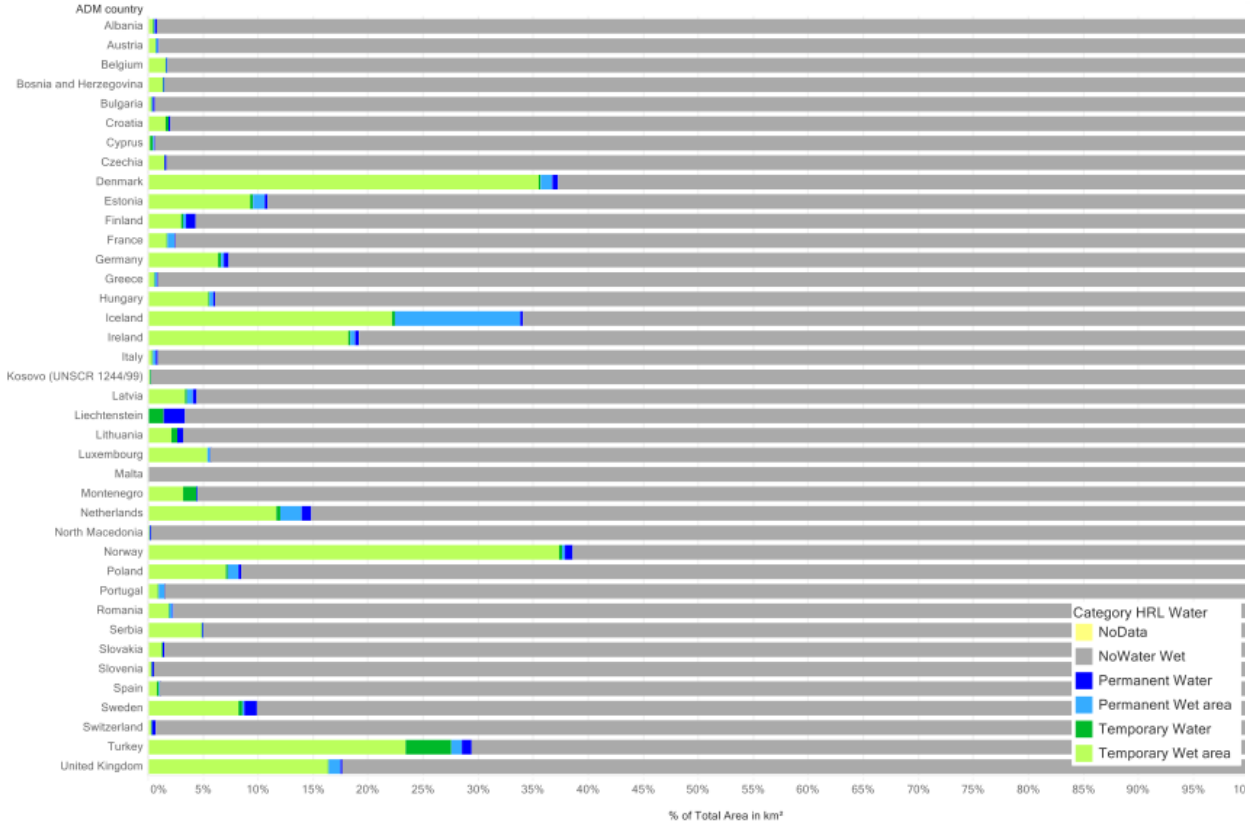
Results

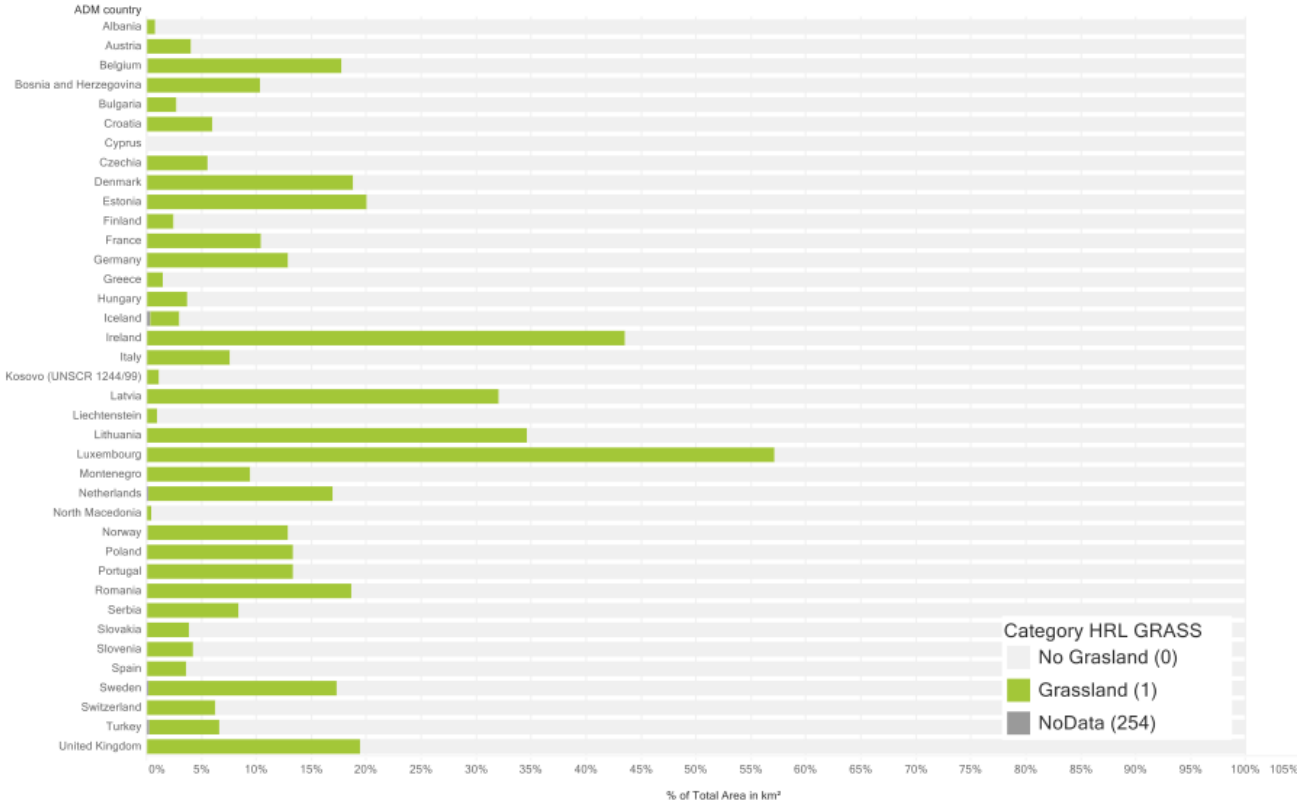
Update type	Relevant HRL's	HNV (in/out)	Relevant CLC classes	Conclusion/Relevance
Exclusion	Water&Wetness (Permanent Water) or Tree Cover Density > 30%	Inside	211, 213, 221, 222, 223, 333, 411, 412, 421	Mostly Negligible or Marginal ⇒ Pastures(231) FR, RO, PO, DE, AT… ⇒ Nat.Grassland (321) ES, FR, IT, RO, BG ⇒ Moors&Heathlands (322) NO, ES, FR, PT
Exclusion	Water&Wetness or Tree Cover Density > 50%	Inside	Mixed CLC classes 241, 242, 243	Significant ⇒ Land principally occupied by agriculture, with significant areas of natural vegetation(243) IT, NO, FR, BG, GR ⇒ Transitional woodland (324)
Inclusion	Water&Wetness (Temporary water) & Tree Cover Density < 30% & Grassland	Outside		Negligible - No particular inclusion is proposed

Results – *discussion* W&W

- **HRL Water & Wetness Exclusion**
  - Permanent Water - obviously exclusion candidate
  - Most relevant CLC: 242, 243, 321, 323, 324
  - Temporary Water – less likely candidates (mostly HNV relevant CLC classes as 322, 242…)

- **HRL Water & Wetness Inclusion**
  - Mostly negligible
  - Grassland + Temporary Water outside HNV – often CLC classes partly/not declared as HNV





Results – *discussion* W&W

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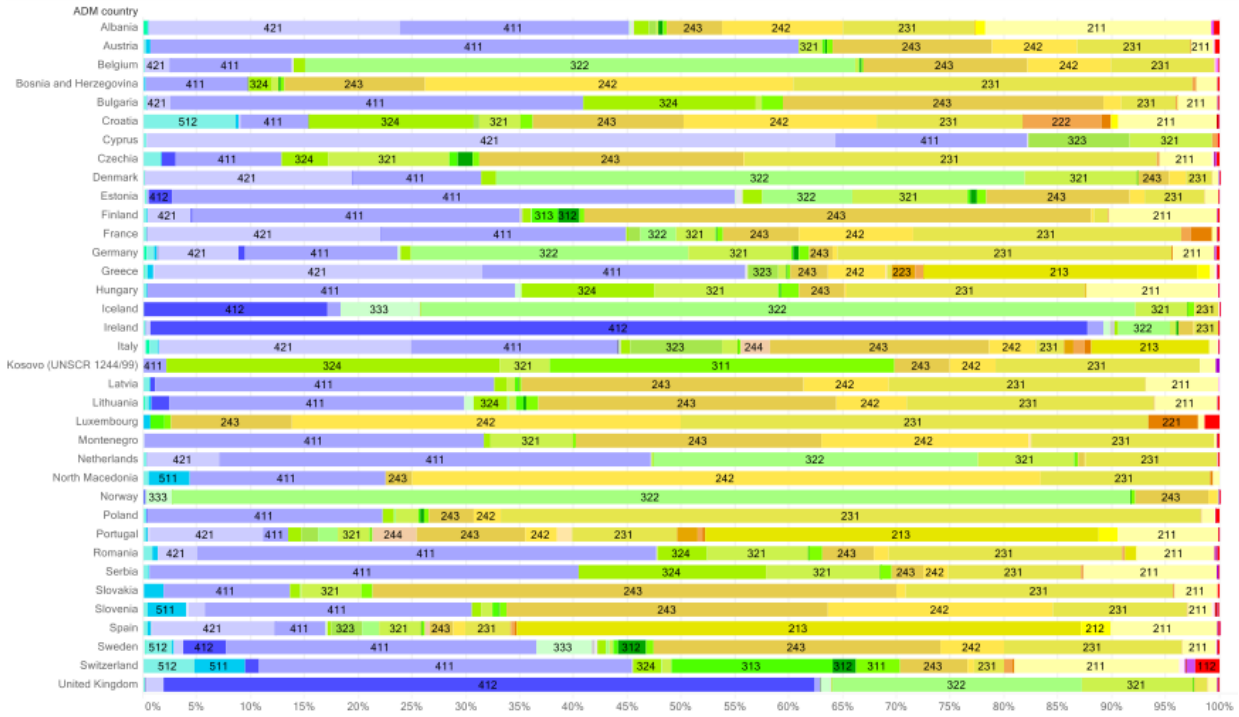
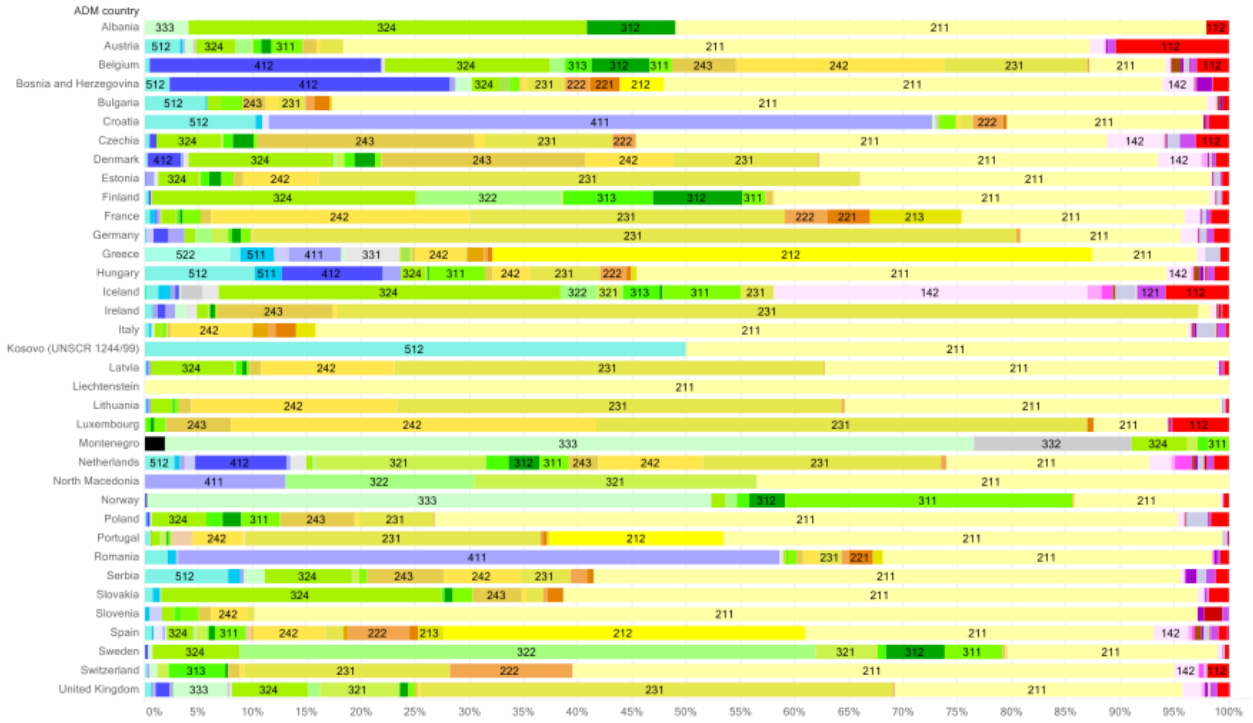
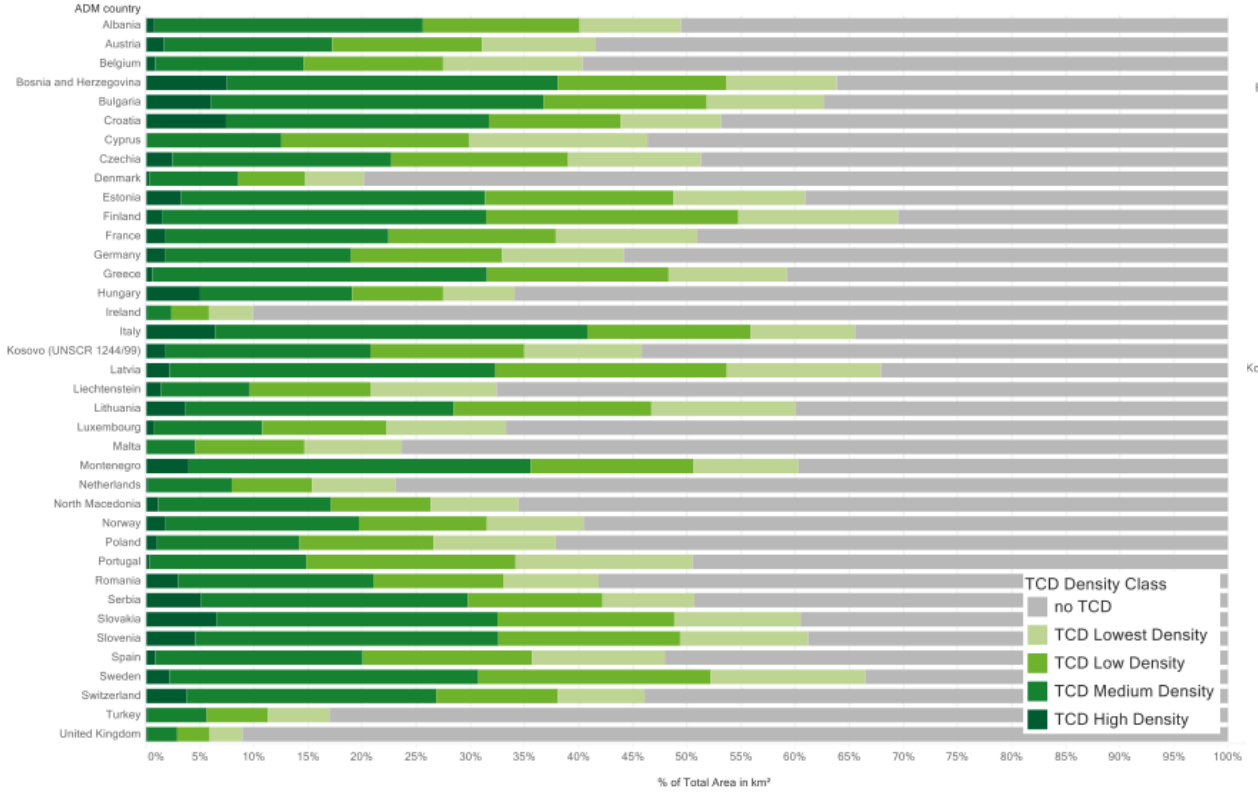
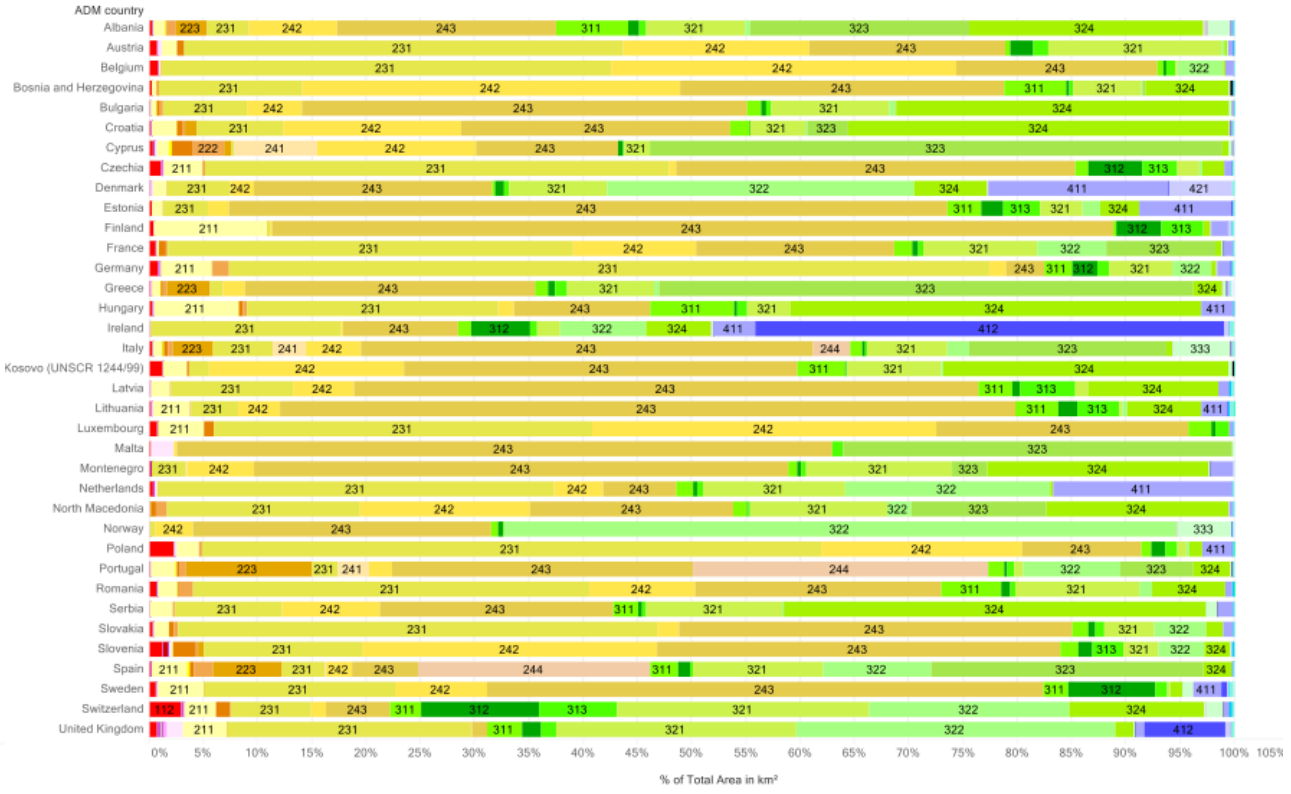




Results – *discussion* Forest TCD

- **HRL Forest TCD**
  - Large areas of HNV – high TCD cover
  - Mostly CLC 24* and 32*
- **HRL Forest TCD & Grassland Inclusion**
  - Considered TCD < 30% & Grassland outside HNV
  - Mostly negligible

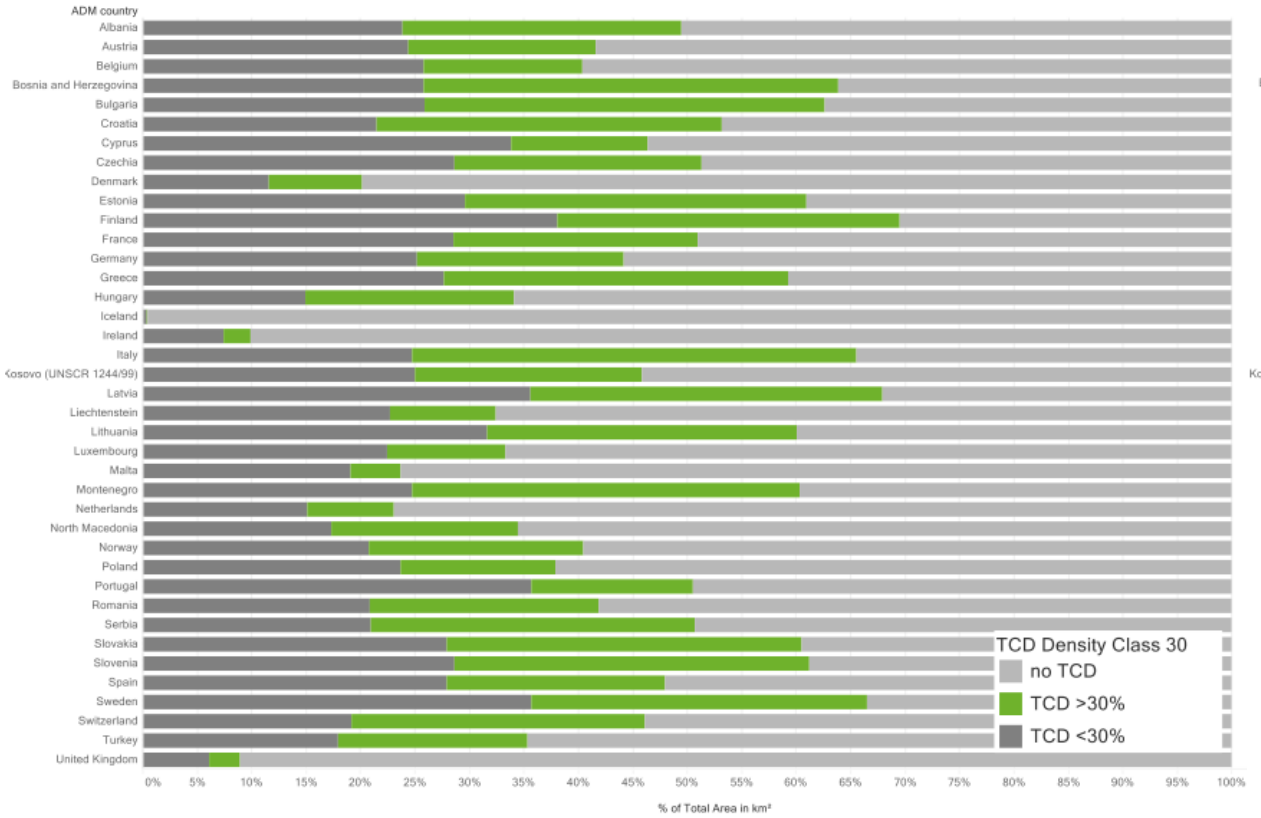




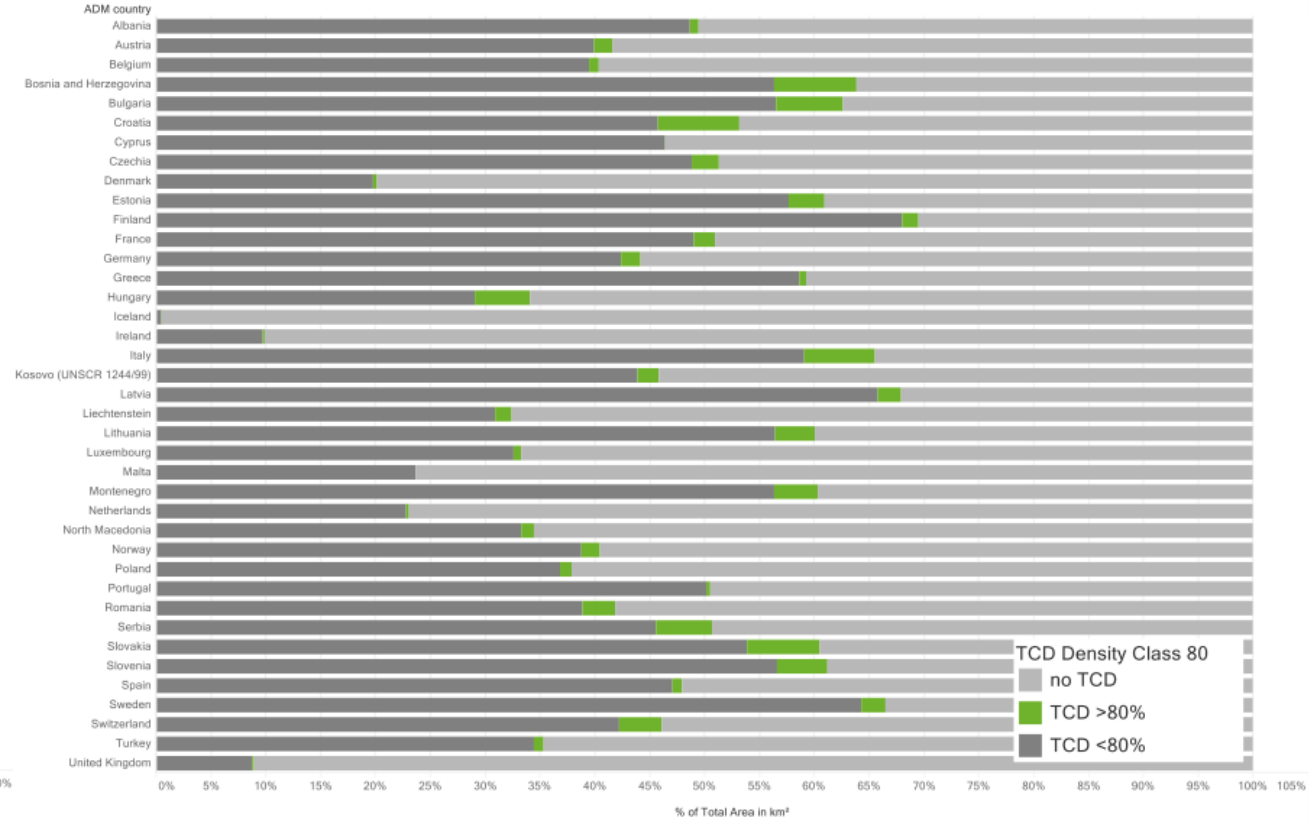
Results – *discussion* Forest TCD

Comparison of HRL Forest – Tree Cover Density threshold , inside HNV map TCD 30% (left) and 80% (right)

30%



80%

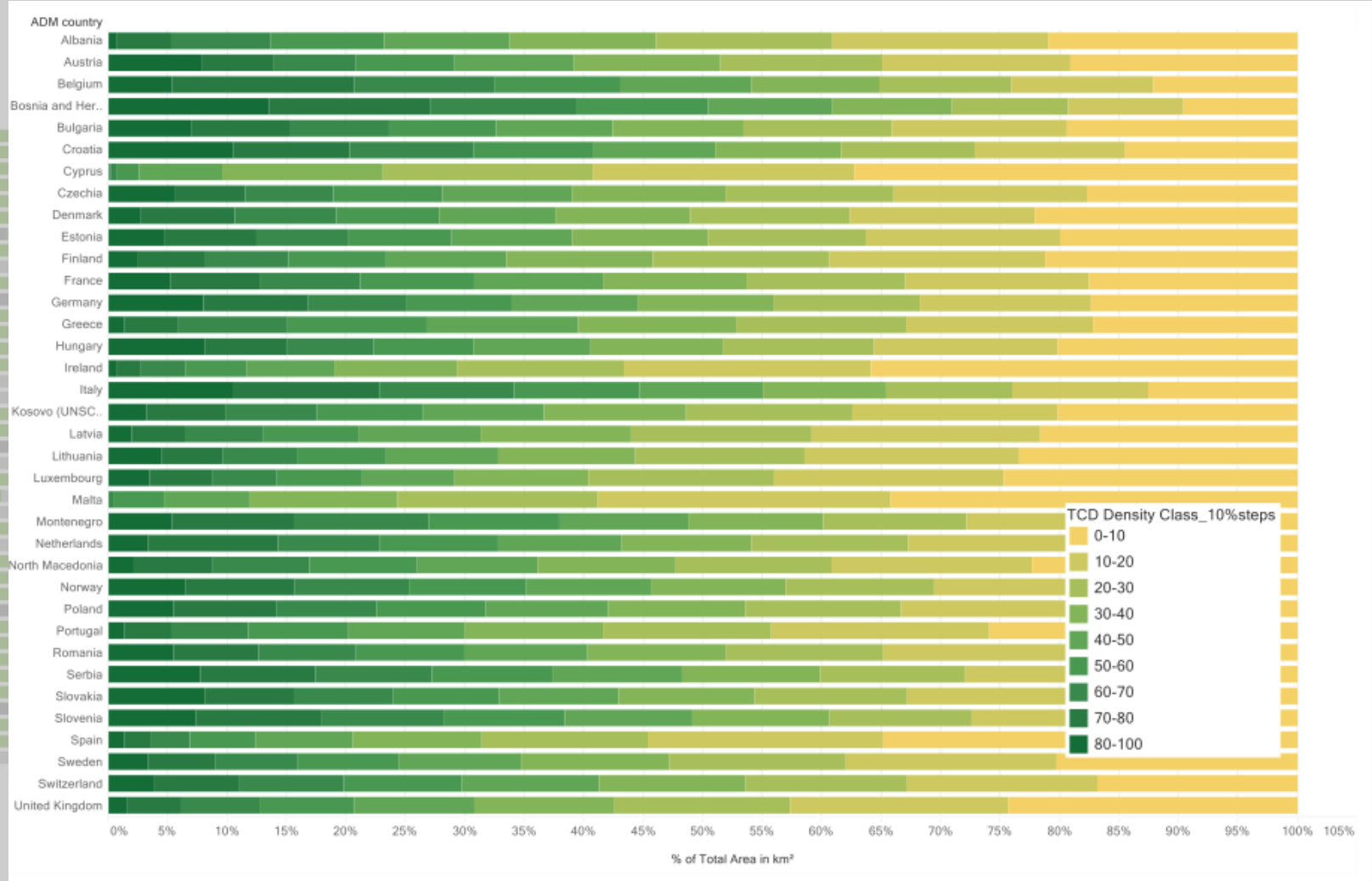


Results – *discussion* Forest TCD

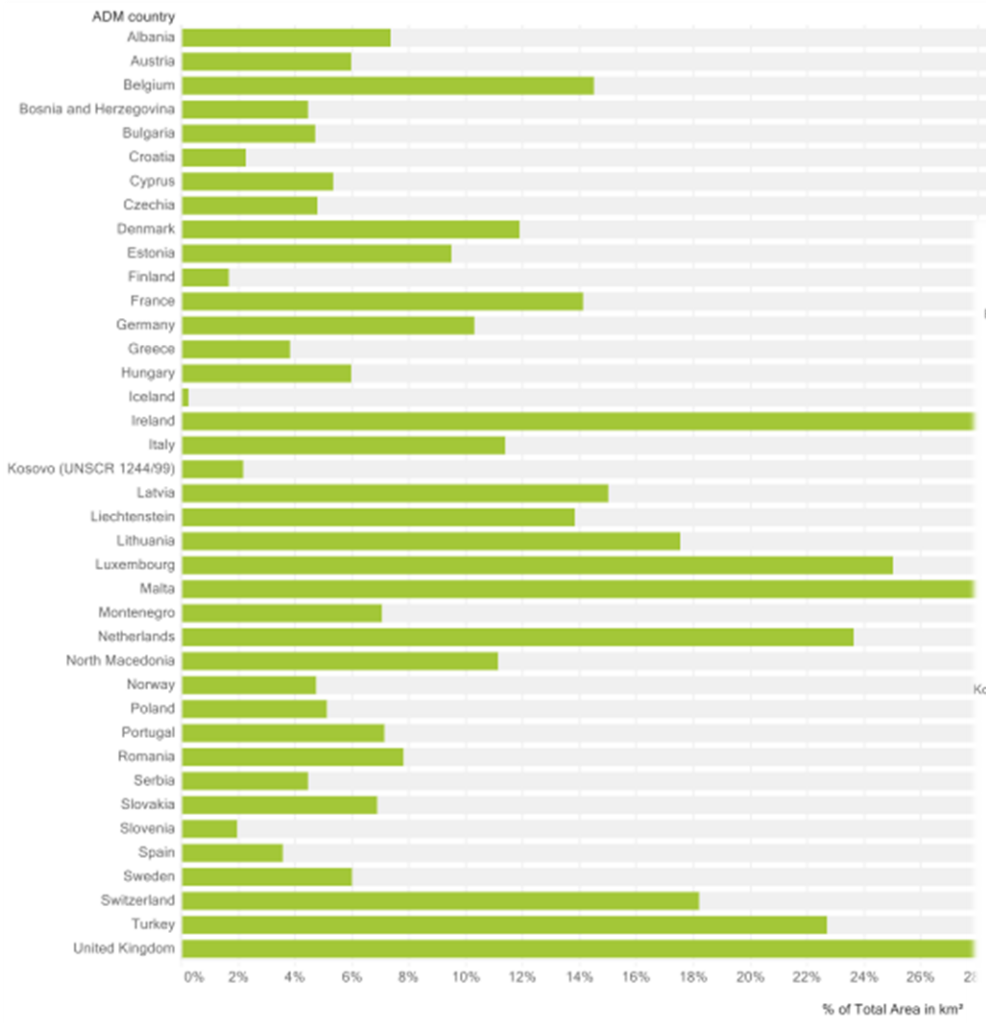
Comparison of HRL Forest – Tree Cover Density threshold , inside HNV map TCD 30% (left) and 80% (right)

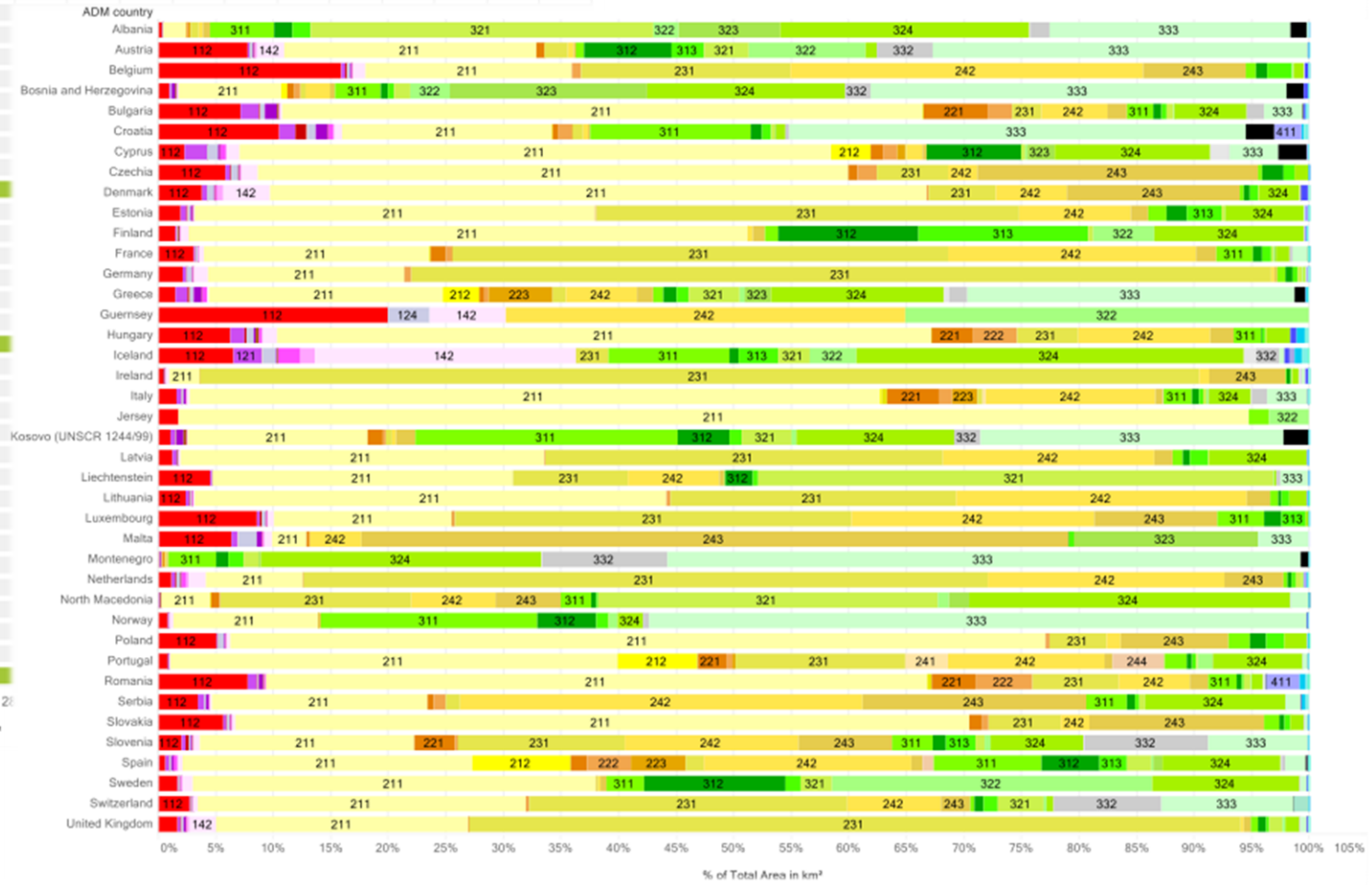
CLC 243

TCD / 10% density steps



Results – *discussion* Grassland (inclusion)





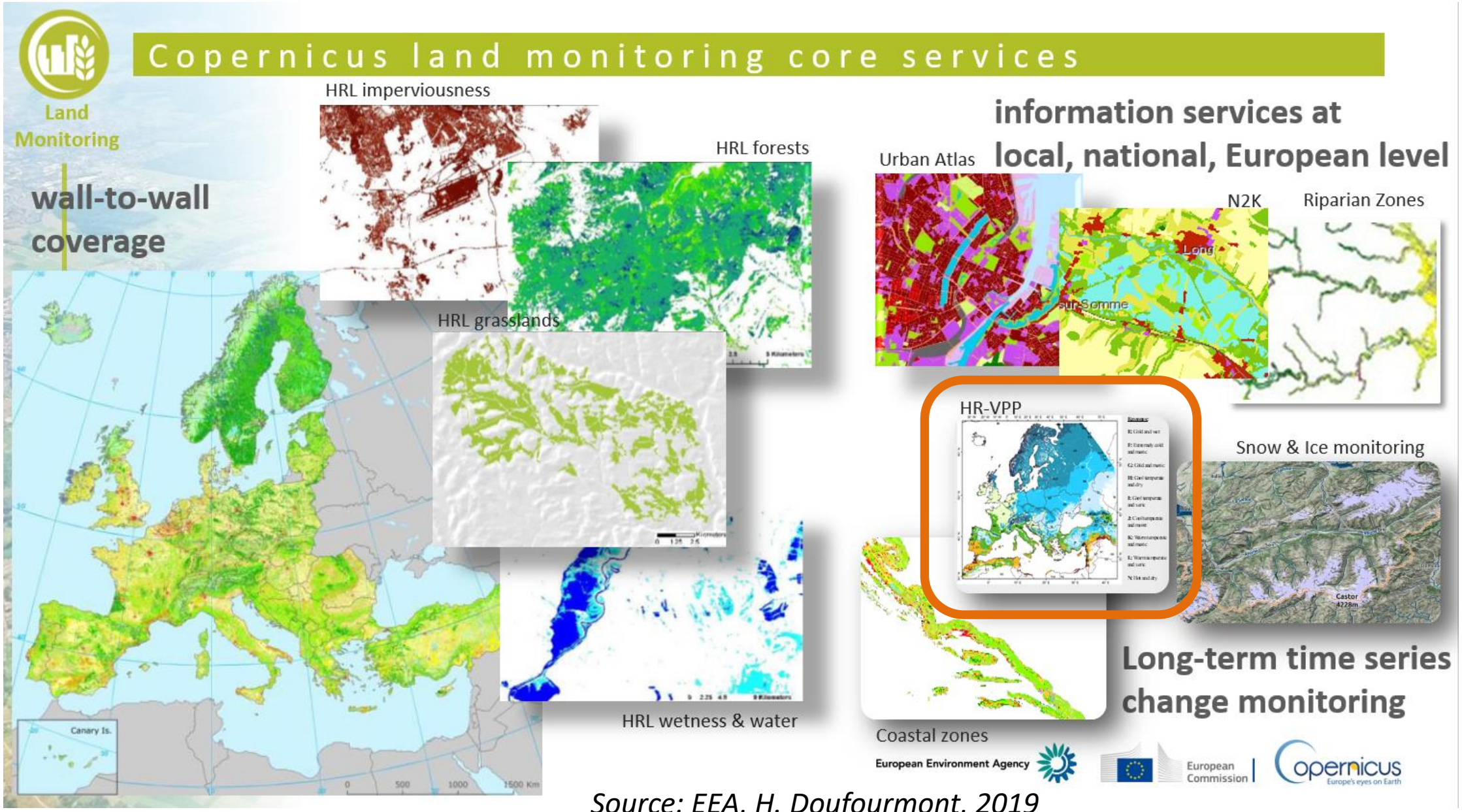
Results

				WW					TCD				
Level 1	**Level 2**	**CLC**	**Level 3**	**WAW**	**Total Area (km²)**	**% of HNV** *(without TR)*	**Exclusion of WAW**	**AND/ OR**	**TCD**	**Total Area (km²)**	**% of HNV** *(without TR)*	**Exclusion of TCD**	**Comments for TCD/ Mainly affected countries**
Agricultural areas	Arable land	211	Non-irrigated arable land	perm. water	582	0.07	√	or	> 30	1926	0.22		**Marginal**
		213	Rice fields	perm. water	919	0.10	√	or	> 30	34	0.00		**Negligible**
	Permanent crops	221	Vineyards	perm. water	29	0.00							
		222	Fruit trees and berry plantations	perm. water	53	0.01	√						
		223	Olive groves	perm. water	12	0.00	√						
	Pastures	231	Pastures	perm. water	2588	0.29	√	or	> 30	23128	2.59	√	**Significant** Would require intensity indicator Mainly relevant for *FR, RO, PO, DE, AT…*
		241	Annual crops associated with permanent crops	perm. water	3	0.00	√	or	> 50	344	0.04		**Negligible** *Mainly relevant for IT, PT, ES, CY, ME*
									>60	*219*	*0.02*		***Negligible***
									>70	*109*	*0.01*		***Negligible***
									>80	*35*	*0.00*		***Negligible***
									> 50	5006	0.56		**Marginal** *Mainly relevant for BE, FR, IT, HR, RO*
	Heterogeneous agricultural areas	242	Complex cultivation patterns	perm. water	599	0.07	√	or	*>60* *>70*	*3127* *1685*	*0.35* *0.19*		**Marginal** **Marginal**

Results - application

CLC	Class	Exclusion rule
211	Non-irrigated arable land	exclusion when TCD > 30 %
212	Irrigated arable land	exclusion when TCD > 30 %
213	Rice fields	exclusion when TCD > 30 %
221	Vineyards	no exclusion at all
222	Fruit trees	no exclusion at all
223	Olive	no exclusion at all
231	Pastures	exclusion when TCD > 30 %
241	Annual crops & permanent crops	exclusion when TCD > 50 %
242	Complex Cultivation pattern	exclusion when TCD > 50 %
243	land principally occupied …	exclusion when TCD > 50 %
244	Agro-forestry	no exclusion at all
311	Broadleaved Forest	no exclusion at all
321	Natural grassland	exclusion when TCD > 30 %
322	Moors and heathland	exclusion when TCD > 30 %
323	Sclerophyllous vegetation	no exclusion at all
324	Transitional woodlan shrub	exclusion when TCD > 50 %
333	Sparsely vegetated	exclusion when TCD > 30 %
411	Inland marshes	exclusion when TCD > 30 %
412	Peat bogs	exclusion when TCD > 30 %
421	Salt marsches	no exclusion at all
512	Water	no exclusion at all

Upcoming Copernicus products

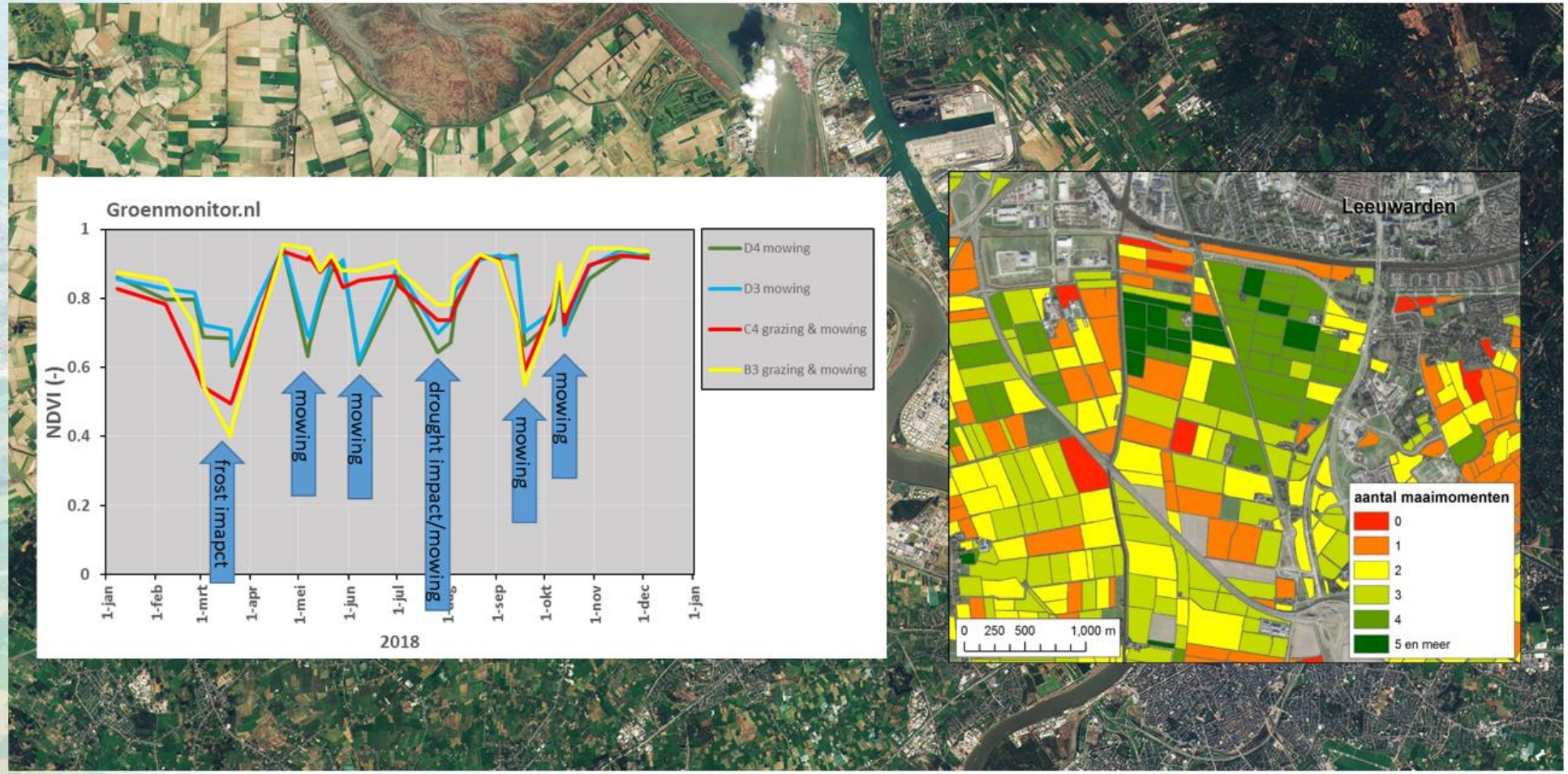


Source: EEA, H. Doufourmont, 2019

Upcoming Copernicus products

Land Monitoring

HRL grassland and HR-VPP for grassland mowing cycles



Source: EEA, H. Doufourmont, 2019

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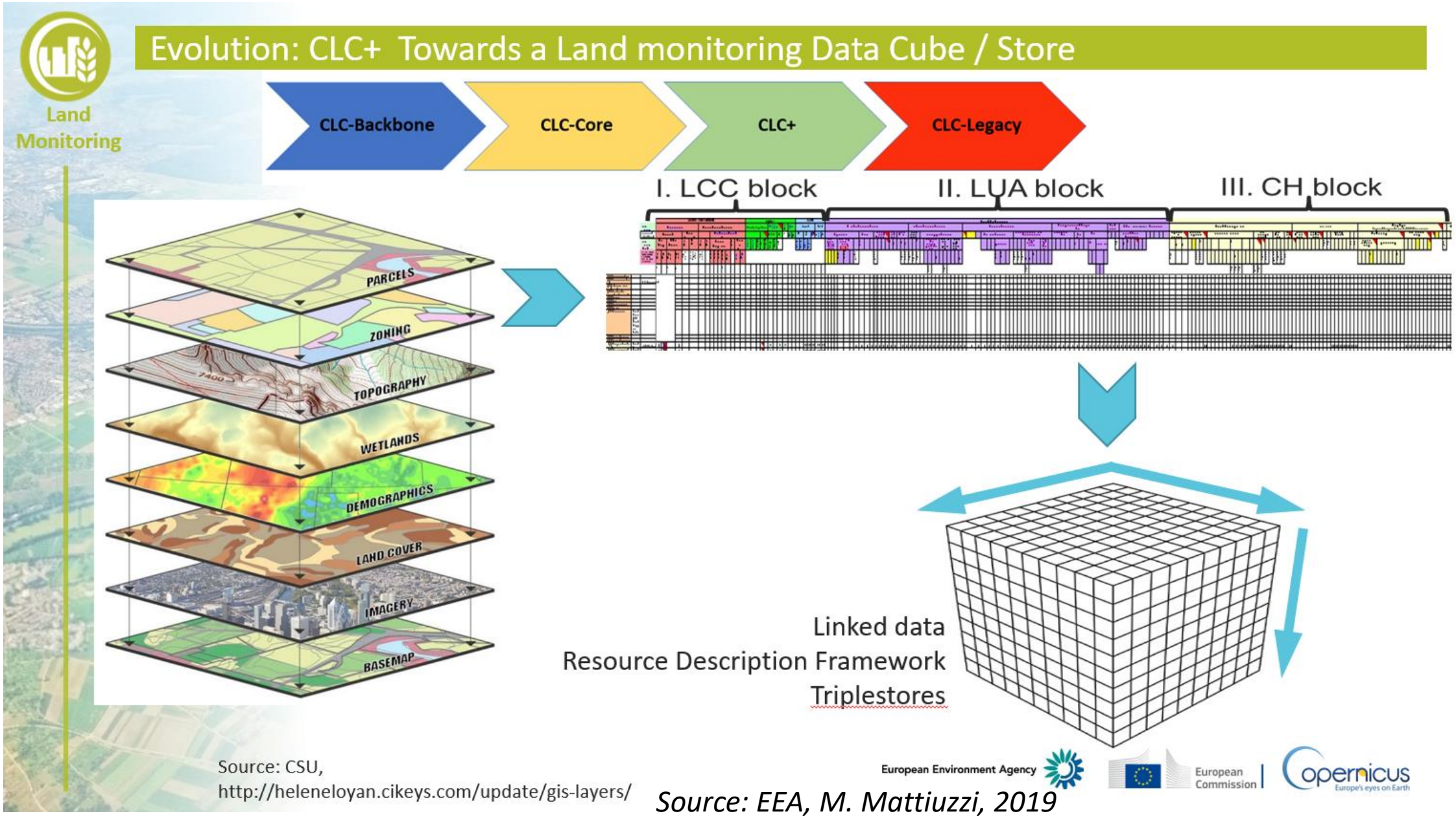
Upcoming Copernicus products



Source: EEA, M. Mattiuzzi, 2019

Session 2: Comparison of analysis of HRL grassland data with current HNV ‘map‘; review of satellite data opportunities

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