What does Sentinel-2 offer for Regional Development?

6th Czech User Forum,
25 May 2017, Prague

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Directorate of Earth Observation Programmes

Copernicus - Sentinel Launches

S1A/B: Radar Mission   3 Apr 2014/25 Apr 2016

S2A/B: High Resolution Optical Mission   23 June 2015/6 March 2017

S3A/B: Medium Resolution Imaging and Altimetry Mission   16 Feb 2016/2018

S4A/B: Geostationary Atmospheric Chemistry Mission   2021/2027

S5P: Low Earth Orbit Atmospheric Chemistry Mission   2017

S5A/B/C: Low Earth Orbit Atmospheric Chemistry Mission   2021/2027

S6A/B: Altimetry Mission   2020/2025

European Space Agency

Launch Sentinel-2 A/B

- 23 June 2015 & 06 March 2017
- Kourou spaceport
- Vega rocket
- "Colour vision" of Copernicus

Upcoming Launches

Sentinel-3B launch slot
March 2018

risk mitigation measures being considered

Sentinel-5P launch date
21 September 2017

European Space Agency
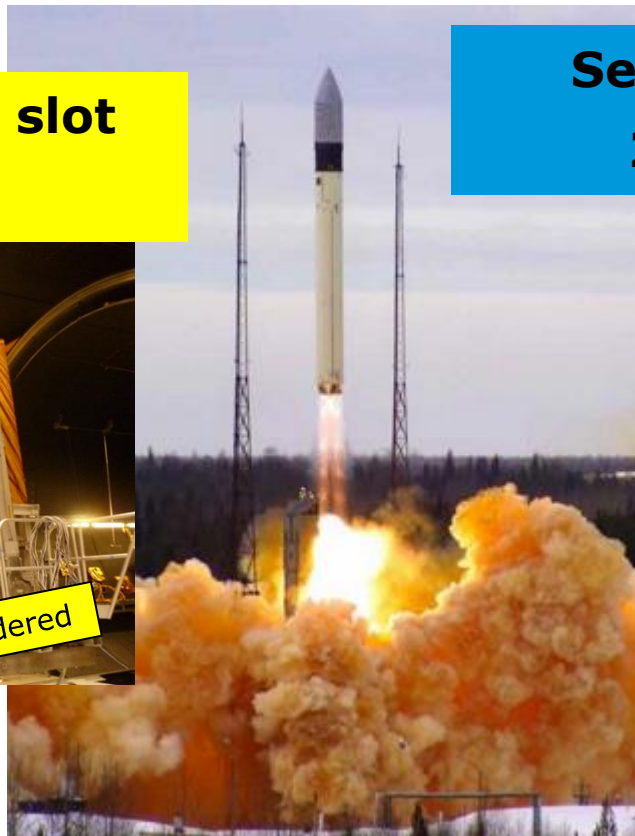
GSE CadasterENV

Facilitating the harmonisation of **National Land Monitoring Systems within and amongst European Countries** for the production of
up-to-date, detailed and standardised information
on the land cover, its use and its conditions,
at **different scales** and for **different domains of applications**.

European Space Agency

- Implement **multi-scale** and **multi-purpose** national Land Monitoring systems according to national specifications:

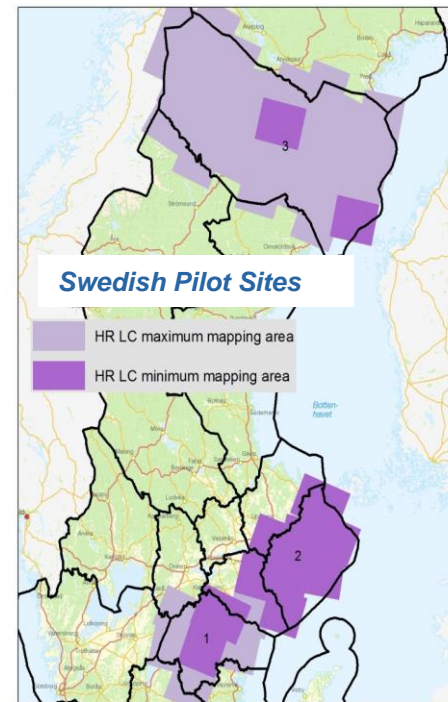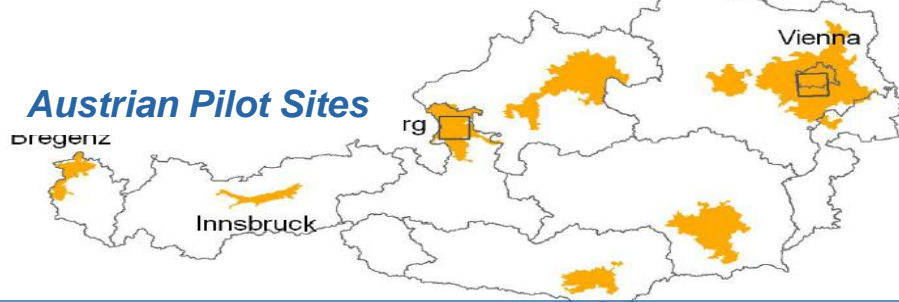 - **VHR Land Cover (LC) Mapping component,** based on Earth Observations at very high spatial resolution (Pleiades, Orthophotos) with pilot demonstrations over 10,000 km2.

  - **HR Land Cover Change (LCC) Alert system,** based on Earth Observations at high spatial resolution (SPOT-4/5 in preparation of Sentinel 2), with pilot demonstrations over 100,000 km2.

- Two **pilot countries**: Sweden and Austria

Swedish Pilot Sites

HR LC maximum mapping area

HR LC minimum mapping area

Austrian Pilot Sites

European Space Agency

CadasterENV, meeting LC/LU mapping needs of large national user bases

cadasterenv austria

cadasterenv sweden

Austria:
- Environment Agency Austria (UBA)
- Federal Office of Metrology and Surveying (BEV)
- Federal Ministry of Agriculture, Forestry, Environment and Water Management
- Statistics Austria
- Federal State of Tyrol
- Federal State of Salzburg
- Federal State of Upper Austria
- Federal State of Styria
- City of Vienna
- Austrian Conference on Spatial Planning (OREK partnership)

Sweden:
- Swedish Environmental Protection Agency (SEPA)
- Swedish Board of Agriculture
- Swedish Forest Agency
- National Land Survey of Sweden (LandMateriet)
- Statistics Sweden
- Country Administrative Board of Stockholm
- Country Administrative Board of Ostergotland
- Country Administrative Board of Vasterbotten

LISA (Land Information System Austria) **Data Models**:

- **Land Cover data model**
  - 13 classes + 12 attributes
  - MMU: starting from 25 m^2
  - 95% overall accuracy
  - directly and independently derived from EO data
  - Buildings, other built-up areas, bare soil, bare rocks, trees, bushes, herbaceous vegetation, water ….

- **Land Use data model**
  - 25 classes + 72 attributes
  - MMU: starting from 1.000 m^2
  - based on land cover maps, orthophotos, DSMs, ancillary and in-situ data
  - settlements, roads, railways, arable lands, grasslands, forests, alpine pastures, …
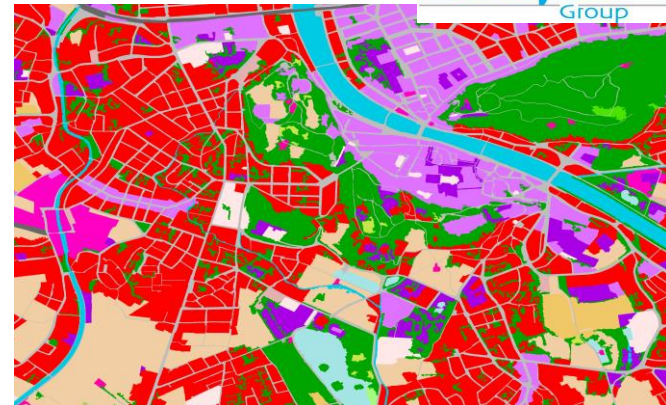
CadasterENV Sweden, a HR/VHR stratified approach to LC/LU mapping

**CadasterENV Sweden
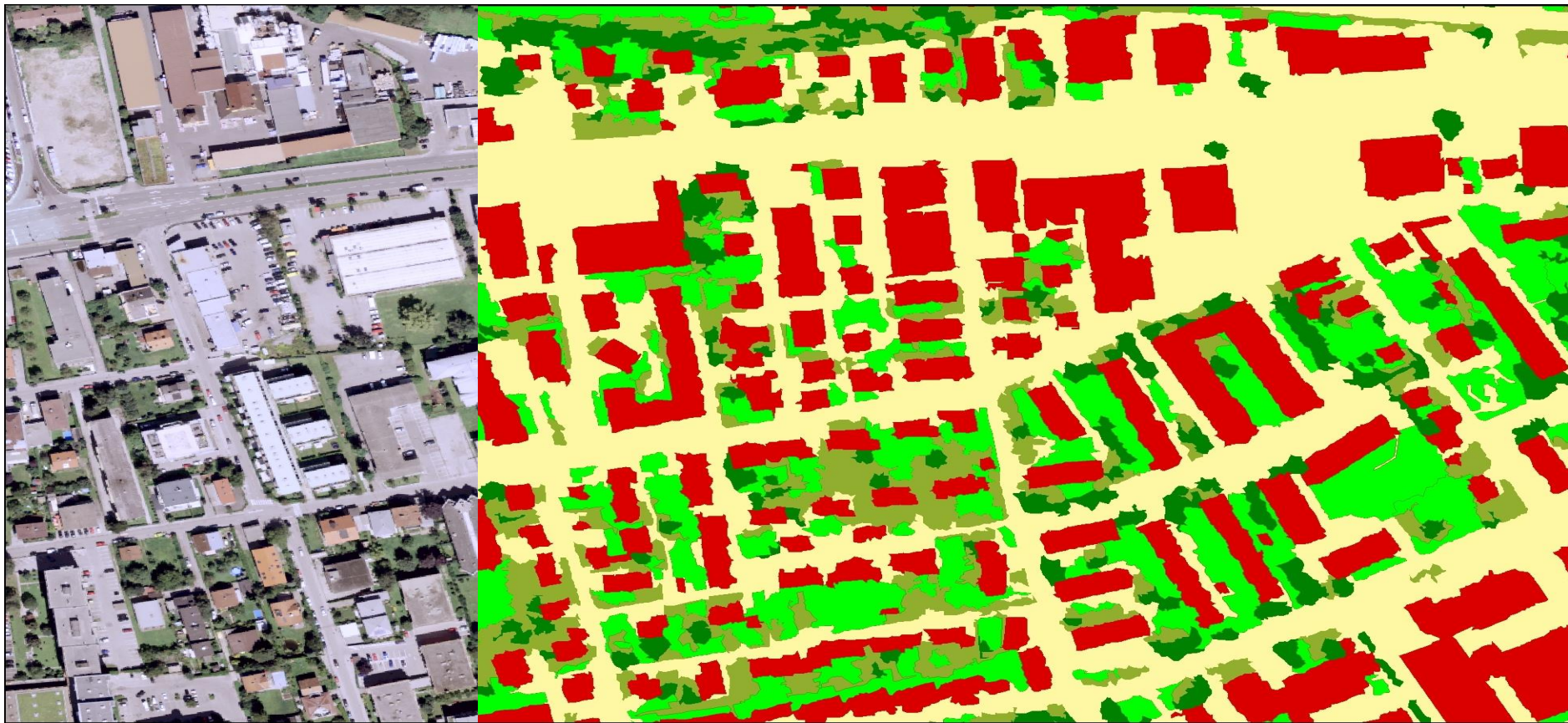HR/VHR Land Cover data model**

- LC data model with 24 thematic classes

  - Hierarchical Levels 1-3

  - HR (10m) / VHR (2m) raster

- 10m HR LC Map (based on SPOT-5)
  2m VHR LC Map (based on Pleiades)

- Different MMUs

- LC Attributes as separate layers
  (e.g. Tree and Bush Height & Cover, Land Use, etc.)

- Use of various Swedish Ancillary data (road networks, LPIS data, forest clear cuts, etc.) and LIDAR height measurements

Class/class group	Code
1. Forest	**1**
1.1. Forest not on wetland	*11*
1.1.1. Pine forest	111
1.1.2. Spruce forest	112
1.1.3. Mixed coniferous forest	113
1.1.4. Mixed forest	114
1.1.5. Deciduous forest	115
1.1.6. Deciduous hardwood forest	116
1.1.7. Deciduous forest with deciduous hardwood forest	117
1.1.8. Temporarily non forest	118
1.2. Forest on wetland	*12*
1.2.1. Pine forest	121
1.2.2. Spruce forest	122
1.2.3. Mixed coniferous forest	123
1.2.4. Mixed forest	124
1.2.5. Deciduous forest	125
1.2.6. Deciduous hardwood forest	126
1.2.7. Deciduous forest with deciduous hardwood forest	127
1.2.8. Temporarily non forest	128
2. Open wetland	**2**
3. Arable Land	**3**
4. Other open land	**4**
4.1. Non-vegetated other open land	*41*
4.2. Vegetated other open land	*42*
5. Artificial non-vegetated surfaces	**5**
5.1. Built-up areas	*51*
5.2. Non Built-up areas	*52*
6. Water	**6**
6.1. Inland water	61
6.2. Marine water	62

HR

VHR
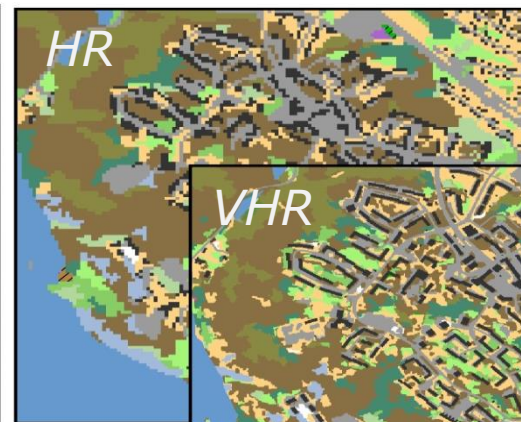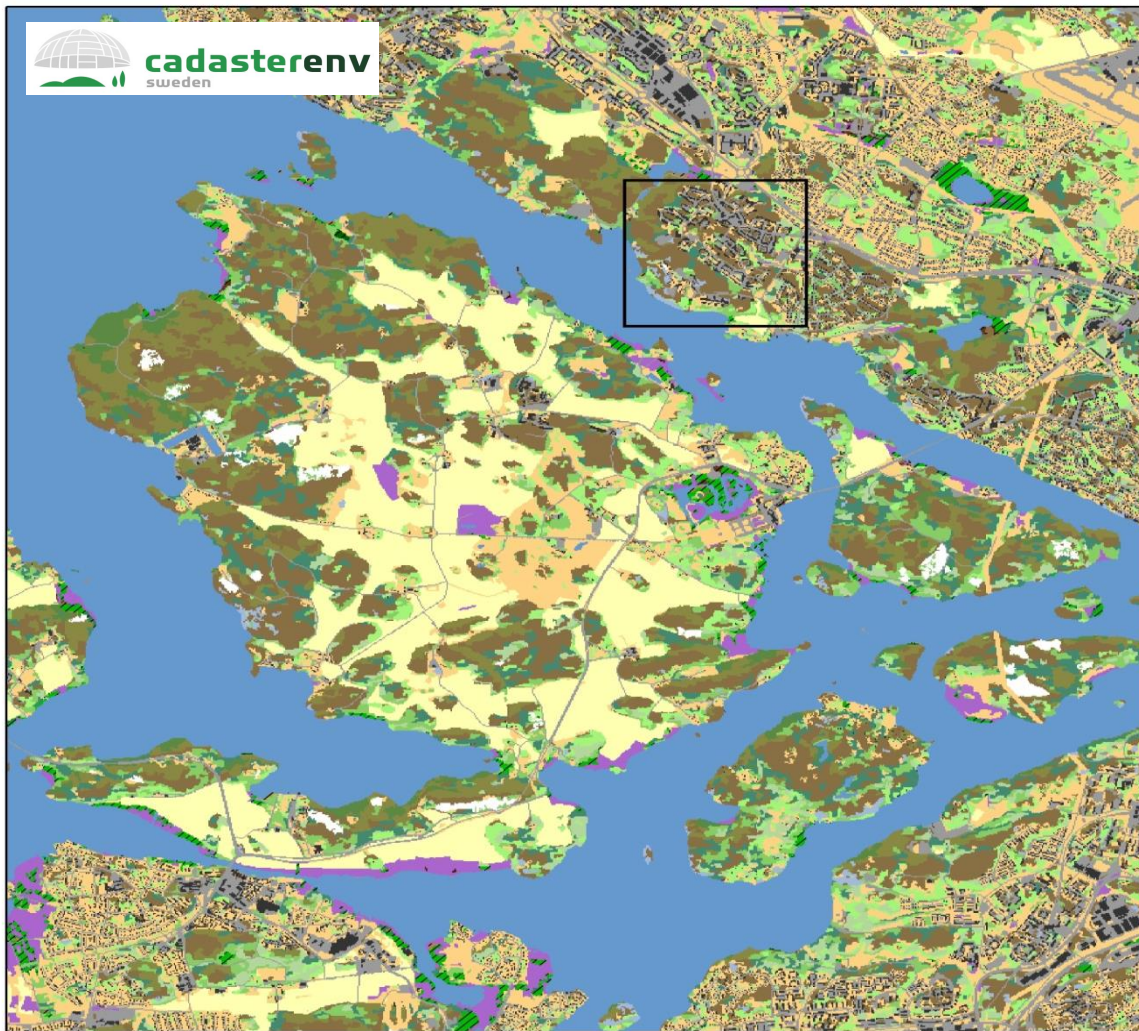
Legend

▉	2 Open wetland
▉	3 Arable land
▉	41 Non-vegetated other open land
▉	42 Vegetated other open land
▉	51 Built-up areas
▉	52 Non built-up areas
▉	61 Inland waters
▉	62 Marine water
▉	111 Pine forest (not on wetlands)
▉	112 Spruce forest (not on wetlands)
▉	113 Mixed coniferous forest (not on wetlands)
▉	114 Mixed forest (not on wetlands)
▉	115 Deciduous forest (not on wetlands)
▉	116 Deciduous hardwood forest (not on wetlands)
▉	117 Deciduous forest with hardwood forest (not on wetlands)
▉	118 Disturbed forest (not on wetland)
▨	Forest on wetlands

GSE CadasterENV project (2015-2017)

- Consolidate the Austrian **multi-scale** and **multi-purpose** Land Monitoring system, integrating Sentinel 2 data in the Land Information System Austria (LISA)

  - **Multi-scale**: optimised and combined use of EO from static VHR imagery (orthophotos/Pleiades) and multi-temporal HR time series (Sentinel 2).

  - **Multi-purposes**: S2-based land monitoring system for detection of Land Cover/Land Use and ecosystem/habitat change.

- Compliance with the **EAGLE** European land cover harmonisation lead by the European Environment Agency.

- Two **international workshops** to share experiences and build synergies.

Land Cover Mapping		Land Cover / Land Use Monitoring		
HR Land Cover Mapping	**Enriched VHR LC Mapping**	**LC Change Alert system**	**Land Use monitoring**	**Ecosystem Status monitoring**
Sentinel 2 based Land cover map	VHR LC classification enriched with S2	Detection of hot-spots of changes	Detection of cyclical changes	Detection of land conditional changes
S2A	Pleiades + S2A	L8, SPOT-5, S2A	S2A	L8, SPOT-5, S2A
84,000 km2	10,000 km2	16,800 km2	16,800 km2	3,000 km2
2016	2016	2014-16	2016	2014-2016

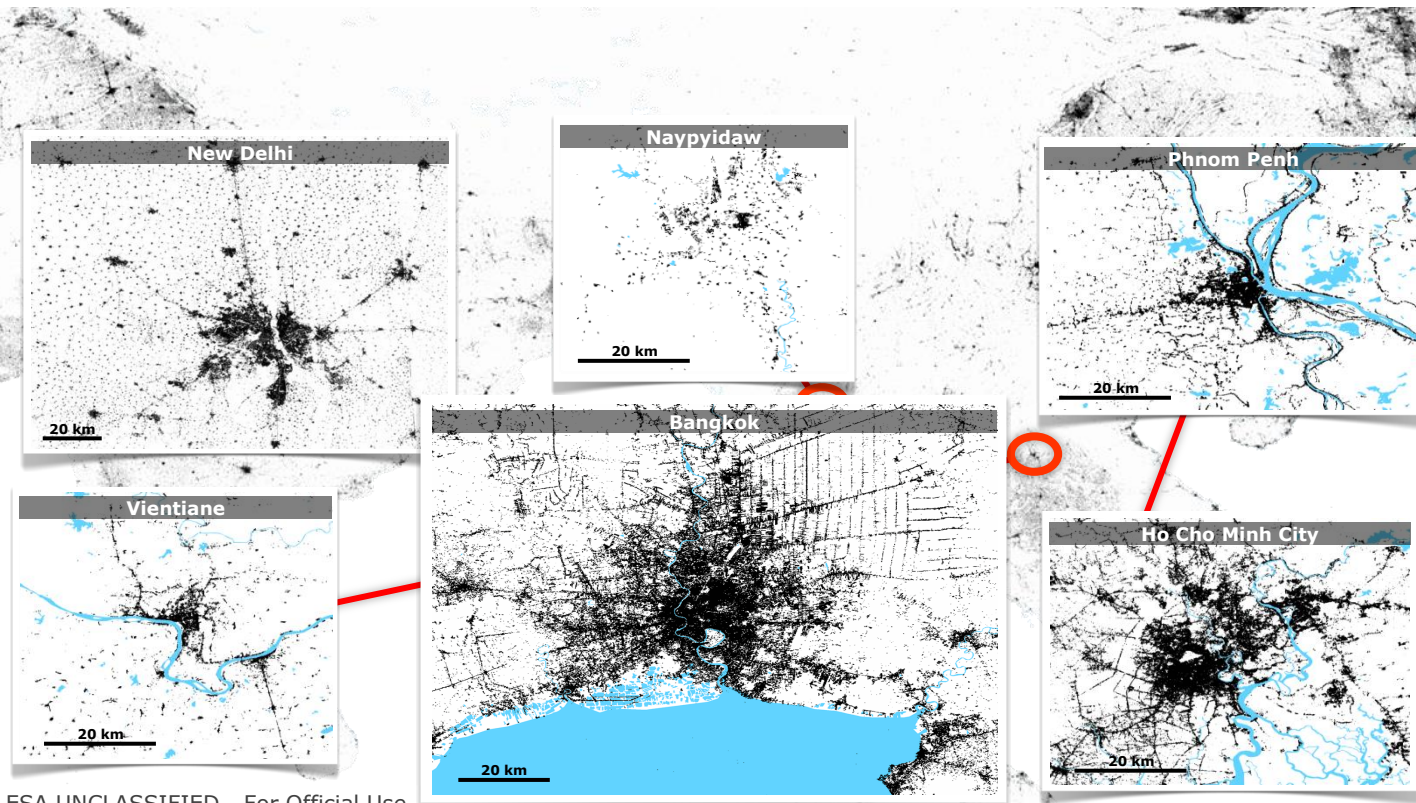*Funded by the ESA Earth Watch GMES Service Element (GSE)*

- **Share experience and build synergies** between National Land monitoring initiatives.

- Explore Sentinel 2 **integration in National land monitoring systems**.

- **Expected improvements**: higher classification accuracies, more detailed classification, field layers characterisation in open lands, etc.

- **Adaptations** needed in national land monitoring schemas to cope with multi-temporal data and high data volume.

- Capacity to detect different **types of changes** (abrupt changes, cyclic changes, conditional changes)

- **Sectorial land applications**: LC/LU mapping and Habitat monitoring.

- Perspectives and challenges for **national roll-out of services**.

Next CadasterENV International workshop in 2017 Q3 at EEA
Please contact marc.paganini@esa.int

Global Urban Footprint
Urban Extent from TerraSAR-X

New Delhi

Naypyidaw
20 km

Phnom Penh
20 km

Vientiane
20 km

Bangkok
20 km

Ho Cho Minh City
20 km

20 km

"Global Urban Footprint": Worldwide mapping of settlements with unprecedented spatial resolution of approx. 12 m, based on imaging radar data.

Binary (black and white) map for urban/non-urban, available for 2014.

Allows for the analysis of urban structures, and hence the proportion of settled areas, the regional population distribution and the arrangement of rural and urban areas.

European Space Agency

GUF+ 2015

- First global urban extent layer derived at 10m spatial resolution by jointly exploiting multitemporal optical and SAR imagery;

Engineered in SAR4Urban, powered by U-TEP

European Space Agency

Agriculture and rural development

European Space Agency

Data Access Stats: 22 May2017

78,321 Cop Open Access Hub Users

Steady Growth of Registered Users Continues

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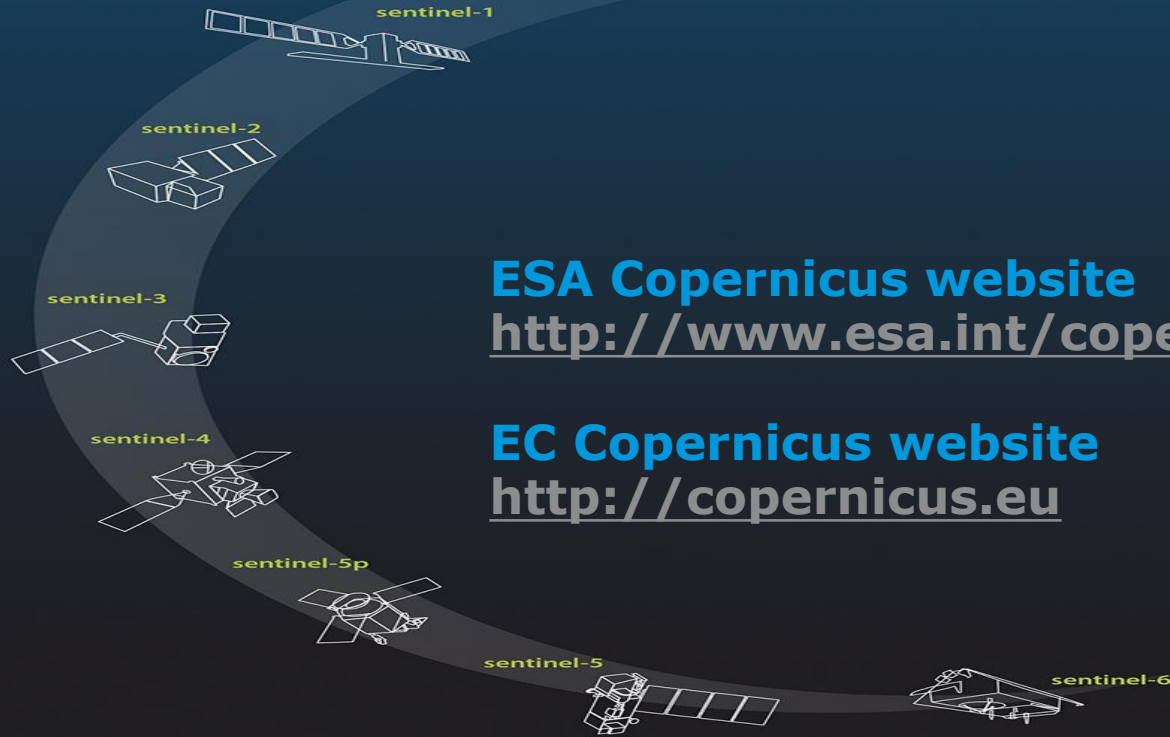
Volume of User Downloads
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Open Access Hub Availability
in the past month
98.8%

Sentinel-2A,B status

- S2A: Systematic coverage of Europe, Greenland and Africa every 10 days (at equator). Rest of the World: 20-day revisit till additional station (Inuvik) and/or EDRS is introduced (~summer 2017)

- First Sentinel-2 Validation Team (S2VT) and 2nd Sentinel-2 Quality Working Group meeting held in November 2016 confirming excellent performance of S2A. Product evolution recommendations being analysed.

- Pre-operational Level-2A 'Europe' released 02 May via Open Access Hub

- Sentinel-2B IOC phase proceeding nominally, IOCR and hand-over to Mission Manager planned for mid June, followed by ramp-up phase (4 months)

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http://copernicus.eu