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POSSIBILITIES AND LIMITATIONS OF SATELLITE DATA APPLICATION INTO THE BUILDING OF TOPOGRAPHIC AND KEY THEMATIC DATABASES IN EU MEMBER STATES

MOŻLIWOŚCI I OGRANICZENIA STOSOWANIA DANYCH SATELITARNYCH DO BUDOWY BAZ TOPOGRAFICZNYCH I KLUCZOWYCH BAZ TEMATYCZNYCH W PAŃSTWACH CZŁONKOWSKICH UE

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Introduction

The early civil and military works (1961–1972), as well as 36 years of civil research and development (1972–2008), resulted in creation of many remote sensing satellite systems, providing regularly wholly available, detailed, exhaustive, standardized, repeatable and thematically comparable data. Most of them is very rich, complementary and (in big part) interoperable data, which can be used in topographic and key thematic databases.

The aim of this research was to compare the characteristics of civil satellite data, to investigate the suitability of potential use of these data into the European topographic and key thematic databases, to estimate a degree of their real application in creation and updating of these databases, and to analyse the recent needs for satellite data and derivative information. To achieve these goals, it was necessary to classify the types of satellite data, to analyse the possibility of generation of thematic information, to identify the European topographic and key thematic databases, to analyse theirs thematic scope and the possibilities of usage of satellite data derivative information in these databases. Analysis of the real level of satellite data application in these databases allowed to detect the reasons of identified state and to formulate issues concerning the recent satellite data needs.

The analysed remote sensing data and its typology

The object of analysis were data provided by 20 civil remote sensing satellites active in 2008: WorldWiev-1, QuickBird, Ikonos, KOMPSAT-2, EROS A-1, SPOT-2, SPOT-4, SPOT–5, FORMOSAT–2, Kosmos KVR–1000, Kosmos TK 350, IRS, Landsat 5, NOAA, ERS, Radarsat, Sich-1M, Envisat, ALOS, Terra-ASTER (Tab. 1).

Table 1. Remote sensing satellites active in 2008. Spectral ranges, frequencies and polarizations

Satellites		WorldView 1	QuickBird	Ikonos	KOMPSAT-2	EROS	Kosmos KVR-1000	Kosmos TK 350	IRS	Formosat	SPOT			Landsat	TERRA- ASTER	ERS	Sich 1 M	RADARSAT	ALOS	ENVISAT
											HRV	HVIR	HRG/HRS	TM						
Spectral range	µm	resolution (meters)																		
Panchromatic	0.45 – 0.90	0.5	0.61	1	1														2.5	
	0.49 – 0.69												10							
	0.50 – 0.75								5.8 (5)		10	10	5							
	0.50 – 0.90					1.8 (1)	2	10												
	0.52 – 0.90																			
IV / Blue	0.37 – 0.45																1100			
Blue	0.4125																			300
	0.42 - 0.50																		10	
	0.4425																			300
	0.45 – 0.51																1100			
	0.45 – 0.52		2.44		4					8				30						
	0.45 – 0.53			4																
	0.49																			300
Green	0.50 – 0.59										20	20	10				34 x 24			
	0.50 – 0.60																1500 x 1800			
	0.51																			300
	0.52 – 0.59								23											
	0.52 – 0.60		2.44		4					8				30	15					
	0.52 – 0.61			4																
	0.55																			1000
	0.56																			300
Red	0.58 – 0.68																1100			
	0.60 – 0.70																1500 x 1800			
	0.61 – 0.68									2	20	20	10							
	0.61 – 0.69																34 x 24		10	
	0.62																			300
	0.62 – 0.68								23/188											
	0.63 – 0.69		2.44		4					8				30	15					
	0.64 – 0.72			4																
	0.665																			300
	0.67																			1000

Near Infrared	0.68 – 0.78																1100			
	0.68125																			300
	0.70 – 0.80																1500 x 1800			
	0.705																			300
	0.75375																			300
	0.76																			300
	0.76 – 0.89																		10	1000
	0.76 – 0.90		2.44		4									30						
	0.77 – 0.86								23/188											
	0.77 – 0.88			4																
	0.775																			300
	0.78 – 0.86														15					
	0.78 – 0.89									8	20	20	10							
	0.79 – 0.92																34 x 24			
	0.865																			300
	0.89																			300
	0.9																			300
MIR	1.55 – 1.70								70											
	1.55 – 1.75													30						
	1.58 – 1.75											20	10							
	1.60 - 1.70														30					
	1.60																			1000
SWIR	2.08 – 2.35													30						
	2.145 - 2.185														30					
	2.185 - 2.225														30					
	2.235 - 2.285														30					
	2.295 - 2.365														30					
	2.360 - 2.430														30					
	3.55 – 3.93																1100			
	3.70																			1000
TIR	8.125 - 8.475														90					
	8.475 - 8.825														90					
	8.925 - 9.275														90					
	10.25 - 10.95														90					
	10.40 – 12.50													30						
	10.85																			1000
	10.95 - 11.65														90					
	12.00																			1000
Frequency	Polarization																			
C	VV															25				30
	HH																	25	10, 100, 250	30
K	VV															25	2500			20
Ka	VV. HH. VH																			20
Ku	VV. HH. VH																			
	HH. VV. HH and HV. VV and VH																		10, 100, 250	
S	VV. HH. VH																			
X																	1300 x 700			

The possibility of generation of thematic information with satellite data depends (non quantitative way) on spatial resolution of satellite systems, availability of spectral scopes, frequencies and polarizations (and it's efficiency), as well as possibilities related to direct and indirect interpretation features and external knowledge of interpreters. Taking like a criterion the type of satellite sensor system, the number of spectral ranges, frequencies and polarizations, as well as it's efficiency and potential richness of thematic scope of data, it is possible to distinguish 3 types and 9 subtypes of remote sensing data acquired by:

1. passive (optical) systems
   a. of very high resolution (≤ 1 m pixel), considerable number of spectral ranges and very rich thematic scope, suitable like main source material for creation or updating the reference maps, thematic databases and advanced, detailed data products (QuickBird, Ikonos, KOMPSAT-2);
   b. of very high resolution (≤ 1 m pixel), sole channel and quite rich thematic scope, (based on direct and indirect interpretation features analysis possibilities and external knowledge of interpreter), suitable like main source material for creation or updating the reference maps and databases (WorldWiev-1);
   c. of high resolution (1–2.5 m pixel), considerable number of channels and rich thematic scope (based on good choice of ranges of spectrum), appropriate like main source material for creation or updating the reference maps and thematic databases (SPOT–5, FORMOSAT–2);
   d. of high resolution (1–2.5 m pixel), sole channel and quite rich thematic scope (based on interpretation features analysis possibilities), suitable like main source material for creation or updating the reference maps and databases (EROS A-1, Kosmos KVR–1000);
   e. of medium resolution satellites (5–10 m pixel), considerable number of channels and relatively rich thematic scope (based on good choice of ranges of spectrum), appropriate like main source material for creation of thematic maps and databases (SPOT-2, SPOT-4, IRS);
   f. of medium resolution (5–10 m pixel), sole channel and relatively rich thematic scope, used like main source material for updating of thematic maps and databases (Kosmos TK 350);
   g. of low resolution (15–100 m pixel), considerable number of channels and rich thematic scope, suitable like main source material for thematic maps and databases (Landsat);
   h. of 'regional view' resolution (500–1000 m pixel), considerable number of channels and specialised thematic scope, appropriate like main, auxiliary or supplementary source material for creation and updating of thematic databases (NOAA);
2. active (synthetic aperture radar) systems of small number of frequencies, polarizations and specialised thematic scope (ERS, Radarsat);
3. hybrid (SAR/optical) systems of rich thematic scope, big number of spectral ranges, considerable number of frequencies, polarizations and of medium (Envisat, ALOS, Terra-ASTER) or 'regional view' (Sich–1 M) resolution.

Regarding the geometrical precision (Tab. 2) it is possible to distinguish 7 types of remote sensing data, suitable like main source material for creation of databases of level of detailness corresponding to the:

Table 2. Geometrical precision of satellite data and their suitability for maps and databases preparation

Satellite data	Topographic / thematic maps and databases scale							
	1: 500	1: 1000	1: 2000	1: 5000	1: 10 000	1: 25 000	1: 50 000	1: 100 000
WorldWiev-1	S	S	A	X	X	X	X	X
QuickBird	S	S	A	X	X	X	X	X
Ikonos	S	S	A	A	X	X	X	X
KOMPSAT-2	S	S	A	A	X	X	X	X
EROS	S	S	A	A	A	X	X	X
Kosmos KVR 1000	S	S	S	A	A	X	X	X
SPOT 5								
P	S	S	S	A	A	X	X	X
XS	S	S	S	S	A	A	X	X
ALOS								
P	S	S	S	A	A	X	X	X
XS	S	S	S	S	A	A	X	X
Kosmos TK 350	S	S	S	S	A	A	X	X
FORMOSAT - 2								
P	S	S	S	S	A	X	X	X
XS	S	S	S	S	S	A	X	X
IRS								
P	S	S	S	S	A	X	X	X
XS	S	S	S	S	S	S	A	X
Landsat ETM+								
P	S	S	S	S	S	A	A	X
XS	S	S	S	S	S	S	A	A
TERRA (ASTER)								
P	S	S	S	S	S	A	A	X
XS	S	S	S	S	S	S	A	A
Sich – 1 M	S	S	S	S	S	S	S	A
NOAA	S	S	S	S	S	S	S	S

S supplementary source material; A auxiliary source material; X main source material

1. 1:5000 scale maps (WorldWiev-1, QuickBird);
2. 1:10 000 maps and auxiliary source materials in the case of 1:5000 maps (Ikonos, KOMPSAT);
3. 1: 25 000 maps and auxiliary materials in the case of 1:10 000 maps (EROS, Kosmos KVR 1000);
4. 1:25 000 maps in the case of panchromatic data and 1:50 000 maps in the case of multispectral data (SPOT-5, ALOS, FORMOSAT-2);
5. 1:25 000 maps using panchromatic and 1:100 000 maps using multispectral data (IRS);
6. 1:50 000 scale maps (Kosmos TK 350);
7. 1:100 000 scale maps (Landsat TM, Terra – ASTER),

as well as 2 types of remote sensing data, suitable like auxiliary source material for creation of:

1. 1:100 000 scale thematic maps (Sich – 1 M);
2. 1:1000 000 scale thematic maps (NOAA).

The analyse of the possibility of generation of thematic information with satellite data has proved that WorldView products can provide very detailed data about the geometry of most of surface topographic objects (with exception of small or thin objects like phone box, transformers, power lines). However, to generate an information about its characteristics (i.e. type and sanitary stand of forests, type of road surfaces, house construction material) it is necessary to use other data. The QuickBird panchromatic data allow to generate the information of almost the same geometrical quality, but with multispectral characteristics of objects this information is more rich and reliable. It is possible to have an information about all elements of surface hydrography (with exception of soil moisture), road, railway, tramway transport networks and airports (including data on surface type of all roads, runways, aprons), natural and semi-natural vegetation (in the case of bushes or trees it is possible to identify the type, and sometimes also species, as well as it's health and sanitary stand), arable crops, meadows (types, sometimes also species), all buildings and structures (in majority cases including the type of construction material) and all landmark objects. Similar, but less detailed geometrically information it is possible to generate with Ikonos products. It is, however, to mention that spectral scope of Ikonos multispectral data differs from scope of all other satellites (Tab. 1), which result in partial lack of interoperability of generated information. These spectral differences can be however a source of additional information about the sanitary stand of vegetation. The KOMPSAT-2 data is of the same geometrical precision like this of Ikonos, but the spectral scope is similar to this of QuickBird. It is possible to generate an information about majority of elements of surface hydrography (with exception of thin irrigation channels and soil moisture), road networks (including the data on surface type), natural and semi-natural vegetation (for bigger bushes and all trees it is possible to identify the type, it's health and sanitary stand), arable crops (types, sometimes species), all buildings and majority of structures (with data about the type of construction material) and big part of landmark objects. The QuickBird, Ikonos and KOMPSAT-2 data can allow to generate very rich topographic, as well as thematic information for studies on land use/land cover, vegetation, agriculture, forestry, transport, surface hydrology, local and regional planning, emergency planning. The EROS and Kosmos KVR-1000 data can provide information on the extent of broad linear elements of surface hydrography, roads and railways, the extent of airports, natural and semi-natural vegetation (without the information on it's type, health and sanitary stand), arable areas, all buildings and big part of structures. The Kosmos TK 350 type data can allow to generate the information about the main elements of hydrography, road and rail networks, the extent of build-up areas, biggest structures, airports, arable land, scrub/forests, parks/gardens. To be reliable, this information must be completed with supplementary information. The SPOT HRV data can be a source of rich thematic information about the natural and semi-natural vegetation polygons (including type and sanitary stand characteristics of forests, young trees and scrubs), meadows, arable lands, parks, gardens/cemeteries, concrete areas (build-up areas, airports, transport areas, biggest structures), sands, swamps and peat bogs. In the case of SPOT HVIR and HRGHRS it is also possible to generate the more detailed information about the health and sanitary stand of forests, as well as about the soil humidity. The thematic scope of information, which can be gained with IRS data is similar to these of SPOT HRV, while the FORMOSAT – to these of SPOT HRGHRS (however, it is to mention, that due the spectral differences, these information are not comparable, nor interoperable). The data from all SPOT HRV, HVIR and HRGHRS instruments can be used to generate the DTM. The Landsat TM data allow to generate very rich, but geometrically generalized thematic information about the vegetation polygons (including type, very detailed forests sanitary stand characteristics, information about the humidity), concrete areas (build-up areas, airports, biggest transport areas), sands and swamps. The more rich information about the soil moisture and vegetation is available with Aster data. The ERS data can be used like a source of information about the wind, sea–surface and cloud–top temperatures, ozone layer and micro-particle pollution in the lower atmosphere. The RADARSAT data provide data suitable for research and analysis of physical, biophysical and biochemical conditions of the environment. The Envisat data allow to gain the information about the profiles of ozone, NO2, NO3, OClO, temperature, water vapour between the tropopause and 100 km, chlorophyll pigment concentration, suspended sediment concentration, aerosol loads over the marine domain, gaseous emission spectra, stratospheric chemistry, atmospheric water vapour column, cloud liquid water content, surface emissivity and soil moisture. They can be also applied for analysis of the ocean 3D topography, carbon cycle, thermal regime of the upper ocean and management of fisheries. The ALOS data can be applied to generate the information similar to this of SPOT HRGHRS as well as to create the DTM and carry out the soil moisture analyses. The Sich 1-M provides data which are useful for low resolution sea ice surveying and monitoring of: snow coverage, atmospheric vapour, sea surface temperature, clouds, atmospheric temperature and humidity, wind speed, precipitation, electric and magnetic field fluctuations.

The topographic and key thematic databases in Europe

In May of 2008 it was possible to identify in Europe 69 operational or semi-operational civil topographic databases (Tab. 3) and 1 designed 1:50 000/1:25 000 database of Russian Federation.

It was also possible to identify 19 European key thematic databases, including spatial (or spatial related) data, concerning the environmental issues (Tab. 4).

Using the criteria of level of precision, it is possible to distinguish four groups of these databases, corresponding to the topographic maps of scale ranges:

- 1: 1000 – 1: 25 000 (large scale);
- 1: 25 000 – 50 000 (medium scale);
- 1: 50 000 – 1: 250 000 (so called ‘general scale’);
- 1: 250 000 – 1: 500 000 (small scale).

In the case of the first group Dukaczewski et al. (2007) have proposed a typology employing criteria of the number of topographic objects, number of attribute groups and number of attributes, which allowed to distinguish 4 types of topographic databases of different scope of thematic information. Using the same criteria in the case of all groups, it is possible to propose the typology as in Table 5.

Among the European key environmental thematic databases employing the remote sensing data it is possible to distinguish three main groups: including spatial data (no. 101–102, 105–112, 114–116), including spatial related data (no. 117–119) and using spatial data for visualisation of spatial related data (no. 103, 104, 113).

Using the criterion of level of detailness, it is possible to distinguish databases of medium scale thematic maps (no 102), so called ‘general scale’ thematic maps (101, 103–110), small scale (111–116) and very small scale (112, 114, 115). Employing like a criterion the thematic scope of data, it is possible to distinguish five types of databases of: very rich scope (no. 102

Table 3. Civil topographic databases in European countries

No.	Database	Scale	Country	No.	Database	Scale	Country
1	Österreichische Karte 1:50 000	1:50 000	Austria	35	KDB10LT midi level, mini level	1:10 000	Lithuania
2	Österreichische Karte 1:200 000	1:200 000		36	LTDBK 50 000	1:50 000	
3	TOP10v–GIS	1:10 000	Belgium	37	GDB200	1:200 000	
4	TOP50v–GIS	1:50 000		38	BD-L-TC	1:5 000	Luxembourg
5	TOP250v–GIS	1:250 000		39	TC 1/20 000	1:20 000	
6	ZABAGED	1:10 000	Czech Republic	40	Latvijas Republikas Topografiska Karte	1:50 000	Latvia
7	CBM	1:5 000	Croatia	41	Latvija 1:200 000	1:200 000	
8	TK25	1:25 000		42	Base Map	1:2 500	Malta
9	TOP10DK	1:10 000	Denmark	43	FKB (Felles KartdataBase)	1:5 000	Norway
10	Kort25	1:25 000		44	SCN10K Carta de Portugal	1:10 000	Portugal
11	Danmark 1:50 000	1:50 000		45	SCN50K Carta de Portugal	1:50 000	
12	Danmark 1:100 000	1:100 000		46	TBD	1:10 000	Poland
13	Danmark 1:200 000	1:200 000		47	BDO	1:250 000	
14	Eesti Pöhikaardi 1:10 000 Digitaalkaardistuse	1:10 000	Estonia	48	Basis-DLM	1:10 000	Federal Republic of Germany
15	Eesti Pöhikaardi 1:20 000 Digitaalkaardistuse	1:20 000		49	DLM50	1:50 000	
16	Eesti Pöhikaardi 1:50 000 Digitaalkaardistuse	1:50 000		50	DLM250	1:250 000	
17	Maastotietokanta	1:5 000-1:10 000	Finland	51	DTK 5	1:5 000	Slovenia
18	1:20 000 Peruskarta	1:20 000		52	ZB GIS	1:10 000	Slovakia
19	1:100 000 Karttatietokanta	1:100 000		53	MD.0.1-MO-CH	1:1 000	Switzerland
20	1:250 000 Karttatietokanta	1:250 000		54	VECTOR25	1:25 000	
21	BD TOPO Pays	1:5 000-1:25 000	France	55	VECTOR200	1:200 000	
22	BD CARTO	1:50 000 -1:250 000		56	GSD-Grundläggande Geografiska Data GGD	1:10 000	Sweden
23	Ελλαδα M 708	1:50 000	Greece	57	GSD-Tätort	1:10 000	

24	Ελλαδα 1501	1:250 000	Greece	58	GSD-Terrängkartan	1:50 000	Sweden
25	BCN 25	1:25 000	Spain	59	GSD-Översiktskartan	1:100 000 -1:250 000	
26	BCN 200	1:200 000		60	DTA_10	1:10 000	Hungary
27	TOP10NL	1:10 000	Netherland	61	DTA_100	1:100 000	
28	TOP50vector	1:50 000		62	OSMasterMap	1:10 000	Great Britain
29	TOP250vector	1:250 000		63	1:250 000 Scale Digital Database	1:250 000	
30	PLACE Data	1:1 000; 1:2 500; 1:5 000	Ireland	64	OSNI Map	1:50 000	
31	Discovery Data	1:50 000		65	Small Scale Map	1:210 000	
32	Holiday Data	1:250 000		66	25db vpf	1:25 000	Italy
33	Digi Ireland	1:450 000		67	Italia M892	1:50 000	
34	IS 50 V	1:50 000	Island	68	dbVmap level1	1:250 000	

Table 4. European key thematic spatial databases, related to the environmental issues

No.	Database	Scale	Institution
101	Corine Land Cover level 3	1:100 000	EEA
102	Corine Land Cover level 4 (international bases)	1:50 000	EEA
103	Corine Biotopes	1:100 000	EEA
104	EMEP/CORINAIR	1:100 000	EEA
105	CORILIS	1:100 000	EEA
106	GUA – Green Urban Areas	1:100 000	EEA
107	LEAC – Land and Ecosystem Accounting	1:100 000	ETC – LUSI
108	Global Land Cover 2000– Europe	1:100 000	EEA
109	DISMED – Desertification Information System for the Mediterranean	1:100 000	ETC – LUSI
110	EUROSION	1:100 000	DG Environment
111	EUROLandscape	1:250 000	JRC
112	MapBSR	1:1 000 000	Maanmittauslaitos
113	Natura 2000 EUNIS database		DG Environment
114	GISCO – GIS for the European Commision	1:1 000 000	EUROSTAT
115	EGM – EuroGlobalMap	1:1 000 000	Eurogeographics
116	EGM – EuroRegionalMap	1:1 250 000	Eurogeographics
117	ClioSat – Climatologies Oceaniques Satellitaires		MétéoMer, CLAROM
118	Mediterranean Wave Analysis Datasets		ECMWF
119	Euro Wind		ABS Consulting

Table 5. Typology of scope of thematic information of the European and EU topographic databases

Scope of thematic information	Database groups			
	1:1000–1:25 000	1:25 000–1:50 000	1:50 000–1:250 000	1:250 000–1:500 000
Very broad	ZB-GIS; BD TOPO Pays; Master Map; Basis-DLM; BCN 25; MD.01-MO-CH	OSNI Map; DLM50; VECTOR25	BCN 200; DLM250; VECTOR200	
Broad	Maastotientokanta; TOP10NL; Place Data VECTOR25; Eesti Pöhikaardi 1:10 000; Eesti Pöhikaardi 1:20 000; Peruskarta	TOP50v-GIS; BD CARTO; IS50V; Eesti Baaskaardi: TOP50vector; VECTOR25; Italia M892	TOP250v-GIS; TOP250vector 1:100 000, 1:250 000 Karttatietokanta	
Average	TOP10v-GIS; KDB10LT midi level; FKB; GDD, ZABAGED; TBD; SCN10K; Kort25; BD-L-TC; TC1/20000; DTA_10	LTDBK 50 000; SCN10K; SCN50K; Ελλαδα M708; Discovery Data GSD-Terrängkartan	BDO; GDB200; GBD200; Ελλαδα 1501; dbVmap level 1; GSD Översiktskartan; DTA100; Danmark 1:100 000; Latvija 1:200 000	Digi Ireland
Narrow	TOP10DK; DTK5	Danmark 1:50 000	Danmark 1:200 000; Holiday Data	

till 89 spatial items), rich scope (no. 101, 103, 105–110 from 44 till 50 spatial items), relatively rich scope (no. 111, 112, 115), average scope (no. 113, 114), and narrow scope (no. 117–119).

The possibilities and real application of satellite data derivative information in topographic databases and selected key thematic databases

Analysis of the possibilities of application of satellite data derivative information carried out for 33 topographic databases (for which the lists of objects were available), has revealed that remote sensing data can be employed (like main, auxiliary or supplementary source material) for the generation of information about 235 of 301 groups of items included in these databases (Tab. 6). Apart from information about administrative and special divisions, as well as geodetic network, it was difficult to acquire information about indistinctly defined objects (e.g. ‘other sport facility’), underground or little objects (‘post box’), as well as part of its attributes, related to the function (‘court’, ‘office building’). It was possible to identify 27 variants of possible applications of remote sensing data, which can be divided into the 5 main groups of potential application of:

1. all remote sensing data (in the case of sea, mangrove and glaciers),
2. very high and high resolution passive data and SAR data (essential for accurate delimitation of swamps, pit bogs, flood lands, marshes),
3. very high, high and medium resolution passive data (in the case of land cover and land use items);
4. very high and high resolution passive data (mainly in the case of medium area objects);

Table 6. Possibilities of usage of satellite data derivative information in European and EU topographic databases

Level 1	Level 2	Level 3	Databases	WorldViev-1	Quick Bird	Ikonos	Kompsat-2	EROS A-1	Kosmos KVR 1000	Kosmos TK 350	IRS	Formosat-2	SPOT 2	SPOT 4	SPOT 5	Landsat TM	Terra-ASTER	ERS	Sich – 1 M	RADARSAT	ALOS	ENVISAT
Hydrography	Sections of rivers and channels	River, stream	3, 4, 6, 9, 11, 12, 14, 15, 16, 17, 21, 22, 27, 34, 35, 36, 38, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 56, 58, 59, 62	X	X	X	X	A	A	A	A	A	A	A	A	A	A	A	S	A	A	A
		Channel	3, 4, 6, 9, 11, 12, 14, 15, 16, 17, 21, 22, 27, 35, 36, 38, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 56, 58, 59, 62	X	X	X	X	A	A	A	A	A	A	A	A	A	A	A		A	A	A
	Irrigation channels	Irrigation channel	3, 4, 6, 14, 15, 16, 17, 21, 22, 27, 35, 36, 38, 43, 44, 45, 46, 48, 51, 52, 53, 59, 62	X	X	X	X	A	A	A	A	A	A	A	A	A	A	S		S	A	S
	Watershed (3, 6)	Watershed border	3, 6																			
Roads and Railways Network	Paved roads (3, 4, 34, 43, 47, 49, 53, 58, 62)	Motorway	3, 4, 6, 9, 11, 12, 17, 21, 22, 27, 34, 35, 36, 38, 44, 45, 46, 48, 49, 50, 51, 52, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	S	S	X	S
		Express road, express street	3, 4, 6, 9, 11, 12, 17, 21, 22, 38, 44, 45, 46, 48, 52, 56, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S		S	X	S
		Fast circulation road	3, 4, 6, 9, 17, 21, 22, 46, 48, 51, 52, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S		S	X	S
		Main road, Main street	3, 4, 6, 9, 11, 12, 14, 15, 16, 17, 21, 22, 27, 34, 35, 36, 38, 44, 45, 46, 48, 49, 50, 51, 52, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	
		Captivating arterial road, street	46, 51, 62	X	X	X	X	X	X	X	X	X	S	S	A	S	S				X	
		Local road, local street	3, 4, 6, 11, 12, 14, 15, 16, 17, 21, 22, 27, 34, 35, 36, 38, 44, 45, 46, 48, 49, 50, 51, 52, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	S	S	A	S	S				X	
		Other road, other street	3, 4, 6, 9, 11, 12, 14, 15, 16, 17, 21, 22, 27, 34, 35, 36, 38, 44, 45, 46, 48, 49, 50, 51, 52, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	S	S	A	S	S				X	
	Unpaved roads (3, 4, 6, 21, 34, 49, 53, 58, 62)	Passable road	6, 11, 12, 21, 22, 38, 44, 45, 58, 59,	X	X	X	X	X	X	X	X	X	S	S	A	S	S				X	
		Road created by frequent usage	6, 21, 44, 45, 48, 58, 59, 62	X	X	X	X	X	X	X	X	X	S	S	A	S	S				X	
		Inpassable road	6, 58,	S	S	S	S															
		Winter road	9, 14, 15, 16, 17, 58, 59	A	A	A	A	A	A						A						A	
		Channel road	3, 9, 17, 27	A	A	A	A	A	A						A						A	
	Pedestrian and bicycle paths (6, 9)	Alley, passage	3, 14, 15, 16, 17, 21, 27, 35, 36, 38, 43, 44, 45, 46, 48,49, 52, 56, 62	X	X	X	X	X	X						X						X	
		Path	3, 4, 11, 12, 14, 15, 16, 17, 21, 27, 35, 36, 38, 43, 44, 45, 46, 48, 49, 50, 52, 56, 58, 62	A	A	A	A	A	A						A						A	
		Bicycle paths	3, 4, 38, 58, 62	A	A	A	A	A	A						A						A	
	Railway tracks (3, 4, 9)	Railway tracks	3, 4, 6, 11, 12, 14, 15, 16, 17, 21, 22, 27, 35, 36, 38, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	
		Electrified tracs	3, 4, 6, 9, 11, 21, 22, 27, 38, 44, 45, 48, 49, 50, 58, 59,	X	X	X	X	X	X													
		Inactive tracs	3, 4, 6, 9, 21, 22, 27, 44, 45, 48, 49, 50, 58, 59,	A	A	A	A															
		Museum tracs	21, 48, 49,	S	S	S	S															
		Tramway tracks	3, 4, 6, 21, 22, 22, 27, 46, 48, 49, 50, 52, 53, 62	X	X	X	X	X	X	A	A	S	S	A	X	S	S				X	
		Underground tracks	3, 4, 6, 9, 17, 21, 27, 46, 48, 56, 58, 59, 62																			
	River crossings	Ferry	3, 4, 6, 9, 11, 12, 14, 15, 16, 17, 21, 22, 35, 36, 43, 46, 48, 49, 50, 52, 56, 62																			
		Boat crossing	11, 12, 14, 15, 16, 17, 21, 22, 46																			
		Ford	6, 21, 34, 35, 36,43, 46, 48, 52, 62	S	S	S	S	S	S												S	
Waterways	Waterways	Waterways	14, 15, 16, 17, 27, 58, 59, 62																			
		Wreck	14, 15, 16, 17, 27	S	S	S	S															
		Reef	21	A	A	A	A	A	A												A	
		Navigation lights	11, 12, 14, 15, 16, 17, 27, 34	S	S	S	S															
		Buoy	14, 15, 16, 17, 27																			
		Berth	17, 27																			
		Space under keel	17, 27																			
Infrastructure networks	Electro – energetic lines (3, 4, 6, 9, 11, 12, 14, 15, 16, 34, 44, 45, 51, 52, 58, 62)	Power lines on the girdors	17, 21, 35, 36, 38, 43, 46, 53,	A	A	S	S														S	
		Energetic lines on the pylons	17, 21, 35, 36, 38, 43, 46, 48, 53,	A	A	S	S														S	
	Telecommunication lines	Telecommunication lines (telephone, telegraph)	3, 14, 15, 16, 17, 21, 34, 36, 46, 52, 53, 62	S	S	S	S															
	Pipelines (3)	Water supply lines	14, 15, 16, 17, 21, 46, 52, 53, 58, 62																			
		Sewage lines	17, 21, 46, 49, 52, 53,																			
		Gas pipe	6, 17, 21, 27, 35, 43, 44, 45, 46, 48, 51, 52, 53, 56, 58, 62	A	A	A	A	A	A												A	
		Oil line	17, 21, 27, 35, 43, 44, 45, 46, 48, 49, 50, 52, 53, 58, 62	A	A	A	A	A	A												A	
		Heating pipe	3, 17, 21, 43, 46, 52, 58,																			
Land cover complexes	Waters	Sea	3, 4, 9, 11, 12, 14, 15, 16, 17, 21, 27, 34, 35, 43, 46, 47, 48, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Rivers	3, 4, 6, 9, 11, 12, 14, 15, 16, 17, 21, 27, 34, 38, 35, 43, 46, 47,48, 51, 52, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	A		A	X	A
		Water bodies	3, 4, 6, 9, 11, 12, 14, 15, 16, 17, 21, 27, 34, 38, 35, 43, 46, 47,48, 51, 52, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	A	A	A	X	A
		Saline	21	X	X	X	X	X	X	X	X	X	X	X	X	X	X	A	A	A	X	A

Table 6 continued

Level 1	Level 2	Level 3	Databases	WorldViev-1	Quick Bird	Ikonos	Kompsat-2	EROS A-1	Kosmos KVR 1000	Kosmos TK 350	IRS	Formosat-2	SPOT 2	SPOT 4	SPOT 5	Landsat TM	Terra-ASTER	ERS	Sich – 1 M	RADARSAT	ALOS	ENVISAT
Land cover complexes	Build - up areas (11, 12, 14, 15, 16, 22, 35, 36, 43, 47, 48, 51, 52, 58, 59)	Block build – up areas	27, 35, 38, 46, 48, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	A	X	A
		City centre build – up areas/ High building	9, 27, 46, 48, 51, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	S
		Single family housing/Low building	9, 27, 38, 46, 48, 51, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	S
		Industrial and storage build-up areas	6, 9, 11, 12, 21, 22, 38, 46, 48, 52, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	S
		Other build-up areas	38, 46, 48, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	S
	Forest and trees areas	Forest	3, 4, 6, 9, 11, 12, 14, 15, 16, 17, 21, 22, 27, 35, 36, 38, 43, 46, 47, 48, 49, 50, 51, 52, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	A
		Mangrove	21, 22	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Grove	3, 4, 6, 11, 12, 14, 15, 16, 17, 21, 22, 27, 35, 36, 38, 43, 46, 48, 49, 50, 51, 52, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	A
		Other tree – covered areas	17, 21, 27, 35, 36, 43, 46, 48, 52, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	A
		Poplar plantation	3, 60, 61	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	A
	Bush areas	Bush	3, 6, 11, 12, 14, 15, 16, 17, 21, 22, 27, 34, 35, 36, 38, 46, 48, 49, 50, 51, 52, 56, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	A
		Dwarf mountain pine	6, 46, 47, 52	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	A
		Lands	3, 4, 21, 22	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	A
		Lands with trees	3, 4, 21, 22	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	A
		Moors	9, 11, 12, 14, 15, 16, 34, 38, 48, 49	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	S	S	X	S
	Permanent cultures (9, 48)	Orchard	3, 6, 11, 14, 15, 16, 17, 21, 22, 27, 35, 36, 38, 46, 47,48,49, 50, 52, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	A
		Plantation	3, 6, 11, 17, 21, 22, 27, 35, 36, 38, 39, 44, 45, 46, 47, 52, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	A
		Vineyard	1, 2, 3, 21, 22, 23, 25, 26, 38, 39, 44, 45, 53, 54, 66	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	S	S	X	S
		Rose plantation	3, 4	A	A	A	A	A	A	A	A	A	A	A	A	A	A				A	
		Garden plot, Alottment	3, 6, 11, 14, 15, 16, 17, 21, 22, 27, 35, 36, 38, 46, 58, 49, 52, 58, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	S	S	X	S
	Arable lands and meadows	Arable land	3, 4, 6, 11, 12, 14, 15, 16, 17, 27, 34, 35, 36, 38, 43, 46, 47, 48, 49, 50, 51, 52, 56, 58, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	A
		Grass covered areas/ Meadows	3, 4, 6, 11, 12, 14, 15, 16, 17, 21, 22, 27, 34, 35, 36, 38, 43, 46, 47, 48, 49, 50, 52, 53, 56, 58, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	A	S	X	A
	Other vegetation	Ruderal vegetation	3	X	X	X	X	X	X						X						X	
		Ruderal vegetation with bushes	3	X	X	X	X	X	X						X						X	
	Communicaton areas(9)	Roads area	3, 21, 27, 35, 36, 43, 46, 48, 52, 53, 62	X	X	X	X	X	X	X	X	X	S	S	A	S	S				X	
		Railways area	3, 6, 17, 21, 27, 35, 43, 46, 48, 51, 52, 53, 56, 62	X	X	X	X	X	X	X	X	X	S	S	A	S	S				X	
		Road / railways area	3, 6, 46, 52	X	X	X	X	X	X												X	
		Airport area	3, 4, 11, 12, 14, 15, 16, 17, 21, 34, 35, 36, 38, 43, 46, 47, 52, 53, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	S	S	X	S
	Sand, gravel areas, rocks	Sand or gravel areas	3, 4, 9, 11, 12, 14, 15, 16, 17, 21, 22, 27, 35, 36, 43, 46, 48, 49, 50, 51, 52, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	S	S	X	S
		Stone area	3, 9, 11, 12, 17, 21, 22, 34, 35, 43, 46, 48, 49, 50, 52, 53, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	S	S	X	S
		Scree, Mound of stones, Rocks	3, 4, 21, 22, 34, 35, 46, 48, 49, 50, 51, 52, 53, 56, 58, 59, 62	X	X	X	X	X	X	A	A	X	X	X	X	X	X	S	S	S	X	S
		Sludge	3	X	X	X	X	X	A	A	A	X	X	X	X	X	X	S	S	S	X	S
		Ooze	27	X	X	X	X	X	X	A	A	X	X	X	X	X	X	S	S	S	X	S
		Watt	11, 12, 27, 48	X	X	X	X	X	X	A	A	X	X	X	X	X	X	S	S	S	X	S
		Areas without a vegetation	3, 17, 27, 34, 35, 46, 48, 49, 50, 52, 53, 56, 62	X	X	X	X	X	X	A	A	X	X	X	X	X	X	S	S	S	X	S
		Glaciers	21, 22, 34, 48, 53, 58, 59	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Industrial and storage areas (9, 14, 15, 16, 43 58, 59)	Technical facilities area	46																			
		Paved yard	21, 27, 35, 46, 52, 56	X	X	X	X	X	X	A	A	X	X	X	X	X	X	S	S	S	X	S
		Waste stockpile	3, 4, 17, 21, 46, 51, 52, 62	X	X	X	X	X	X	A	A	X	X	X	X	X	X	S	S	S	X	S
		Dump area	6, 14, 15, 16, 17, 21, 27, 46, 48, 51, 52, 56, 62	X	X	X	X	X	X	A	A	X	X	X	X	X	X	S	S	S	X	S
		Pit area	6, 14, 15, 16, 17, 21, 22, 35, 46, 48, 51, 52, 56, 58, 59, 62	X	X	X	X	X	X	A	A	X	X	X	X	X	X	X	S	X	X	X
		Other industrial and storage areas	46, 56, 62																			
		Unpaved yard	6, 35, 46, 52	X	X	X	X	X							X						X	
Buildings and structures	Buildings (9, 34, 43, 49, 50, 53)	Residential building	3, 4, 6, 9, 11, 12, 14, 15, 16, 17, 21, 27, 35, 36, 38, 46, 48, 49, 51, 52, 56, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Industrial building	3, 4, 6, 11, 12, 14, 15, 16, 17, 21, 27, 35, 36, 38, 46, 48, 49, 52, 56, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Active industrial building	3, 38, 62	A	A	A	A	A							A						A	
		Inactive industrial building	3, 38, 62	A	A	A	A	A							A						A	
		Transport, communication facilities building	3, 6, 9, 17, 21, 27, 35, 36, 38, 43, 46, 48, 51, 52, 56, 62	A	A	A	A	A							A						A	
		Commercial, service centre building	3, 21, 38, 46, 48, 52, 56, 62	X	X	X	X	X							X						X	
		Storehouse, tank, silo	3, 6, 9, 14, 15, 16, 21, 22, 35, 38, 43, 46, 48, 52, 53, 56, 58, 62	X	X	X	X	X							X						X	

Buildings and structures	Buildings (9, 34, 43, 49, 50, 53)	Office building	3, 6, 17, 21, 22, 27, 38, 46, 48, 49, 50, 51, 52, 62																			
		Court	6, 38, 48, 62																			
		Post	6, 38, 21, 22, 62																			
		Health Centre, Social Security Centre	3, 6, 21, 27, 38, 46, 48, 51, 52, 56, 62																			
		Education, science, culture, sport building	3, 6, 21, 27, 38, 46, 48, 51, 52, 56, 62	A	A	A	A	A							A						A	
		Agricultural production building	3, 21, 27, 46, 48, 52, 62	X	X	X	X	X							X						X	
		Religious building	3, 6, 11, 12, 14, 15, 16, 17, 21, 27, 35, 36, 38, 44, 45,46, 48, 49, 50, 51, 52, 56, 58, 59, 62	X	X	X	X	X							X						X	
		Inactive religious building	3	A	A	A	A															
		Fire station	3, 21, 38, 48, 58, 62	A	A	A	A	A							A						A	
		Police station	3, 4, 21, 38, 48, 58, 62																			
		Hangar	3, 4, 6, 21, 48, 62	X	X	X	X	X							X						X	
		Garage	6, 14, 15, 16, 21, 48, 62	X	X	X	X	X							X						X	
		Other building	3, 17, 21, 46, 48, 51, 62																			
	Bridge structures	Bridge, viaduct, overpass	3, 6, 14, 15, 16, 17, 21, 27, 35, 36, 38, 43, 44, 45, 46, 48, 49, 50, 51, 52, 53, 56, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Tunnel	6, 9, 17, 21, 27, 35, 36, 44, 45, 46, 48, 49, 50, 51, 52, 53, 56, 62																			
		Underground passage	3, 14, 15, 16, 17, 21, 27, 35, 43, 46, 51, 52, 53, 56, 62																			
		Pedestrian overpass	3, 6, 14, 15, 16, 17, 21, 27, 35, 36, 43, 46, 51, 52, 53, 56, 62	X	X	X	X	X							X						X	
		Culvert	3, 6, 21, 43, 46, 52, 62	A	A	A	A	A														
	Hydrotechnical structures (3)	Movable weir	17, 21, 27, 46, 48, 52, 62	S	S	S	S															
		Solid weir	17, 14, 15, 16, 21, 22, 27, 38, 43, 46, 48, 51, 52, 62	X	X	X	X	X							X						X	
		Lock, sluice	6, 4, 14, 15, 16, 17, 21, 22, 27, 35, 36, 43, 46, 48, 49, 50, 52, 56, 58, 59, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	
		Dam	3, 4, 6, 9, 14, 15, 16, 17, 21, 22, 27, 35, 38, 43, 44, 45,46, 48, 49, 50, 51, 52, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	
	Sport facilities (49)	Outdoor swimming pool	3, 6, 9, 14, 15, 16, 21, 22, 35, 36, 38, 43, 44, 45, 46, 48, 49, 50, 52, 58, 62	X	X	X	X	X							X						X	
		Indoor swimming pool with plastic roof	3, 21, 46	X	X	X	X	X							X						X	
		Stadium	6, 14, 15, 16, 21, 38, 43, 44, 45, 46, 48, 49, 50, 52, 56, 58, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Ski jump	6, 21, 43, 46, 49, 50, 52, 53, 56	X	X	X	X	X	X	S	S	S	S	S	X	S	S				X	
		Artificial ski slope	21, 46, 53	X	X	X	X	X	X	S	S	S	S	S	X	S	S				X	
		Other sport facility	4, 43, 46																			
	High technical structures	Chimney	3, 4, 6, 14, 15, 16, 17, 21, 22, 35, 38, 43, 46, 49, 50, 51, 52, 53, 62	X	X	X	X	A							A						A	
		Cooling tower	3, 4, 9, 11, 12, 17, 21, 35, 38, 43, 46, 51, 52, 53, 62	X	X	X	X	A							A						A	
		Water tower	3, 4, 6, 11, 12, 14, 15, 16, 17, 21, 22, 27, 35, 38, 43, 46, 48, 49, 50, 51, 52, 53, 58, 59, 62	X	X	X	X	A							A						A	
		Telecommunication mast	3, 4, 6, 9, 11, 12, 14, 15, 16, 17, 21, 27, 35, 36, 43, 46, 48, 49, 50, 51, 52, 53, 58, 59, 62	X	X	X	X	A							A						A	
		Lamp standard	3, 17, 21, 27, 35, 43, 46, 48, 51, 52, 53, 62																			
		Tower superstructure	6	S	S	S	S															
		Wind turbine	3, 4, 6, 9, 11, 12, 14, 15, 16, 17, 21, 27, 35, 36, 43, 46, 48, 49, 50, 52, 56, 58, 59, 62	X	X	X	X															
		Mineshaft tower	3, 6, 21, 27, 44, 45, 46, 49, 50, 51, 52, 56, 62	A	A	A	A															
		Girder	3, 17, 21, 43, 46, 52, 56, 62																			
		Other high industrial structure	6, 21, 43, 46, 51, 62																			
	Technical basins	Stable material tank	3, 21, 35, 36, 46, 52, 53, 62	X	X	X	X	A							A						A	
		Fuel or gas tank	3, 6, 14, 15, 16, 17, 21, 35, 46, 52, 62	X	X	X	X	A							A						A	
		Technical water tank	3, 9, 21, 35, 43, 46, 51, 52, 62	A	A	A	A															
		Settling tank	3, 21, 35, 46, 52, 62	A	A	A	A															
	Bank reinforcements	Water reinforcement wall	3, 4, 11, 12, 14, 15, 16, 17, 21, 27, 35, 36, 43, 44, 45, 46, 48, 62	X	X	X	X	A							A						A	
		Groin	3, 4, 9, 17, 21, 27, 35, 43, 46, 48, 62																			
		Breakwater	3, 4, 9, 11, 12, 14, 15, 16, 17, 21, 27, 35, 36, 43, 46, 62	X	X	X	X	A							A						A	
		Bank protection	3, 17, 11, 12, 21, 27, 43, 46, 48, 62	X	X	X	X	A							A						A	
	Road and railways reinforcements	Road or railroad reinforcement wall	3, 17, 21, 27, 35, 46, 48, 52, 62	X	X	X	X	A							A						A	
		Platform, ramp	3, 21, 27, 43, 46	X	X	X	X	A							A						A	
	Walls	Stable wall	3, 4, 9, 11, 12, 21, 27, 35, 38, 43, 44, 45, 46, 48, 49, 50, 52, 56, 62	X	X	X	X	A							A						A	
		Historic wall	3, 21, 43, 46, 48, 49, 50, 52, 62	X	X	X	X	A							A						A	
	Earth structures	Causeway	3, 4, 9, 11, 12, 17, 21, 27, 43, 44, 45, 46, 48, 52, 62	X	X	X	X	A							A						A	
		Embankment	3, 4, 9, 11, 12, 17, 21, 27, 35, 36, 43, 44, 45, 46, 48, 52, 62	X	X	X	X	A							A						A	
		Dig, dry moat	3, 4, 17, 21, 27, 43, 46, 62	X	X	X	X	A							A						A	
	Transport facilities	Conveyor	6, 21, 43, 46, 48, 62	X	X	X	X	A							A						A	
		Gauntry	21, 46, 48, 62	X	X	X	X	A							A						A	
		Railway turn-plate	3, 4, 14, 15, 16, 21, 38, 46, 62	X	X	X	X	A							A						A	
		Cableway	3, 6, 17, 21, 22, 27, 35, 36, 43, 44, 45, 46, 48, 49, 50, 51, 52, 53, 62	X	X	X	X	A							A						A	
		T-bar	3, 21, 22, 43, 44, 45, 46, 48, 49, 51, 52, 53, 62	X	X	X	X	A							A						A	

Table 6 continued

Level 1	Level 2	Level 3	Databases	WorldViev-1	Quick Bird	Ikonos	Kompsat-2	EROS A-1	Kosmos KVR 1000	Kosmos TK 350	IRS	Formosat-2	SPOT 2	SPOT 4	SPOT 5	Landsat TM	Terra-ASTER	ERS	Sich – 1 M	RADARSAT	ALOS	ENVISAT
Building and structures	Other technical facilities and structures	Transformer	3, 6, 9, 21, 35, 43, 44, 45, 46, 48, 51, 52, 58, 62	S	S	S	S															
		Transformer group	3, 9, 21, 35, 43, 44, 45, 46, 52, 58, 62	X	X	X	X															
		Weather station	6, 21, 35, 46, 48, 62	A	A	A	A	A	S						S						S	
		Petrol pump complex	3, 27, 35, 46, 48, 62	A	A	A	A															
		Oil terminal	3, 21, 46, 48, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Water intake	6, 9, 21, 27, 35, 43, 46, 48, 49, 51, 52, 53, 62																			
		Oil well, gas well	21, 35, 46, 52, 62	A	A	A	A	A	S						S						S	
	Cemeteries	Group of tombs	21, 35, 46, 51, 52, 62	X	X	X	X	X	A	A	A	A	A	A	A	A	A				X	
	Other structures	Stand	3, 43, 46, 48, 51, 52, 62	X	X	X	X															
		Stage	21, 43, 46, 48, 51, 52	X	X	X	X															
Land use complex	Residential complex	Housing estate	46, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Group of properties	43, 46, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
	Industrial complex	Industrial, services, renovation plant	3, 6, 21, 46, 62																			
		Open cast mine	3, 9, 17, 21, 35, 36, 38, 43, 46, 49, 50, 51, 52, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Power station	3, 4, 6, 14, 15, 16, 21, 34, 35, 36, 38, 43, 44, 45, 46, 48, 49, 50, 52, 53, 56, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Combined heat & power station	9, 21, 35, 46, 48, 52, 56	A	A	A	A	A	A													
		Gasworks	3, 21, 38, 46, 48, 52, 56, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Water works	3, 6, 21, 27, 35, 36, 46, 48, 52, 53, 56, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Recycling plant	21, 46, 62	S	S	S	S															
		Sewage treatment plant	3, 21, 22, 27, 44, 45, 46, 48, 52, 53, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Dump	9, 14, 15, 16, 17, 21, 22, 46, 47, 48, 52, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Transformer station	3, 6, 9, 17, 21, 27, 35, 46, 48, 49, 52, 53, 56, 62	S	S	S	S															
		Pumping station	3, 4, 6, 21, 22, 27, 46, 48, 49, 52, 53, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Animal breeding farm	3, 6, 21, 46, 52, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
	Commercial and service complex	Commercial centre	3, 21, 27, 38, 46, 52, 53, 56, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Market place, bazaar	17, 21, 46, 52, 56, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
	Communication complex	Airport, airfield	3, 6, 9, 11, 12, 17, 21, 27, 34, 35, 36, 38, 43, 46, 47, 48, 49, 50, 51, 52, 53, 56, 58, 62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	S	S	S	X	S
		Runway	3, 4, 6, 21, 27, 44, 45, 48, 49, 50, 53, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Parkway	3, 4, 21, 27, 48, 49,53, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Heliport	3, 11, 12, 21, 48, 53, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Port, harbour	3, 4, 6, 9, 11, 12, 17, 21, 27, 35, 43, 46, 48, 49, 50, 52, 56, 58, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Railway station	3, 4, 6, 11, 12, 17, 21, 22, 27, 35, 44, 45, 46, 48, 49, 50, 52, 56, 58, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Bus station	21, 46, 48, 52, 56, 62	X	X	X	X	X	A						X						X	
		Underground station	3, 21, 27, 46, 56, 58, 62																			
		Filling station	3, 27, 35, 43, 46, 48, 52, 56, 62	X	X	X	X	X	A						X						X	
		Parking	3, 4, 6, 9, 21, 22, 27, 35, 43, 46, 48, 52, 56, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Toll point	21, 22, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Phone box	62																			
		Postbox	62																			
		Depot, transport base	3, 6, 9, 17, 21, 27, 35, 43, 46, 48, 51, 52, 56, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
	Sport and leisure complex (9, 58)	Sport & leisure centre	3, 6, 17, 21, 27, 43, 46, 48, 51, 52, 53, 56, 62	S	S	S	S															
		Complex of holiday houses	6, 46	X	X	X	X	X	X	S	S	S	S	S	X	S	S				X	
		Park	6, 4, 11, 12, 14, 15, 16, 17, 21, 27, 35, 36, 38, 43, 46, 47, 48, 49, 50, 51, 52, 53, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Botanic garden	3, 21, 27, 38, 46, 52, 53, 62	X	X	X	X	X	X	S	S	S	S	S	X	S	S				X	
		Zoo	3, 4, 6, 14, 15, 16, 21, 27, 38, 46, 48, 52, 53, 62	X	X	X	X	X	X	S	S	S	S	S	X	S	S				X	
		Safari park	6, 21, 48	X	X	X	X	X	X	S	S	S	S	S	X	S	S				X	
		Car cinema	48, 62	X	X	X	X	X	X	S	S	S	S	S	X	S	S				X	
		Amusement park	4, 62	X	X	X	X	X	X	S	S	S	S	S	X	S	S				X	
		Rugby ground	62	X	X	X	X	X	A						X						X	
		Greyhound Stadium	62	X	X	X	X	X	A						X						X	
		Cricket ground	62	X	X	X	X	X	A						X						X	
		Golf area	3, 4, 6, 11, 12, 17, 21, 27, 48, 49, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	

Land use complex	Hotels and tourists services complex (9)	Hotel, Motel area	21, 27, 46, 52, 56	X	X	X	X	X														
		Holiday centre	3, 6, 21, 27, 46, 52, 62	S	S	S	S															
		Camping	6, 11, 12, 17, 21, 27, 43, 46, 48, 49, 52, 62	X	X	X	X	X	X	S	S	S	S	S	X	S	S				X	
		Mountain shelter, hostel	6, 21, 27, 46, 52, 62	S	S	S	S															
	Education complex	School, school group	3, 4, 6, 21, 27, 34, 46, 48, 52, 56, 62	X	X	X	X	X	A						X						X	
		High school	3, 4, 21, 27, 38, 46, 48, 52, 56, 62	X	X	X	X	X	A						X						X	
		Scientific station, scientific centre	21, 27, 38, 46, 48, 52, 62	X	X	X	X	X														
		Astronomical observatory	6, 62	X	X	X	X	X														
		Nursery school, Kindergarten	21, 27, 46, 48, 52, 62	X	X	X	X	X	A						X						X	
	Health, Social Security complex	Hospital, sanatorium	3, 4, 6, 11, 12, 14, 15, 16, 21, 22, 27, 38, 44, 45, 46, 48, 49, 50, 51, 52, 56, 62	S	S	S	S															
		Social security facility, Children's home	3, 21, 27, 46, 52, 62																			
	Historical monuments complex (9)	Castle	3, 4, 6, 11, 12, 21, 38, 44, 45, 46, 48, 49, 50, 52, 56, 62	X	X	X	X	X	X	S	S	S	S	S	X	S	S				X	
		Palace	6, 11, 12, 21, 38, 44, 45, 46, 48, 49, 50, 52, 56, 62	X	X	X	X	X	A						X						X	
		Fortress	6, 11, 12, 21, 44, 45, 46, 48, 52, 53, 62	X	X	X	X	X	X	S	S	S	S	S	X	S	S				X	
		Skansen	6, 21, 46, 48, 52, 62	X	X	X	X	X	A						X						X	
		Museum	6, 21, 27, 46, 48, 52, 62	S	S	S	S															
		Place of national martyrology	21, 22, 35, 46, 48, 62	X	X	X	X															
	Sacral complex and cemeteries (9)	Sacral complex, Couvent	3, 4, 6, 17, 21, 27, 35, 38, 43, 46, 48, 52, 53, 56, 62	X	X	X	X	X	A						X						X	
		Cemetery	3, 4, 6, 9, 11, 12, 14, 15, 16, 17, 21, 22, 27, 35, 38, 43, 46, 48, 49, 50, 51, 52, 53, 56, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
	Dangerous Areas (48)	Shooting range	6, 11, 12, 21, 48, 53	X	X	X	X	X	A						X						X	
		Polygon	21, 48, 58, 59, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Test area	48	X	X	X	X															
		Mining damage area	48	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Polder	48	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Floodland	44, 45, 48	X	X	X	X	X	X	A	A	A	A	A	X	A	A	X	X	X	X	X
		Landslide areas	48, 53	X	X	X	X															
	Other complex of land use	Special institution	3, 21, 46, 62																			
		Prison	3, 4, 21, 48	X	X	X	X	X	A						X						X	
		Fallows	21, 48	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Other complex of land use	3, 9, 21, 46, 62																			
Other objects	Nature objects	Source	3, 4, 6, 11, 12, 14, 15, 16, 17, 21, 22, 27, 34, 38, 46, 51, 52, 53, 62																			
		Mineral water source	6																			
		Waterfall	3, 6, 17, 21, 34, 46, 49, 51, 52, 58, 62	X	X	X	X															
		Rock steep	6, 9, 21, 34, 46, 51, 52, 62	X	X	X	X															
		Line of trees	3, 6, 9, 14, 15, 16, 17, 21, 27, 35, 46, 48, 49, 52, 53, 62	X	X	X	X	X	A						X						X	
		Tree	3, 6, 9, 14, 15, 16, 17, 21, 35, 46, 48, 49, 52, 53, 62	X	X	X	X	X	A						X						X	
		Group of trees	3, 6, 9, 14, 15, 16, 17, 21, 27, 35, 46, 49, 52, 53, 62	X	X	X	X	X	A						X						X	
		Hedge, Line of bushes	3, 9, 17, 21, 27, 35, 46, 48, 49, 52, 62	X	X	X	X	X	A						X						X	
		Group of bushes	3, 17, 21, 27, 35, 46, 52, 53, 62	X	X	X	X	X	A						X						X	
		Group of dwarf mountain pine	46, 52	X	X	X	X	X	X	A	S	S	A	A	X	S	S				X	
		Firebreak	6, 17, 27, 43, 46, 52, 62	X	X	X	X	X	A						X						X	
		Isolated rock	3, 6, 9, 14, 15, 16, 17, 21, 43, 44, 45, 46, 48, 52 ,53, 62	X	X	X	X	X	A						X						X	
		Erratic block	3, 9, 17, 21, 43, 46, 62																			
		Mound of stones	3, 17, 21, 46, 48, 52, 53, 62	X	X	X	X	X	A						X						X	
		Entrance to the cave	3, 6, 34, 46, 52, 53, 62																			
	Communication objects	Bus stop, tramway stop	17, 21, 27, 46, 52, 53, 56, 62	S	S	S	S															
		Railway stop	3, 6, 9, 11, 12, 14, 15, 16, 17, 21, 27, 46, 48, 52, 53, 56, 62	X	X	X	X	X	A						X						X	
		Underground entrance	3, 17, 46, 48, 52, 56	S	S	S	S															
		Steps	3, 21, 46, 52, 53, 62	X	X	X	X															
		Signal device	17, 46, 62																			
		Semaphore	46, 62																			
		Road kilometre post	3, 27, 35, 46, 48, 62																			
		Fluvial kilometre post	3, 27, 35, 46, 48, 62																			

Table 6 continued

Level 1	Level 2	Level 3	Databases	WorldVIev-1	Quick Bird	Ikonos	Kompsat-2	EROS A-1	Kosmos KVR 1000	Kosmos TK 350	IRS	Formosat-2	SPOT 2	SPOT 4	SPOT 5	Landsat TM	Terra-ASTER	ERS	Sich – 1 M	RADARSAT	ALOS	ENVISAT
Other objects	Landmark objects	Monument, figure	3, 4, 11, 12, 17, 21, 27, 35, 46, 48, 49, 50, 52, 53, 62	X	X	X	X															
		Chapel, cross	3, 6, 11, 12, 21, 27, 35, 38, 44, 45, 46, 48, 49, 50, 52, 53, 62	X	X	X	X															
		Isolated tomb	6, 27, 35, 46, 48, 52, 62																			
		Bunker, shelter	21, 27, 46, 48, 52, 62	X	X	X	X															
		Roadside post	62																			
		Shed, garden house	21, 46, 52, 62	S	S	S	S															
		Drilled well	3, 21, 35, 46, 48, 62																			
		Fountain	3, 6, 17, 21, 27, 35, 38, 43, 46, 48, 52, 53, 62	A	A	A	A															
		Water meter	17, 27, 35, 4 44, 45, 46, 53, 62																			
		Pier, jetty	3, 4, 9, 17, 21, 27, 35, 43, 44, 45, 46, 48, 49, 50, 53, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
		Beacon	11, 12, 27, 48, 62																			
		Observation tower, Triangulation tower	3, 4, 6, 9, 11, 12, 17, 21, 27, 35, 38, 43, 46, 48, 51, 52, 53, 62	A	A	A	A															
		Greenhouse	3, 4, 6, 9, 11, 12, 21, 27, 35, 38, 46, 48, 52, 53, 56, 62	X	X	X	X	X	X	A	S	S	A	A	X	S	S				X	
		Windmill	3, 4, 6, 11, 12, 14, 15, 16, 17, 21, 27, 38, 44, 45, 46, 48, 49, 52, 56, 62	X	X	X	X															
		Ruin	3, 4, 6, 11, 12, 21, 27, 35, 43, 44, 45, 46, 48, 49, 50, 51, 52, 53, 56, 58, 62	X	X	X	X															
		Tumulus	4, 11, 12, 48, 58, 62	X	X	X	X	X	A						X						X	
		Dolmen	21, 62	X	X	X	X															
		Menhir	3, 21, 62	X	X	X	X															
	Buggy and marshy areas	Marshy area (seasonal marsh)	3, 4, 6, 11, 12, 17, 21, 27, 34, 46, 48, 52, 53, 58, 59, 62	X	X	X	X	X	X	S	S	S	S	S	X	S	S	X	X	X	X	X
		Bog, Marsh	3, 4, 6, 11, 12, 17, 21, 27, 34, 35, 38, 46, 47, 48, 52, 53, 58, 59, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A	X	X	X	X	X
	Reeds, Bulrush	Reeds, Bulrush	21, 34, 46, 48, 52, 62	X	X	X	X	X	X	A	A	A	A	A	X	A	A				X	
Protected areas	National and landscape parks	National Park	17, 21, 22, 35, 44, 45, 46, 47, 48, 49, 50, 52, 53, 58, 59, 62																			
		Landscape Park	6, 17, 21, 22, 35, 43, 44, 45, 46, 47, 48, 49, 50, 52, 53, 58, 59, 62																			
	Reserves	Reserve	6, 17, 21, 22, 35, 43, 44, 45, 46, 47, 48, 49, 50, 52, 53, 58, 59, 62																			
Administration and evidence units	Administration units	Commune	3, 4, 6, 11, 12, 14, 15, 16, 17, 21, 22, 34, 35, 44, 45,46, 48, 49, 50, 52, 53, 58, 59, 62																			
		Quarter	3, 4, 6, 14, 15, 16, 17, 21, 22, 35, 44, 45, 46, 48, 49, 50, 52, 53, 62																			
		State boundary	3, 4, 6, 9, 11, 12, 14, 15, 16, 17, 21, 22, 27, 35, 36, 38, 44, 45, 47, 48, 49, 50, 53, 58, 59																			
		Sea boundary	14, 15, 16, 17, 27, 34																			
		Sea economic zone boundary	14, 15, 16, 17, 27, 34																			
		Statistical area boundary	21, 22,																			
	Evidence units	Bounds	3, 17, 21, 46, 48, 52, 56, 62																			
		Forest section	17, 21, 35, 46, 52, 62																			
	Restricted areas (27, 48)	Restricted areas	27, 48																			
	Localities	City	6, 17, 21, 22, 35, 46, 48, 52, 62																			
		Village	6, 17, 21, 22, 35, 46, 48, 52, 62																			
		Other locality	17, 21, 22, 35, 46, 48, 52, 62																			
Geodetic and photogrammetric control networks	Geodetic control network points	Horizontal control point	3, 4, 9, 11, 12, 14, 15, 16, 21, 35, 36, 38, 43, 44, 45, 46, 51, 52, 53, 62																			
		Vertical control point	3, 4, 9, 11, 12, 14, 15, 16, 17, 21, 35, 36, 38, 43, 44, 45,46, 51, 52, 53, 62																			
	Ground control point	F-point	4, 21, 35, 43, 44, 45,46, 52, 53,																			
		Z-point	4, 17, 21, 35, 43, 44, 45,46, 51, 52, 53,																			
	Border point	Border point	3, 14, 15, 16, 27, 38, 44, 45, 48, 53, 62																			

X main source material **A** auxiliary source material **S** supplementary source material

5. very high resolution data (essentially for interpretation of little objects and elements of networks).

Most of possibilities of application of satellite data derivative information in topographic databases are related to very high resolution data (group 5), then to very high, high and medium resolution passive data (group 3). This situation results of need for detailed information about little area objects and rich thematic information for accurate delimitation of big area objects, using also MIR and SWIR data. It is worth to mention, that these last data have big (and still not wholly used) information potential for thematic development of topographic databases (e.g. concerning the land use, land cover complexes) and thematic databases (mostly in the case of soil moisture, sanitary state of the forest, logging monitoring). The World View, QuickBird, Ikonos and KOMPSAT data derived information can be the main source material for 62% of groups of items. The EROS, Kosmos KVR data can be a main source material for 49% of items, SPOT 5 and ALOS – 44%, SPOT 2, 4, LandsatTM, ASTER – 15% IRS and Formosat –14.28%, while ERS, Radarsat, Envisat – for 2.32% and Sich 1-M for 1.99% of items.

In 2008 the satellite data are employed mainly like a supplementary data source (substitute for aerial photos) only in small part of topographical databases (Ikonos for border zone of Polish TBD, QuickBird as a completion of source materials for Belgian TOP10vector GIS and TOP50vector GIS). Their application for gain the additionally thematic information is very rare (SPOT 5 in the case of Island IS50V, French BD TOPO Pays, Landsat TM in Latvian Latvija200 and Finnish Maastotietokanta), but results in considerable extension of thematic scope of these databases (NLS, 2006). The limited application of satellite data is caused by the group of reasons related to procedures, methodologies applied during construction of databases, as well as to data prices, licences, data availability and interoperability. The analysis of topographic databases documentation has demonstrated that only in case of databases mentionned above, the procedures allowed the application of satellite data. In the most of applications this data is used only in form of orthophotomaps. The absence of more advanced data processing can be in part caused by lack of complete, homogenous coverage of data of the same phenological period and the same year, and by concentration of the satellite data market and services effects, as well as licences policy limitations.

Analysis of the thematic scope of key environmental EU databases proved, that in 11 of 19 cases they were created using satellite data (Landsat TM, ETM+, IRS, SPOT in the case of CORINE Land Cover level 3 and level 4) or satellite data derivative information (CORINE database used to generate CORILIS, GUA, DISMED, EUROSION, EUROLandscape, applied like a reference for CORINE Biotopes, CORINAIR, Natura 2000 EUNIS). The SAR satellite data are applied in the case of EU meteorological databases like CLIOSat, MWAD and EuroWind.

Conclusions

The reasons of considerable limited usage of satellite data in the case of topographic databases are conditioned by the need of closest accomplishment of the procedures and methodologies described in database documentation. These data are more frequently used like a substitute of aerial photos for selected areas. Their possibilities of generation of rich spatial information are limited by necessity to retain the homogeneity of the national databases. Due to the strong concentration of the satellite data market (and satellite data copyrights), almost all EU countries must rely on its own data. In the case of EU thematic environmental databases the crucial factor is the price of very high resolution data, their coverage (lack of completeness for selected years). Possibilities of generation of additionally thematic information are limited also by recent decline of multispectral systems of Landsat TM and Terra – ASTER. Many satellite data users need an access to high and very high resolution MIR and SWIR data, as well as medium resolution hyperspectral ASTER–like type data.

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NLS Topographic Database. Technical description, 2006: Maanmittaushallitus, Helsinki, 67 p.

Abstract

The aim of this research was to compare the information capacity of civil satellite data and to investigate the suitability of potential use of these data into the European and EU topographic and key thematic databases, to estimate a degree of their real application in creation and updating of these databases, as well as to analyse the recent needs for satellite data. To achieve these goals, author has classified the types of data provided by 20 civil remote sensing satellites and has analysed it's possibility of generation of thematic information. The next stage was identification of EU topographic and key thematic databases, analysis of theirs thematic scope, and proposition of their typology. The analysis of the possibilities of usage of satellite data derivative information in 33 European and EU topographic databases and selected thematic databases as well as analysis of the real level of their application in theses databases allowed to detect the reasons of identified state and to formulate issues concerning the recent satellite data needs.

Streszczenie

Celem badania było porównanie zakresu informacyjnego cywilnych danych satelitarnych i określenie potencjalnych możliwości wykorzystania tych danych w europejskich i unijnych bazach danych topograficznych oraz kluczowych bazach tematycznych, ustalenie stopnia ich rzeczywistego zastosowania do tworzenia i aktualizacji tych baz, jak również analiza obecnych potrzeb w zakresie danych satelitarnych. W celu realizacji tych zadań autor zaproponował typologię danych pochodzących z 20 cywilnych satelitów teledetekcyjnych, przeprowadził analizę możliwości generowania na ich podstawie informacji tematycznych. Następnie dokonał identyfikacji europejskich i unijnych baz danych topograficznych oraz kluczowych baz tematycznych i zaproponował ich typologię. Analiza możliwości wykorzystania informacji pochodzących z danych satelitarnych w 33 europejskich i unijnych bazach danych topograficznych oraz w wybranych bazach tematycznych, jak również analiza rzeczywistego stopnia ich zastosowania pozwoliła na określenie przyczyn zidentyfikowanego stanu i sformułowanie wniosków dotyczących obecnych potrzeb w zakresie danych satelitarnych.

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