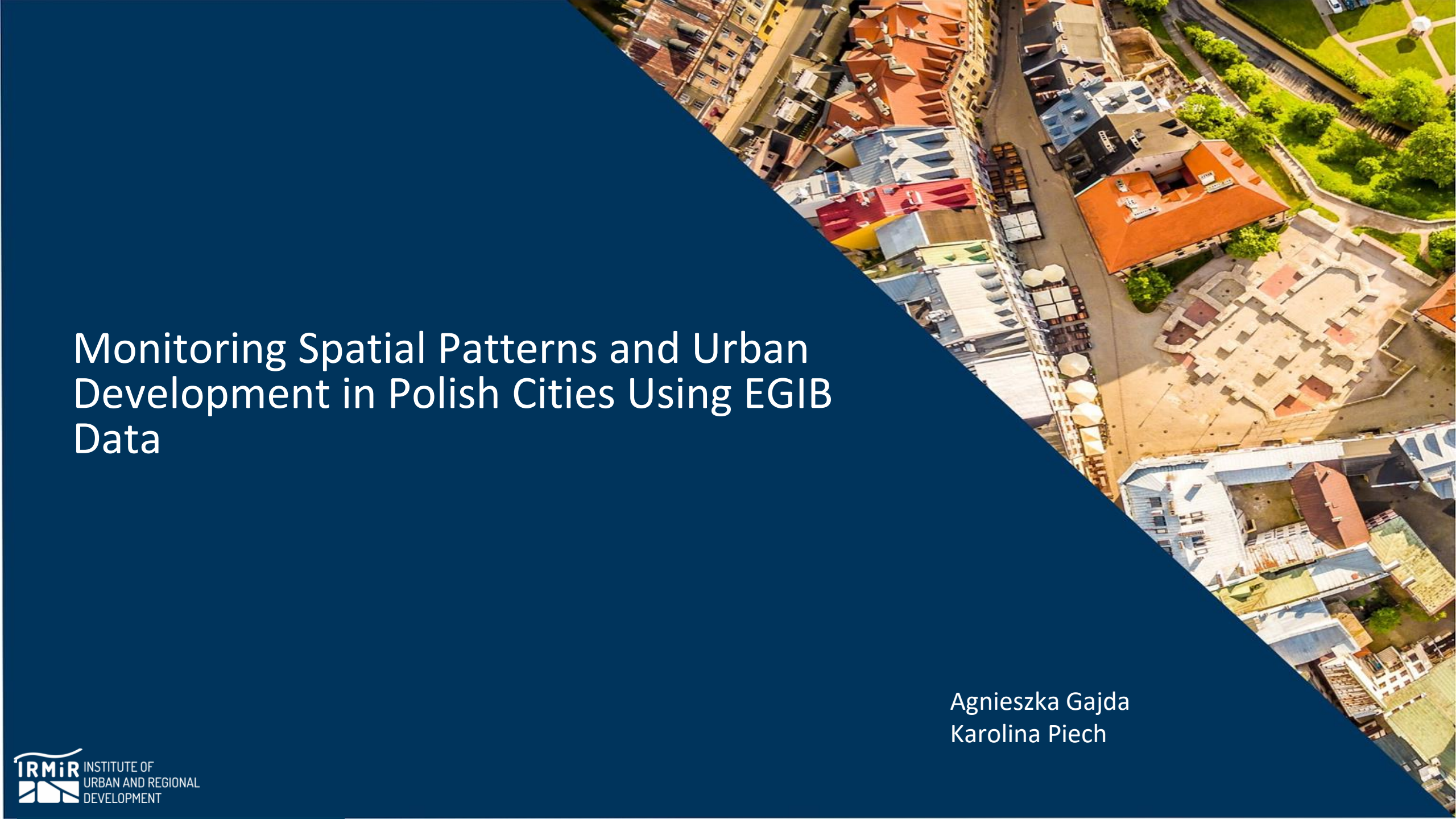


An aerial photograph of a city street, likely in Poland, showing a mix of residential and commercial buildings with colorful roofs (red, orange, blue, yellow). A street with parked cars and a small park area with green trees are visible on the right side of the image. The image is partially obscured by a dark blue diagonal overlay on the left side.

Monitoring Spatial Patterns and Urban Development in Polish Cities Using EGIB Data

Agnieszka Gajda
Karolina Piech

Ideal city

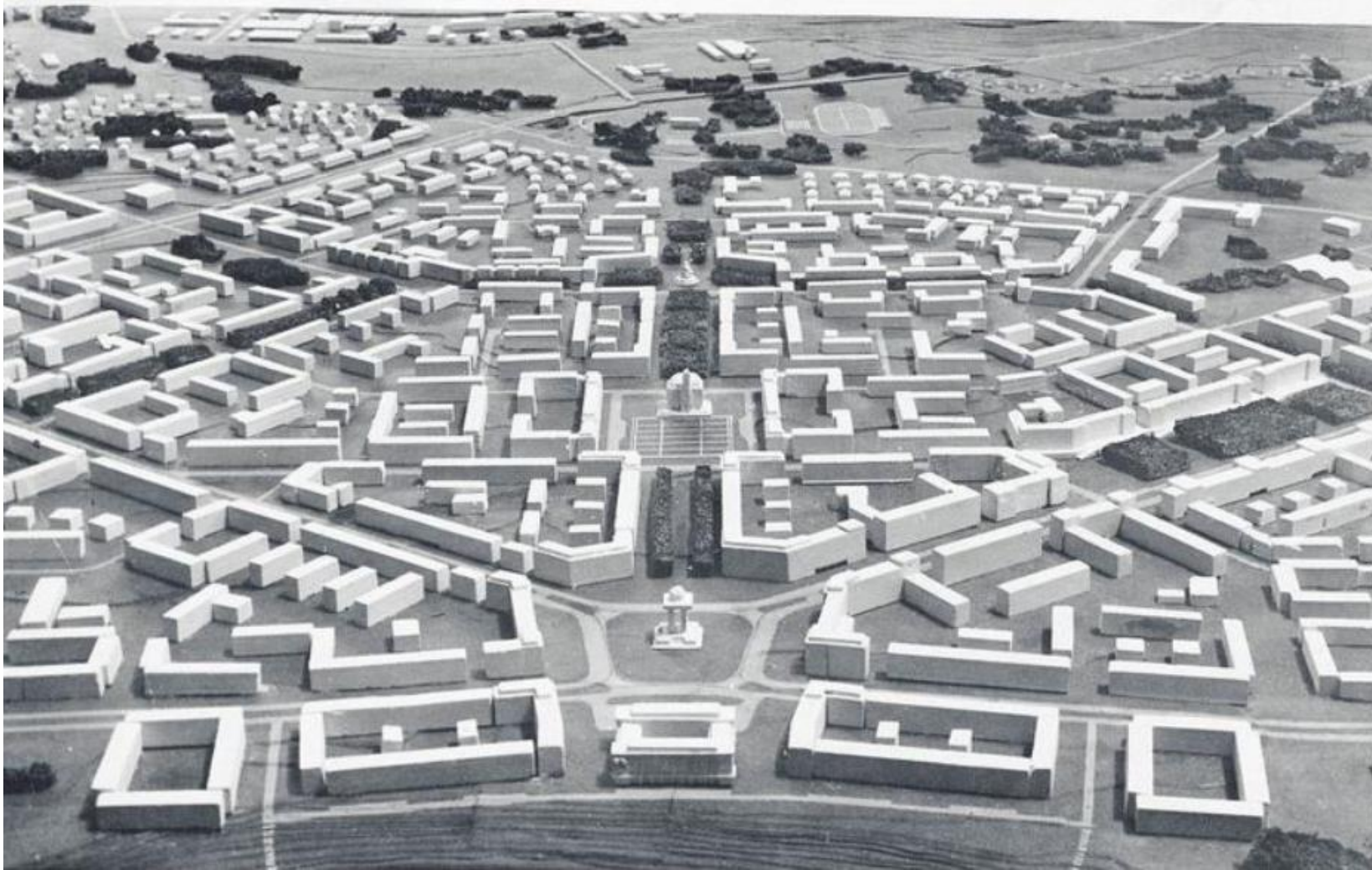


Georg Braun & Franz Hogenberg

Ideal city



Ideal city



Ideal city



Polish National Urban Policy the Pact of Amsterdam

Uncontrolled development of suburbs

Need of efficient land use

Need of quantifying of the process

Assessment of the scale of the problem

Protection of the non-urbanized, arable land

Compact city



What is the issue with the other land use statistics?

Only non-spatial dimension in current countrywide statistics

Low spatial resolution

Too detailed, hard to compare without further analyses

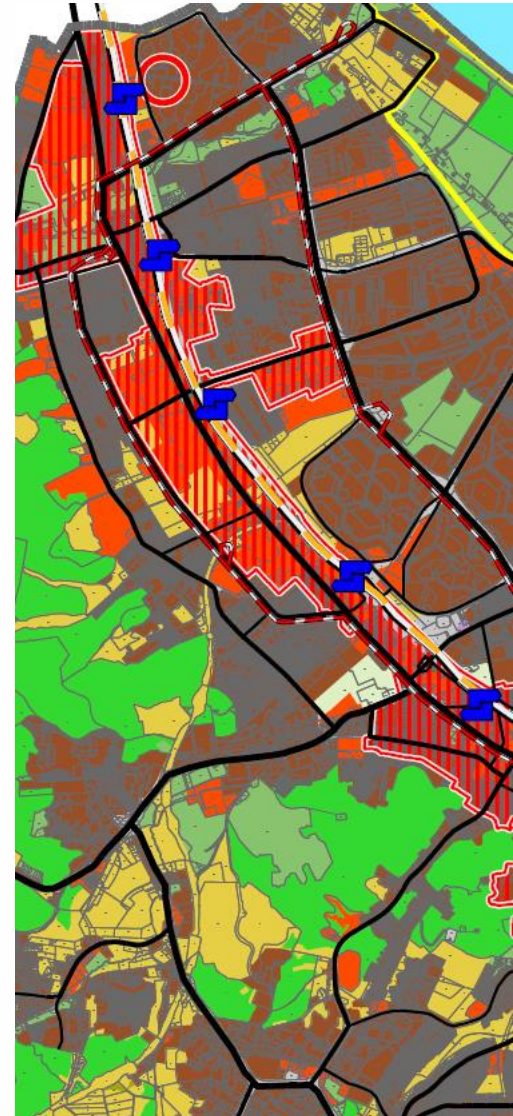
Previous research

For single cities/FUAs (eg. TriCity, Łódź)

No common methodology

Manual classification

Lack of continuity and repeatability



Task - Monitoring system

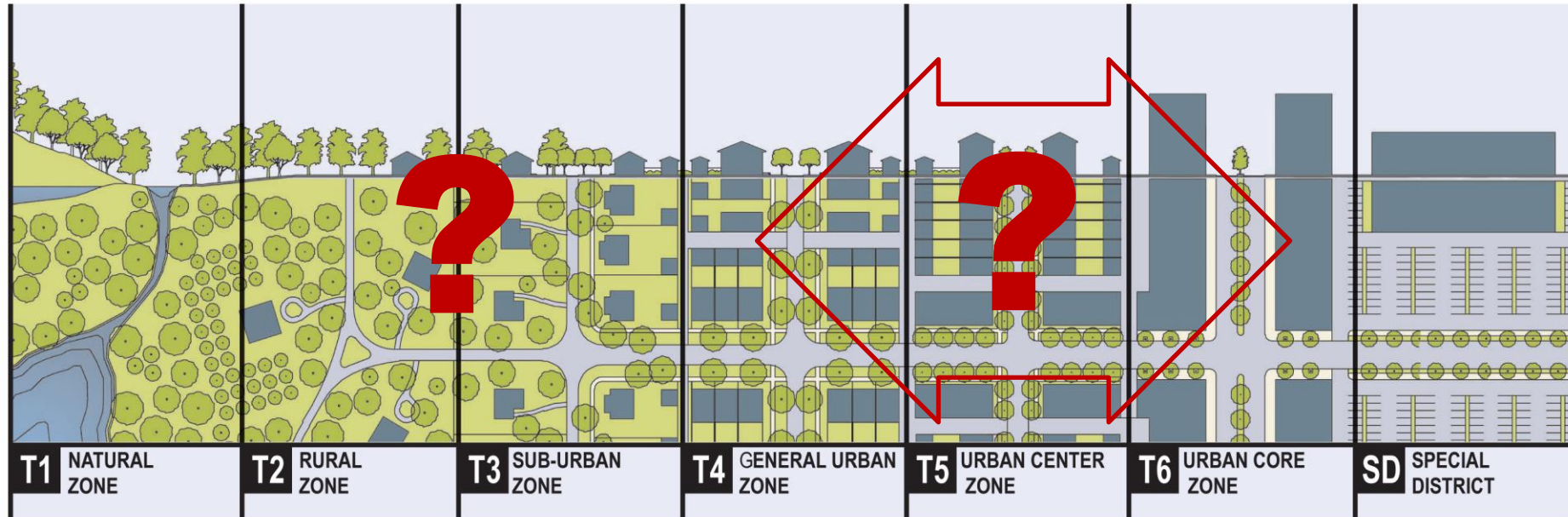
Nationalwide, standardized spatial database

Updates on request

Fast processing - automation

Compatibility with other data

Urban transect model



Rural  Urban

www.transect.org



Image Landsat / Copernicus

Google Earth



Image Landsat / Copernicus

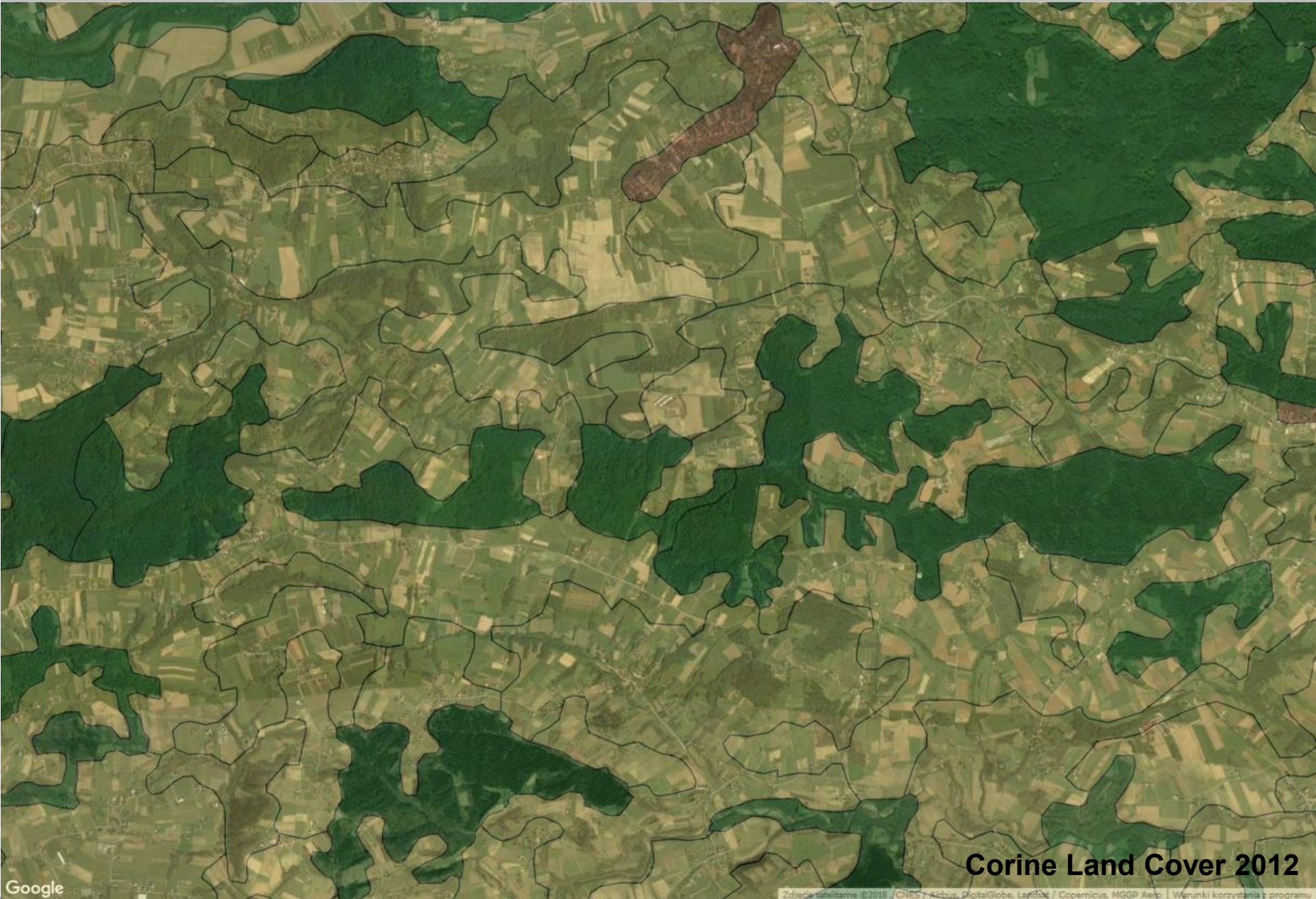
Google Earth





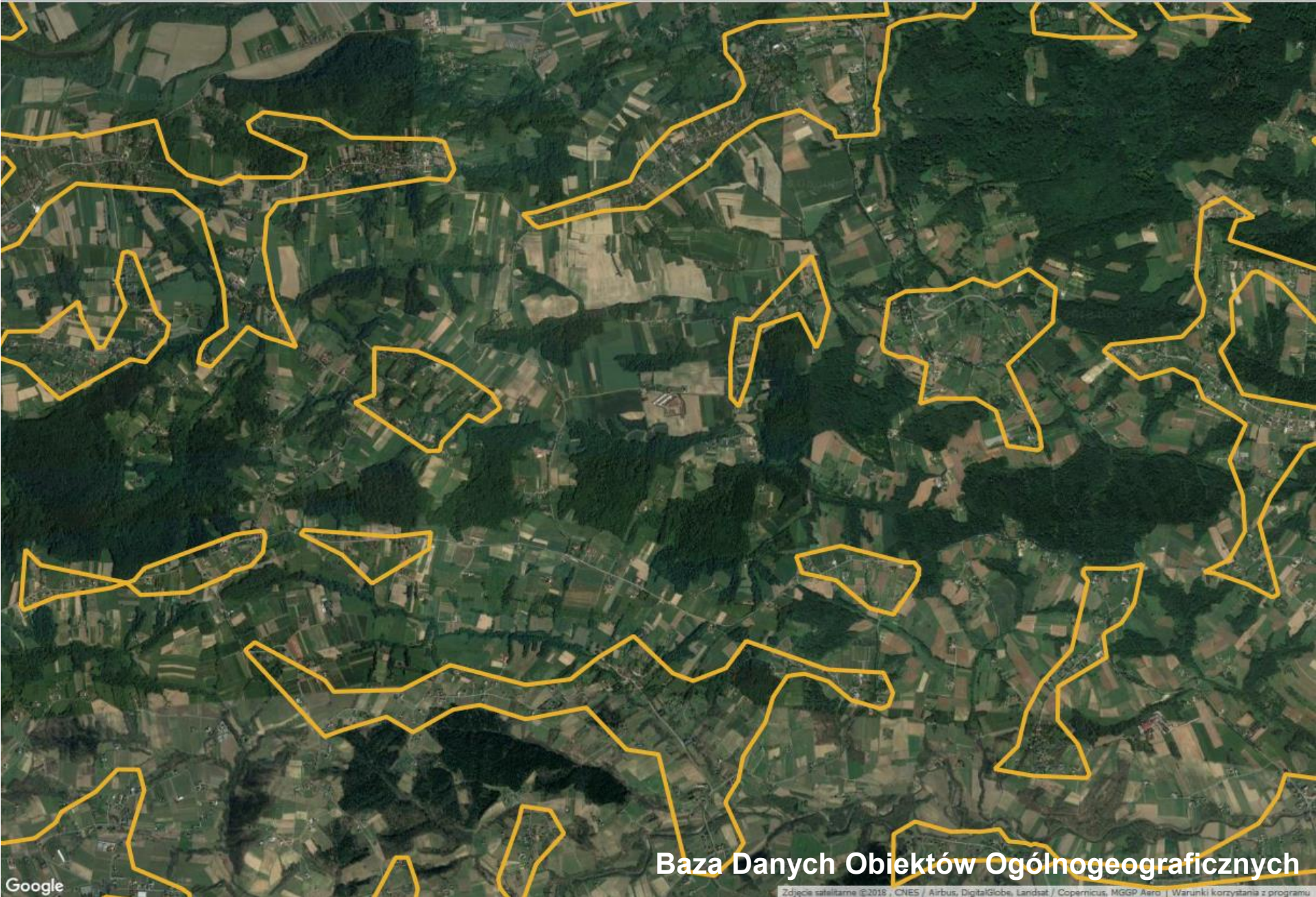
Google

Zdjęcie satelitarne ©2018, CNES / Airbus, DigitalGlobe, Landsat / Copernicus, MGSP Aero | Warunki korzystania z programu



Corine Land Cover 2012

Zdjęcia satelitarne ©2018 / CNES / Airbus, DigitalGlobe, Landsat / Copernicus, MGPP Aero | Warunki korzystania z programu



Google

Baza Danych Obiektów Ogólnogeograficznych

Zdjęcie satelitarne ©2018, CNES / Airbus, DigitalGlobe, Landsat / Copernicus, MGMP Asro | Warunki korzystania z programu



Google

Źródło: Google Earth © 2018, CNES / Airbus, DigitalGlobe, MGPP Aero. Warunki korzystania z programu

Study area

3 subregional
cities

Przemyśl

Tarnów

Wałbrzych



Study area

Heksagonal grid
(honeycomb)

1ha

Clipped to the borders



Data

Buildings & Land use registry - highest detail level available (EGiB)	Landuse type
	Function of buildings
	Height (flors)
Residents registration data (PESEL database)	

Functional zones matrix

1st landuse type

2nd landuse type

Primary building type

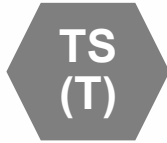
Type of residential buildings

Landuse1	Landuse2	brak zabudowy	brak typu	inne	jednorodzinne	wiel
przemysl	lasy	TS (P)	TS (P)	TS (P)	T3	T3
przemysl	rolne	TS (P)	TS (P)	TS (P)	T3	T4
przemysl	transport	TS (P)	TS (P)	TS (P)	T3	T3
przemysl	woda	TS (P)	TS (P)	TS (P)	T3	T3
przemysl	zabudowa	TS (P)	TS (P)	TS (P)	T3	T4
przemysl	zielen	TS (P)	TS (P)	TS (P)	T3	T3
rolne	brak	T2	T2,5	T2,5	T2,5	T2,5
rolne	inne	T2	T2,5	T2,5	T2,5	T2,5

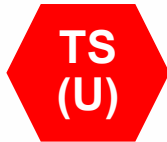
Zones

T1	Non urbanized
T2	Rural
T2,5	Rural with housing
T3	Housing (single-family)
T4	Housing (multi-family)
T4,5	Large housing estates

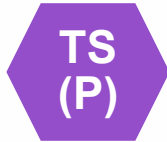
Special zones



Transportation systems



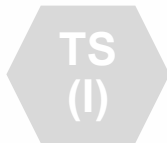
Services



Industry



Urban green



Other

Data processing

Unification of database structure

Geometrical unification

Generalization into LU categories

Python scripting

Accuracy check



ArcGIS Pro

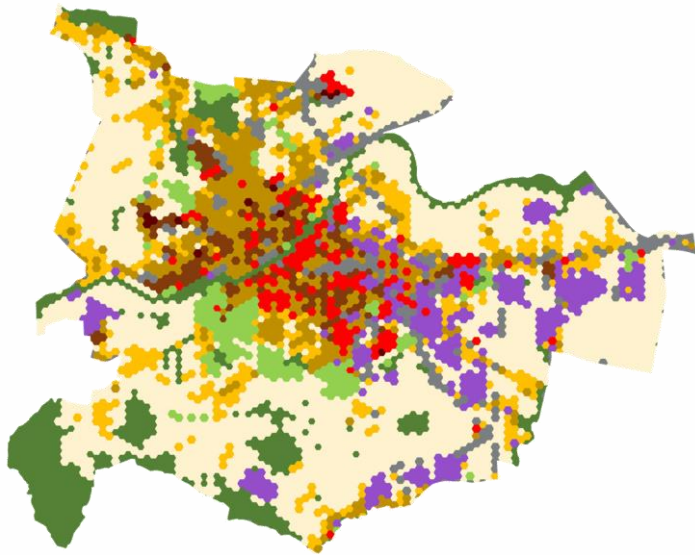


python™

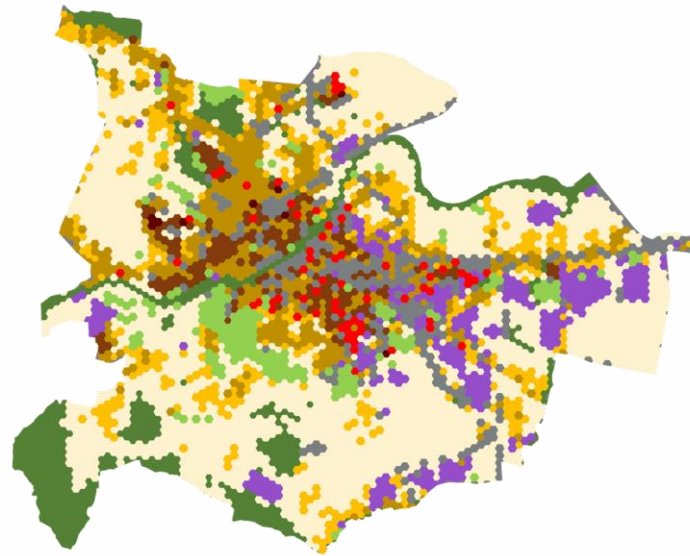
```
39 # === KROK 3: ZLICZANIE POWIERZCHNI TYPÓW W HEKSAGONACH ===
40 print("📊 Zliczanie powierzchni typów użytków...")
41
42 heks_tpy = defaultdict(lambda: defaultdict(float))
43 total = int(arcpy.management.GetCount(intersect_fc)[0])
44 processed = 0
45 start_global = datetime.now()
46 last_report = start_global
47
48 print(f"📊 Do przetworzenia (przecięć): {total}")
49
50 with arcpy.da.SearchCursor(intersect_fc, ["GRID_ID", "typ", "POW"]) as cursor:
51     for grid_id, typ, pow_m2 in cursor:
```


Results (Przemyśl)

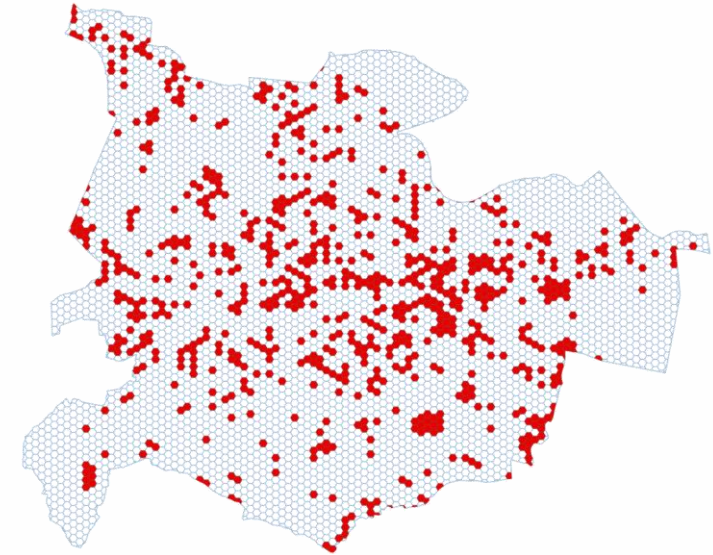
2017



2024

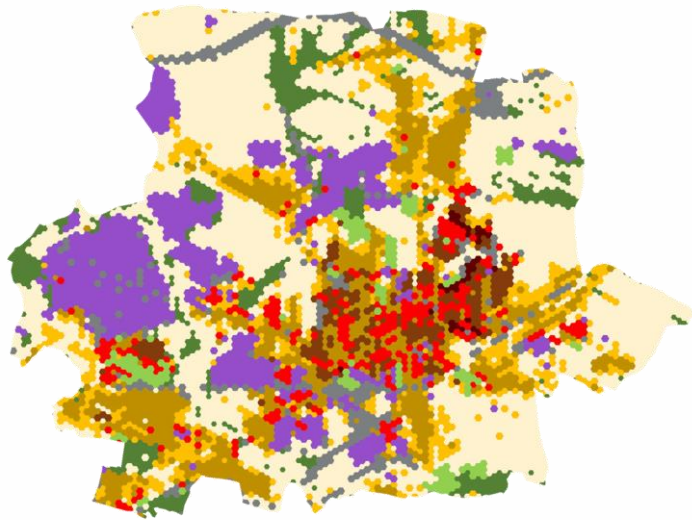


change

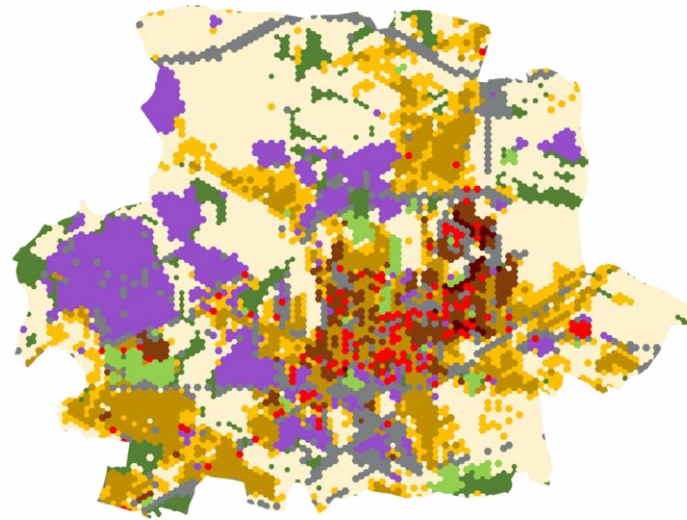


Results (Tarnów)

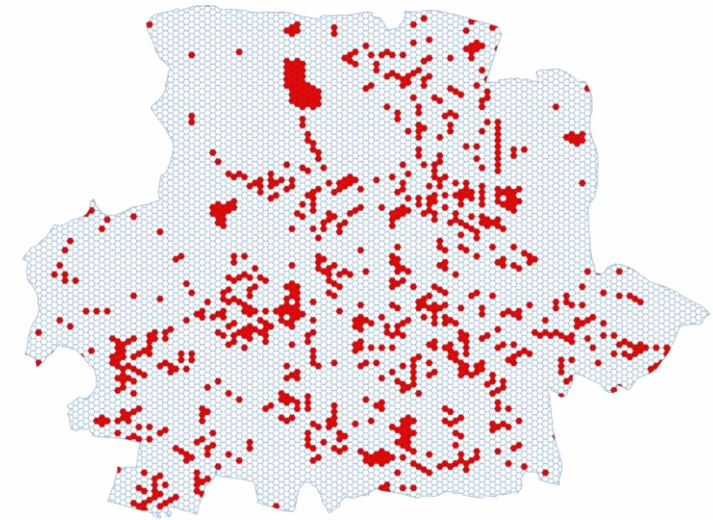
2017



2024

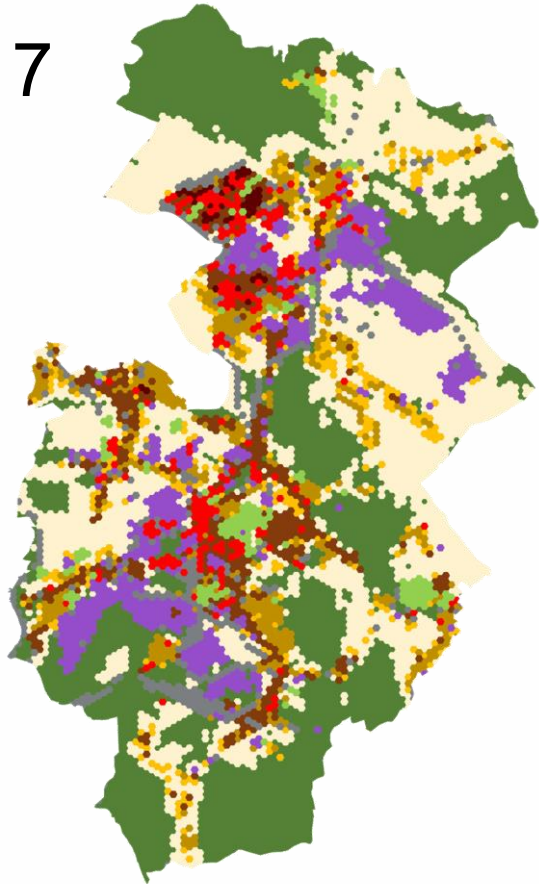


change

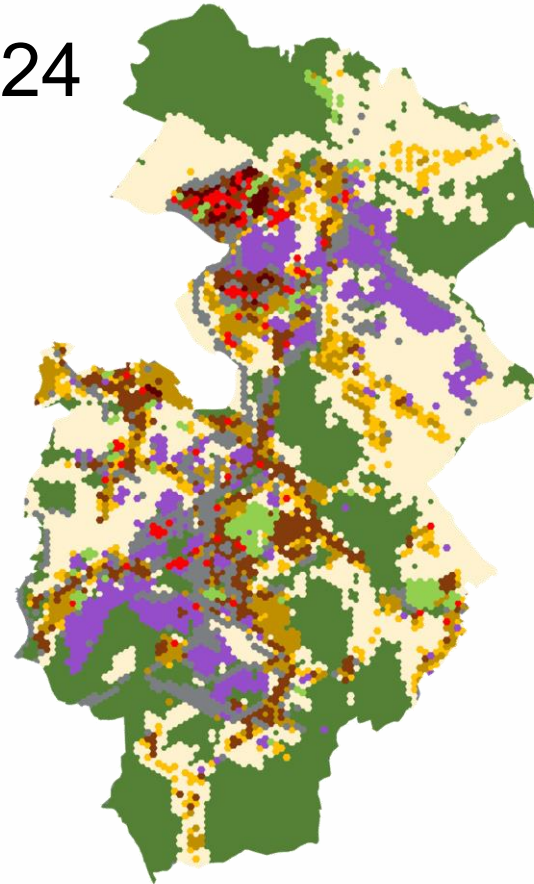


Results (Wałbrzych)

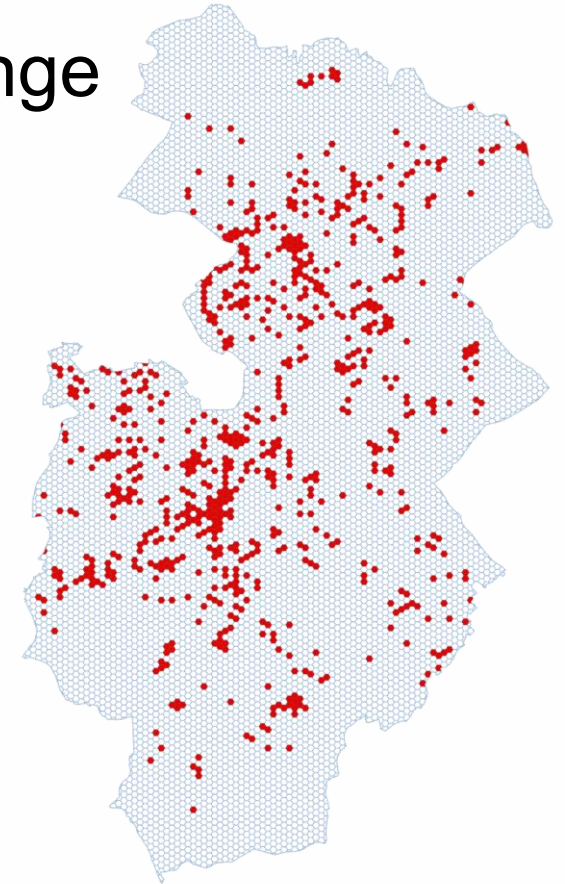
2017



2024



change



Changes

Przemyśl

2024

2017

TYP	T1	T2	T2,5	T3	T4	TS (P)	TS (T)	TS (U)	TS (Z)	SUM
T1		94	3			1	4			102
T2	32		64	12	4	15	13		41	181
T2,5	2	21		94	3	15	5		2	142
T3	2	6	26		24	2	18	5		83
T4	1			10			1	1		13
T4,5				1	1		1			3
TS (P)	1	5	9	5			27	9	3	59
TS (T)	1	7	1	4	2	9		1	1	26
TS (U)	4		9	3	5	2	66		18	107
TS (Z)	3	7	4	3		1	13	4		35
SUM	46	140	116	132	39	45	148	20	65	751

Tarnów

2024

2017

TYP	T1	T2	T2,5	T3	T4	T4,5	TS (P)	TS (T)	TS (U)	TS (Z)	SUM
T1		67	3				1	13			84
T2	11		89	12	4		29	107	1	3	256
T2,5	3	20		86	12		15	11	3		150
T3		7	63		23		4	4	9	1	111
T4				5		1			2		8
T4,5					1						1
TS (P)	6	15	2	4				38	4	2	71
TS (T)	5	10	1	4			12		1		33
TS (U)	3	1	40	6	3		1	110		32	196
TS (Z)	6	3		2				20			31
SUM	34	123	198	119	43	1	62	303	20	38	941

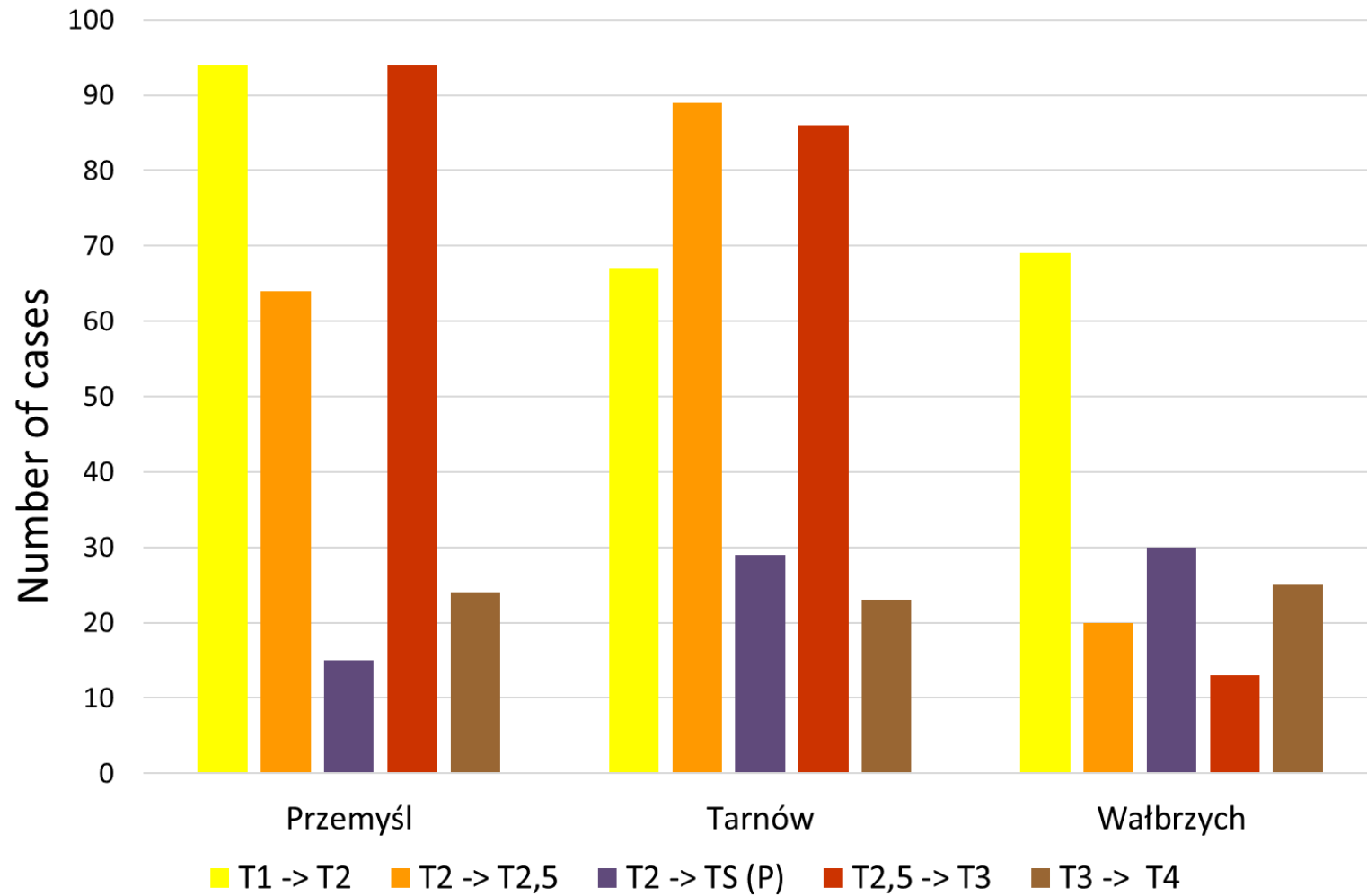
Wałbrzych

2024

2017

TYP	T1	T2	T2,5	T3	T4	T4,5	TS (P)	TS (T)	TS (U)	TS (Z)	SUM
T1		69	2	1			2	20			94
T2	23		20	6	4		30	63		1	147
T2,5	7	25		13	5		16	4			70
T3		9	45		25			5	2		86
T4	1	1	18	50		1		3			74
TS (P)	3	14	1	3	1			46	3		71
TS (T)	1	10	2	9	1		7			1	31
TS (U)	6	2	21	4			3	113		13	162
TS (Z)	11	10	1	1				8			31
SUM	52	140	110	87	36	1	58	262	5	15	766

Landuse densification



Problems

Lack of data

Errors in data

Misinterpretations

Quantification



Other sources of LU/LC statistics?

Low spatial resolution (CLC)

Low temporal resolution

Input data sources

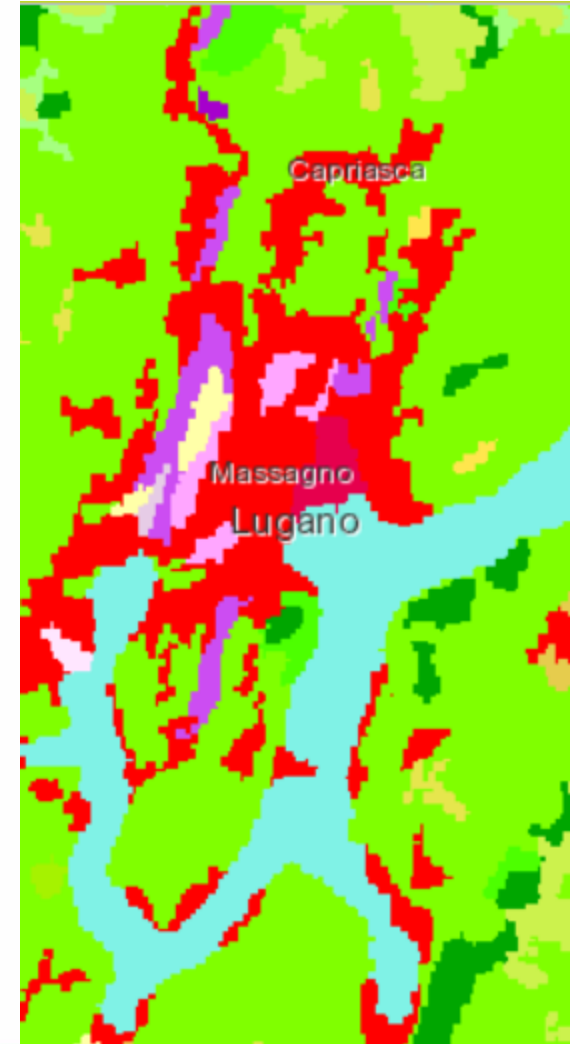




Image Landsat / Copernicus

Google Earth



Image Landsat / Copernicus

Google Earth

Questions?

Agnieszka Gajda
agajda@irmir.pl

Karolina Piech
kpiech@irmir.pl