

# The fourth level of the LULC cassification in the Integrated Environmental Monitoring in Poland



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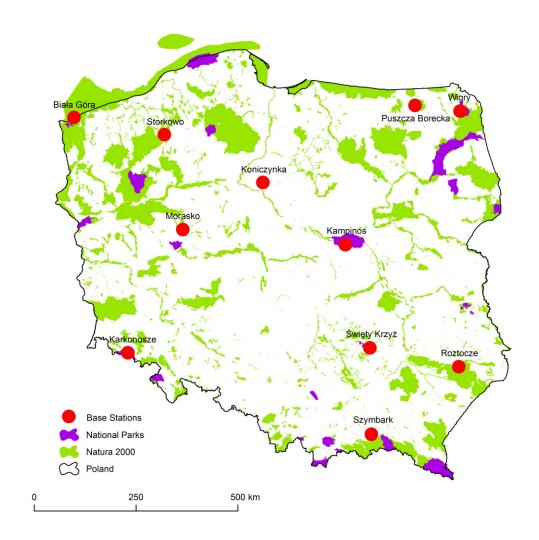
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### Introduction

The Integrated Environmental Monitoring (IEM) functions within the State Environmental Monitoring Programme in Poland since 1994. Its task involves long-term research, both abiotic and biotic of elements of the natural environment, based on planned and organized stationary tests. The aim of the IEM is to provide data for defining the current environmental status and, based on multi-year observation cycles, to present short- and longterm environmental changes in the conditions of climate changes and growing human impact on the environment.

One of the research programs under the Integrated Environmental Monitoring (IEM) is the monitoring of land cover and land use. The purpose of this monitoring is retrodiction, current inventory and anticipating environmental changes within the selected geoecosystems in terms of local and regional spatial scale and short-, medium- and long-term time scale.

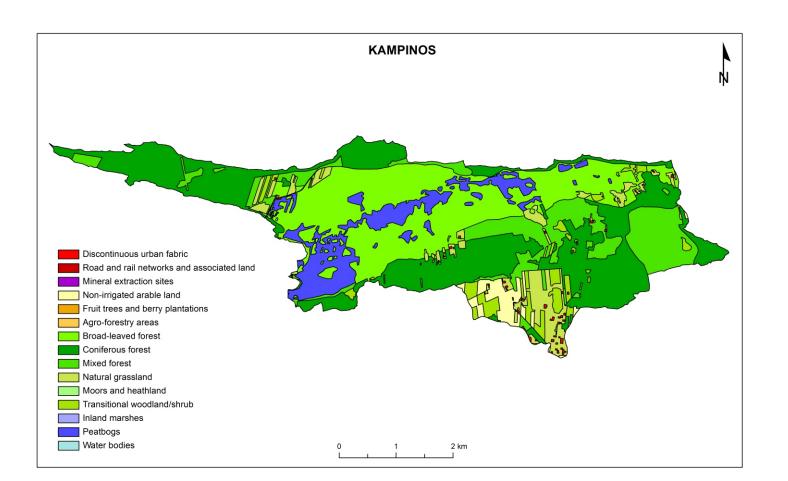
### Study area

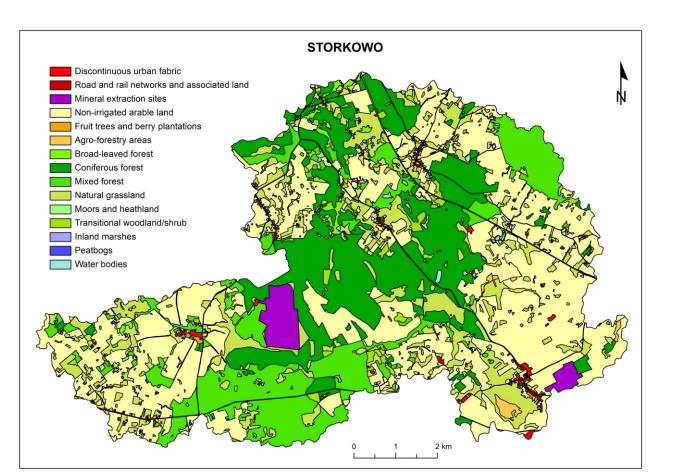


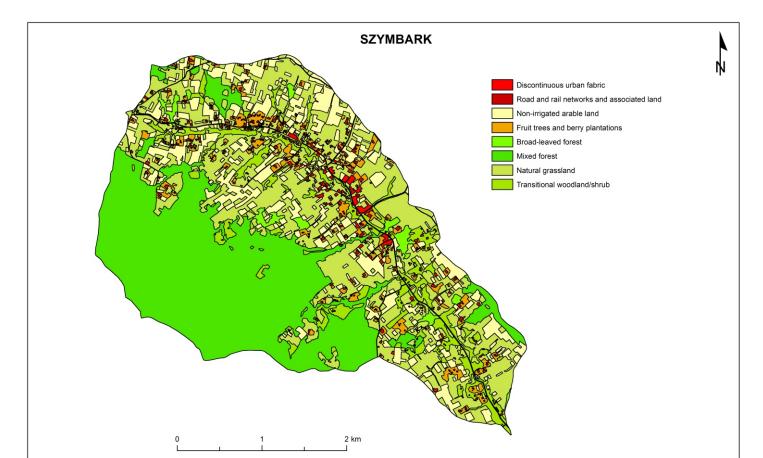
The basic object of IEM research is the river or lake catchment area. A broad range of complementary stationary research is conducted according to standardised methods at 11 IEM Base Stations in the entire country and at the Polar Base Station in Spitsbergen as a reference station for the assessment of the condition of the natural environment in Poland. 6 catchments are located in the Polish National Parks and 8 catchments are located in the area of Natura 2000 sites.

Fig. 1. The location of Integrated Environmental Monitoring Base Stations.

## Land Cover/Land Use maps







According to the classification based on the CLC nomenclature maps of land cover and land use for the catchments were prepared. Source data were SPOT satellite images from 2010. However, monitoring within catchments of the IEM requires another 4th level, which details the classification in order to indicate the more accurately type and direction of changes in land cover and land use.

Fig. 2. Land-cover/Land-use maps for the selected catchments (CLC 3rd level).

# 4th Level CORINE Land Cover nomencalture for the IEM

ARTIFICIEL SURFACES				
CODE	LEVEL 3	CODE	LEVEL 4	
1.1.1	Continuous urban	1.1.1.1	Continuous urban center	
	fabric		built-up areas	
		1.1.1.2	Continuous urban built-up	
			areas	
1.1.2	Discontinuous	1.1.2.1	Discontinuous multifamily	
	urban fabric		built-up areas	
		1.1.2.2	Discontinuous	
			singlefamily built-up areas	
1.2.1	Industrial or	1.2.1.1	Industrial- storehouse	
	commercial units		areas	
		1.2.1.2	Production and service of	
		1 2 1 2	agriculture areas	
		1.2.1.3	•	
		1011	infrastructure areas	
			Commercial-service areas	
1 2 2	Dead and mil		Public areas	
1.2.2	Road and rail	1.2.2.1		
	networks and	1 2 2 2	associated land	
	associated land	1.2.2.2	Rail networks and	
1 2 2	Dont areas	1 2 2 1	associated land	
1.2.3	Port areas		Seaports	
			Inland ports	
1 2 /	Airports		Shipyards Airports with artificial	
1.2.4	Airports	1.2.4.1	Airports with artificial surface	
		1 2 / 2	Airports with grassy	
		1.2.4.2	surface	
		1 2 / 3	Airports - terminals and	
		1.2.4.3	hangars	
131	Mineral extraction	1311	Clastic and clay raw	
1.5.1	sites	1.5.1.1	materials extraction sites	
	31003	1.3.1.2	Quarries	
			Open-cast mines	
			Restored and overgrowing	
			extraction sites	
1.3.2	Dump sites	1.3.2.1		
	•	1.3.2.2	Dump liquid waste sites	
		1.3.2.3	Mining heaps	
		1.3.2.4	Municipal dump sites	
		1.3.2.5	Restored and overgrowing	
			dump sites	
1.3.3	Construction sites	1.3.3.1	Buildings under	
			construction	
		1.3.3.2	Excavations	
1.4.1	Green urban areas	1.4.1.1	Urban parks	
		1.4.1.2	Lawns and squares	
		1.4.1.3	Allotment gardens	
		1.4.1.4	Cemeteries	
		1.4.1.5	Areas with no economic	
			use	
1.4.2	Sport and leisure	1.4.2.1	Sport areas	
	facilities	1.4.2.2	Swimming pools	
		1423	Recreation and camping	
		1. 1.2.5	recreation and camping	

	AGRICULTURAL AREAS				
CODE	LEVEL 3	CODE	LEVEL 4		
2.1.1	Non-irrigated	2.1.1.1	Cereal crops		
	arable land	2.1.1.2	Legume plants crops		
		2.1.1.3	Oil plants crops		
		2.1.1.4	Root plants crops		
		2.1.1.5	Fibre plants crops		
		2.1.1.6	Vegetables crops		
		2.1.1.7	Flowers crops		
		2.1.1.8	Greenhouse crops		
		2.1.1.9	Fallow and set-aside land		
2.1.2	Permanently	2.1.2.1	Canal-irrigated arable land		
	irrigated land	2.1.2.2	Sprikle-irrigated arable land		
2.1.3	Rice fields	2.1.3.1	Flooded rice fields		
		2.1.3.2	Mountain rice fields		
2.2.1	Vineyards	2.2.1.1	Private vineyards		
		2.2.1.2	Commercial vineyards		
2.2.2	Fruit trees and	2.2.2.1	Private orchards		
	berry plantations	2.2.2.2	Commercial orchards		
2.2.3	Olive groves	2.2.3.1	Private olive groves		
		2.2.3.2	Commercial olive groves		
2.3.1	Pastures	2.3.1.1	Permanent pastures		
		2.3.1.2	Periodically pastures		
2.4.1	Annual crops	2.4.1.1	Arable land associated		
	associated with		with permanent crops		
	permanent crops	2.4.1.2	Pastures associated with		
			permanent crops		
2.4.2	Complex	2.4.2.1	Complex cultivation with		
	cultivation		predominance of		
			permanent crops		
		2.4.2.2	•		
			predominance of annual		
			crops		
2.4.3	Land principally	2.4.3.1	Irregular mid-field trees		
	occupied by		and scrub		
	agriculture, with	2.4.3.2	Mid-field shelterbelts		
	significant areas of				
	natural vegetation				
2.4.4	Agro-forestry areas	2.4.4.1			
		2.4.5	and shrubs		
		2.4.4.2	Pastures with trees and		
			shrubs		

areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris 3.3.4 Burnt areas 3.3.4.1 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets		FORESTS AND	SEMI-N	ATURAL AREAS
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3.2.2 Moors and heathland 3.2.3 Sclerophyllous vegetation 3.2.4 Transitional woodland shrub 3.2.4.2 Forest-tree nurseries 3.2.4.3 Afforestation areas 3.2.4.5 Degraded forest 3.3.1 Beaches, dunes, and sand plains 3.3.1.2 Dunes 3.3.1.3 River shoals 3.3.1.4 Sands outside the sea coastal zone 3.3.2 Bare rock 3.3.2.1 Rocks 3.3.2.2 Rock debris 3.3.3 Sparsely vegetated areas 3.3.4 Burnt areas 3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets			3.2.1.2	Typical meadows
heathland 3.2.3 Sclerophyllous vegetation 3.2.3.2 Garigue 3.2.4 Transitional woodland shrub 3.2.4.2 Forest-tree nurseries 3.2.4.3 Afforestation areas 3.2.4.4 Deforestation areas 3.2.4.5 Degraded forest 3.3.1 Beaches, dunes, and sand plains 3.3.1.1 Beaches 3.3.1.2 Dunes 3.3.1.3 River shoals 3.3.1.4 Sands outside the sea coastal zone 3.3.2 Rocks 3.3.2.2 Rock debris 3.3.3 Sparsely vegetated areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris 3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets			3.2.1.3	Wet meadows
3.2.3 Sclerophyllous vegetation 3.2.4 Transitional 3.2.4.1 Mountain pine 3.2.4.2 Forest-tree nurseries 3.2.4.3 Afforestation areas 3.2.4.4 Deforestation areas 3.2.4.5 Degraded forest 3.3.1.1 Beaches 3.3.1.2 Dunes 3.3.1.2 Dunes 3.3.1.3 River shoals 3.3.1.4 Sands outside the sea coastal zone 3.3.2 Rock debris 3.3.2.2 Rock debris 3.3.3.1 Sparsely vegetated areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris 3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets	3.2.2	Moors and	3.2.2.1	Moors and heathland
vegetation 3.2.3.2 Garigue 3.2.4.1 Mountain pine woodland shrub 3.2.4.2 Forest-tree nurseries 3.2.4.3 Afforestation areas 3.2.4.4 Deforestation areas 3.2.4.5 Degraded forest 3.3.1 Beaches, dunes, and sand plains 3.3.1.2 Dunes 3.3.1.3 River shoals 3.3.1.4 Sands outside the sea coastal zone 3.3.2 Bare rock 3.3.2.1 Rocks 3.3.2.2 Rock debris 3.3.3 Sparsely vegetated areas 3.3.3 Sparsely vegetated areas 3.3.4 Burnt areas 3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets		heathland		
3.2.4 Transitional woodland shrub  3.2.4.2 Forest-tree nurseries 3.2.4.3 Afforestation areas 3.2.4.4 Deforestation areas 3.2.4.5 Degraded forest  3.3.1 Beaches, dunes, and sand plains 3.3.1.2 Dunes 3.3.1.3 River shoals 3.3.1.4 Sands outside the sea coastal zone  3.3.2 Bare rock 3.3.2.1 Rocks 3.3.2.2 Rock debris  3.3.3 Sparsely vegetated areas on sandy ground  3.3.3.2 Sparsely vegetated areas on rock debris  3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets	3.2.3	Sclerophyllous	3.2.3.1	Chappral scrub
woodland shrub 3.2.4.2 Forest-tree nurseries 3.2.4.3 Afforestation areas 3.2.4.4 Deforestation areas 3.2.4.5 Degraded forest  3.3.1 Beaches, dunes, and sand plains 3.3.1.2 Dunes 3.3.1.3 River shoals 3.3.1.4 Sands outside the sea coastal zone  3.3.2 Bare rock 3.3.2.1 Rocks 3.3.2.2 Rock debris  3.3.3 Sparsely vegetated areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris  3.3.4 Burnt areas 3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets		vegetation	3.2.3.2	Garigue
3.2.4.3 Afforestation areas 3.2.4.4 Deforestation areas 3.2.4.5 Degraded forest 3.3.1 Beaches, dunes, and sand plains 3.3.1.1 Beaches 3.3.1.2 Dunes 3.3.1.3 River shoals 3.3.1.4 Sands outside the sea coastal zone 3.3.2 Bare rock 3.3.2.1 Rocks 3.3.2.2 Rock debris 3.3.3 Sparsely vegetated areas areas 3.3.3 Sparsely vegetated areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris 3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets	3.2.4	Transitional	3.2.4.1	Mountain pine
3.2.4.4 Deforestation areas 3.2.4.5 Degraded forest  3.3.1 Beaches, dunes, and sand plains 3.3.1.1 Beaches 3.3.1.2 Dunes 3.3.1.3 River shoals 3.3.1.4 Sands outside the sea coastal zone  3.3.2 Bare rock 3.3.2.1 Rocks 3.3.2.2 Rock debris  3.3.3 Sparsely vegetated areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris  3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets		woodland shrub	3.2.4.2	Forest-tree nurseries
3.2.4.5 Degraded forest  3.3.1 Beaches, dunes, and sand plains 3.3.1.2 Dunes 3.3.1.3 River shoals 3.3.1.4 Sands outside the sea coastal zone  3.3.2 Bare rock 3.3.2.1 Rocks 3.3.2.2 Rock debris  3.3.3 Sparsely vegetated areas on sandy ground  3.3.3.2 Sparsely vegetated areas on rock debris  3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets			3.2.4.3	Afforestation areas
3.3.1 Beaches, dunes, and sand plains 3.3.1.2 Dunes 3.3.1.3 River shoals 3.3.1.4 Sands outside the sea coastal zone 3.3.2 Bare rock 3.3.2.1 Rocks 3.3.2.2 Rock debris 3.3.3 Sparsely vegetated areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris 3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets			3.2.4.4	Deforestation areas
and sand plains  3.3.1.2 Dunes 3.3.1.3 River shoals 3.3.1.4 Sands outside the sea coastal zone 3.3.2 Bare rock 3.3.2.2 Rocks 3.3.2.2 Rock debris 3.3.3 Sparsely vegetated areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris 3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets			3.2.4.5	Degraded forest
3.3.1.3 River shoals 3.3.1.4 Sands outside the sea coastal zone 3.3.2 Bare rock 3.3.2.1 Rocks 3.3.2.2 Rock debris 3.3.3 Sparsely vegetated areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris 3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets	3.3.1	Beaches, dunes,	3.3.1.1	Beaches
3.3.1.4 Sands outside the sea coastal zone 3.3.2 Bare rock 3.3.2.2 Rocks 3.3.2.2 Rock debris 3.3.3 Sparsely vegetated areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris 3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets		and sand plains	3.3.1.2	Dunes
coastal zone  3.3.2 Bare rock 3.3.2.1 Rocks 3.3.2.2 Rock debris  3.3.3 Sparsely vegetated areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris  3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets  coastal zone  3.3.2.1 Rocks 3.3.2.2 Rock debris  Sparsely vegetated areas on rock debris  3.3.3.5 Glaciers and glaciers 3.3.4.1 Burnt areas 3.3.5.1 Glaciers 3.3.5.2 Glacierets			3.3.1.3	River shoals
3.3.2 Bare rock 3.3.2.1 Rocks 3.3.2.2 Rock debris 3.3.3 Sparsely vegetated areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris 3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.1 Glaciers 3.3.5.2 Glacierets			3.3.1.4	Sands outside the sea
3.3.2.2 Rock debris 3.3.3.3 Sparsely vegetated areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris 3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.2.2 Rock debris 3.3.2.3 Sparsely vegetated areas on rock debris 3.3.3.4 Burnt areas 3.3.4.1 Burnt areas 3.3.5.1 Glaciers Glaciers Glacierets				coastal zone
3.3.3 Sparsely vegetated areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris 3.3.4 Burnt areas 3.3.4.1 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets	3.3.2	Bare rock	3.3.2.1	Rocks
areas on sandy ground 3.3.3.2 Sparsely vegetated areas on rock debris 3.3.4 Burnt areas 3.3.4.1 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets			3.3.2.2	Rock debris
3.3.3.2 Sparsely vegetated areas on rock debris  3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets  3.3.5.2 Glacierets	3.3.3	Sparsely vegetated	3.3.3.1	Sparsely vegetated areas
on rock debris  3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.2 Glacierets  on rock debris  3.3.4.1 Burnt areas 3.3.5.1 Glaciers Glaciers		areas		on sandy ground
3.3.4 Burnt areas 3.3.5 Glaciers and perpetual snow 3.3.5.1 Burnt areas 3.3.5.1 Glaciers 3.3.5.2 Glacierets			3.3.3.2	Sparsely vegetated areas
3.3.5 Glaciers and perpetual snow 3.3.5.1 Glaciers Glaciers Glacierets				on rock debris
perpetual snow 3.3.5.2 Glacierets	3.3.4	Burnt areas	3.3.4.1	Burnt areas
	3.3.5	Glaciers and	3.3.5.1	Glaciers
3 3 5 3 Pernetual snow covers		perpetual snow	3.3.5.2	Glacierets
J.J.J.J I cipetual show covers			3.3.5.3	Perpetual snow covers

Uniform colour legend is designed for developed classification. The legend corresponds to the pallet used in CLC database with slight modifications of some colours as well as assigning hatches to individual issues on the fourth level. The pallet was developed in the form of thematic layer with symbolization of objects stored in the format \*.lyr for the fourth level.

WETLANDS				
CODE		CODE	LEVEL 4	
4.1.1 Inland marshes	Inland marshes	4.1.1.1	Marshes	
		4.1.1.2	Periodical marshy grounds	
4.1.2	Peatbogs	4.1.2.1	High bogs	
	Ü	4.1.2.2	Lowland bogs	
		4.1.2.3	Transition bogs	
4.2.1	Salt marshes	4.2.1.1	Salt marshes with	
			vegetation	
		4.2.1.2	Salt marshes without	
			vegetation	
4.2.2	Salines	4.2.2.1	Exploited salines	
		4.2.2.2	Unexploited salines	
4.2.3	Intertidal flats	4.2.3.1	Intertidal flats	
	W	ATER BO	DIES	
5.1.1	Water courses	5.1.1.1	Rivers	
		5.1.1.2	Streams	
		5.1.1.3	Creeks	
		5.1.1.4	Canals	
5.1.2	Water bodies	5.1.2.1	Natural water bodies	
		5.1.2.2	Artificial water bodies	
5.2.1	Coastal lagoons	5.2.1.1	Lagoon lakes	
		5.2.1.2	Sandbar lakes	
5.2.2	Estuaries	5.2.2.1	Open estuaries	
		5.2.2.2	Bar-built estuaries	
5.2.3	Sea and ocean	5.2.3.1	Open seas	
		5.2.3.2	Inland seas	
		5.2.3.3	Oceans	

The result of the undertaken analytical work is detailed classification of land cover and land use covering 123 different issues. Developed expanded classification would take into account local environmental conditions of representative catchments of the IEM.

As a result of the classification process the number of distinguished issues increase in the class of artificial surfaces from 11 on the third level to 36 on the fourth level, in the class of agricultural areas from 11 to 29, in the class of forests and semi-natural areas from 12 to 35, in the class of wetlands from 5 to 10, and in the class of water bodies from 5 to 13.