



XXVII FIG CONGRESS

11-15 SEPTEMBER 2022
Warsaw, Poland

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Methodology of Terrain Classification in Terms of Military Passability

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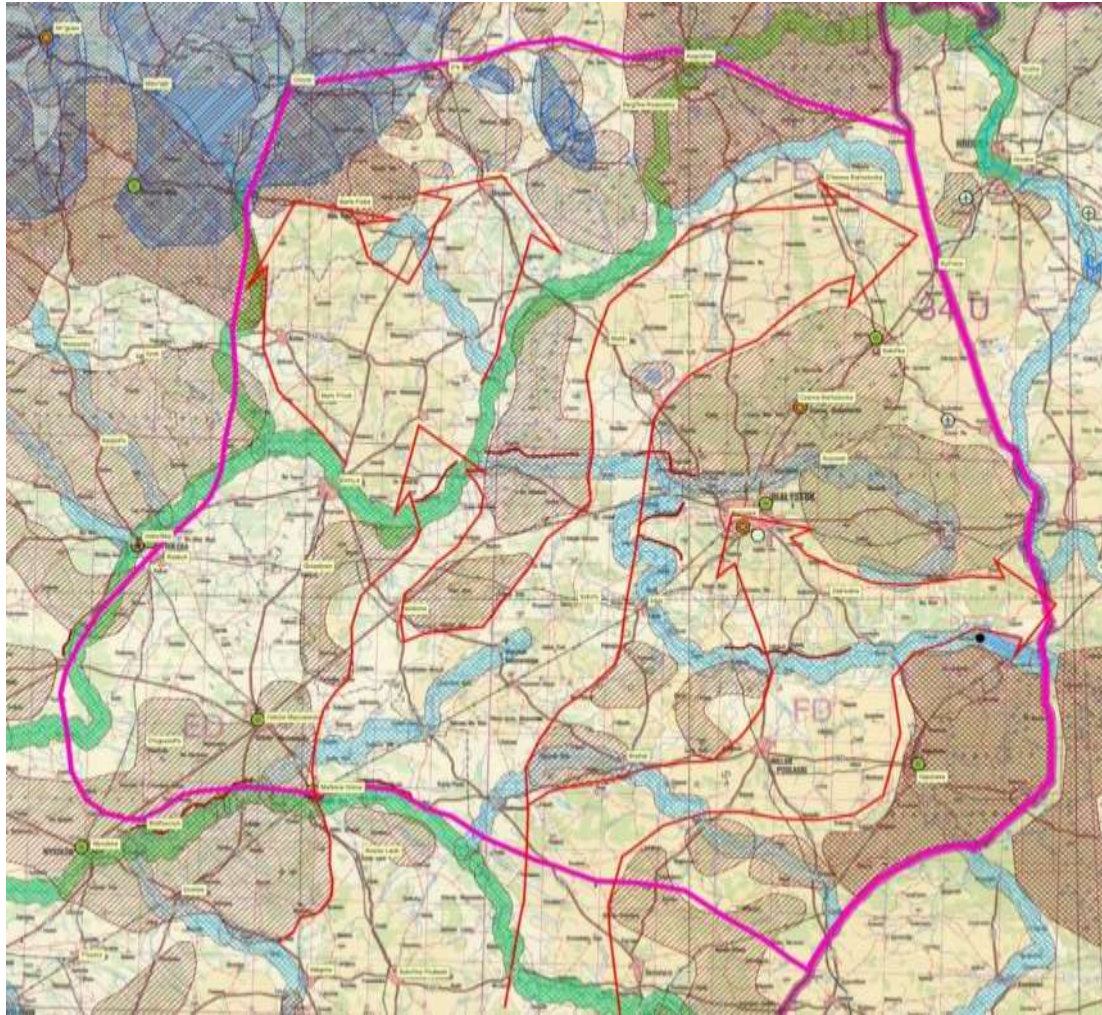




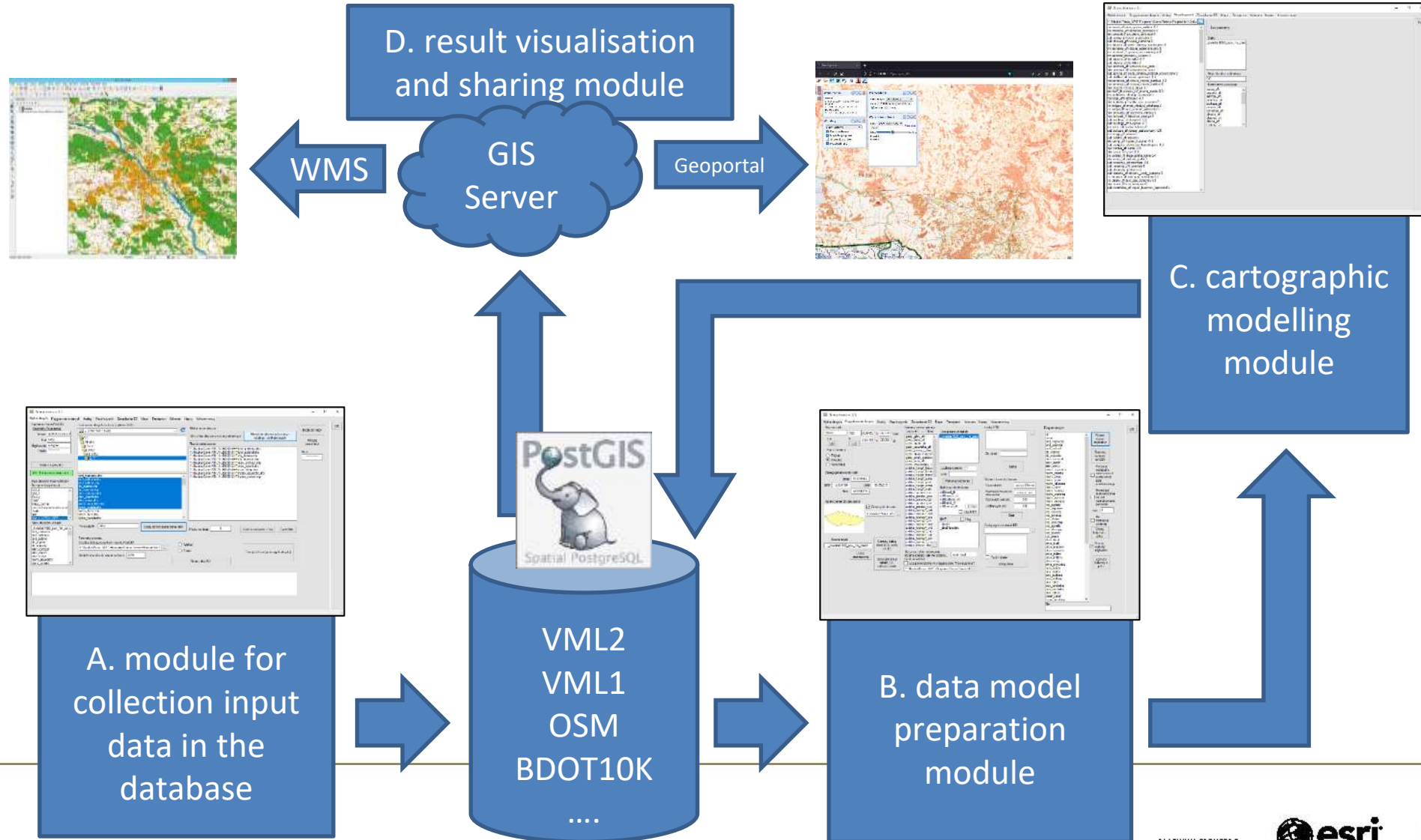
The terrain classification due to passability as one of the most important element of terrain assesment. It is based on the division of terrain into three classes:

- **GO TERRAIN** – does not require any additional measures for ensuring manoeuvres of forces operating in it,
- **SLOW-GO TERRAIN** – reduces possibility of troop manoeuvre movements, but to a lesser degree than NO-GO TERRAIN,
- **NO-GO TERRAIN** – hinders the movement of troops to a very large extent in all directions, drastically reducing the speed of movement.

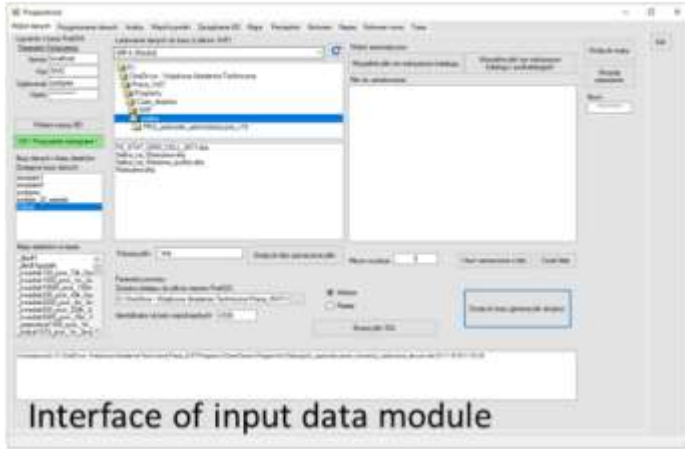




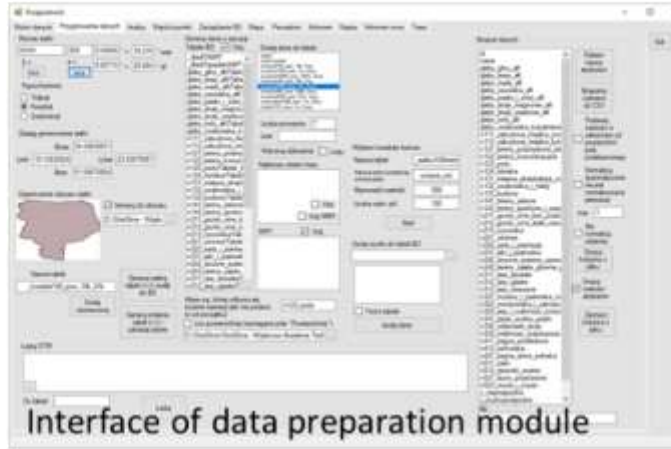
The primary purpose of developing passability maps is the design of **mobility corridors** and **avenues of approach**, which, as much as possible, **should not pass** through NO GO or SLOW GO terrain



All of the above operations were performed using original software (.NET)

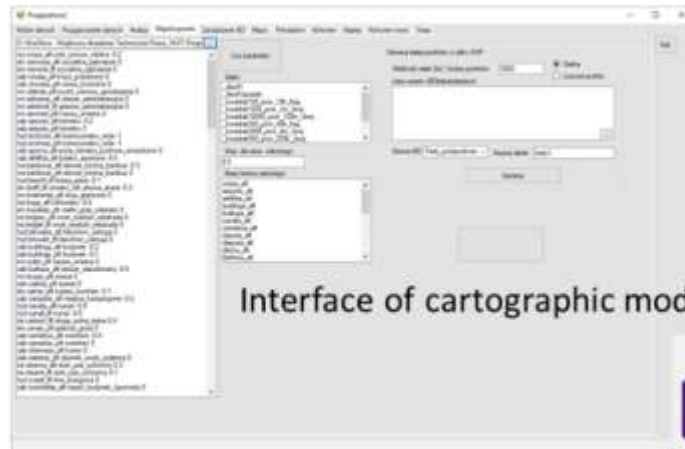


Interface of input data module



Interface of data preparation module

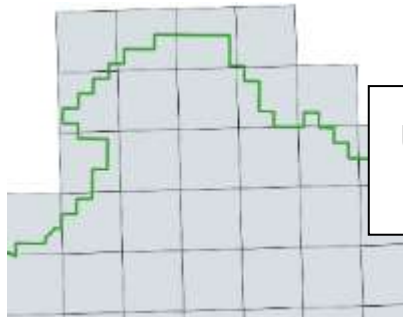
ca. 9000 lines



Interface of cartographic modelling module

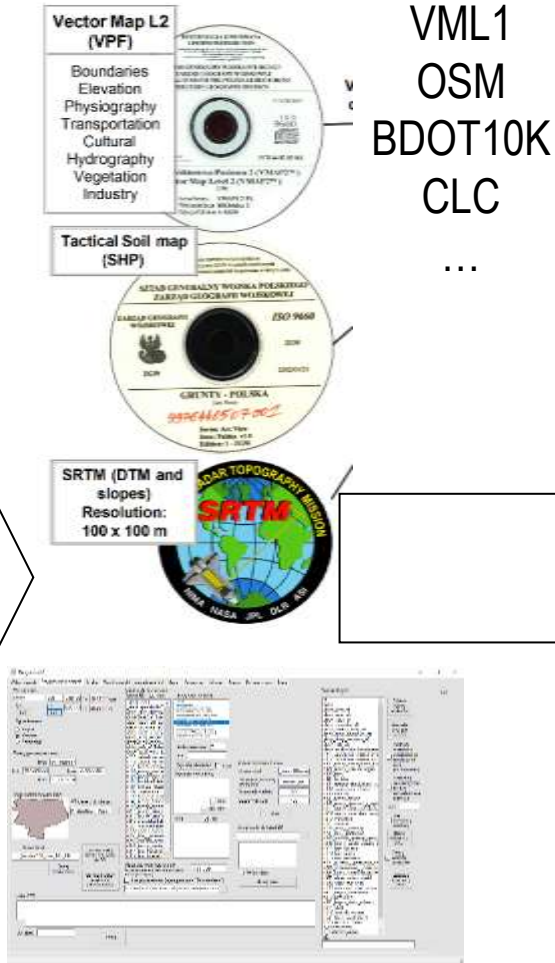


In the presented methodology, passability is determined in relation to the primary field. On the research area, a grid of squares was generated

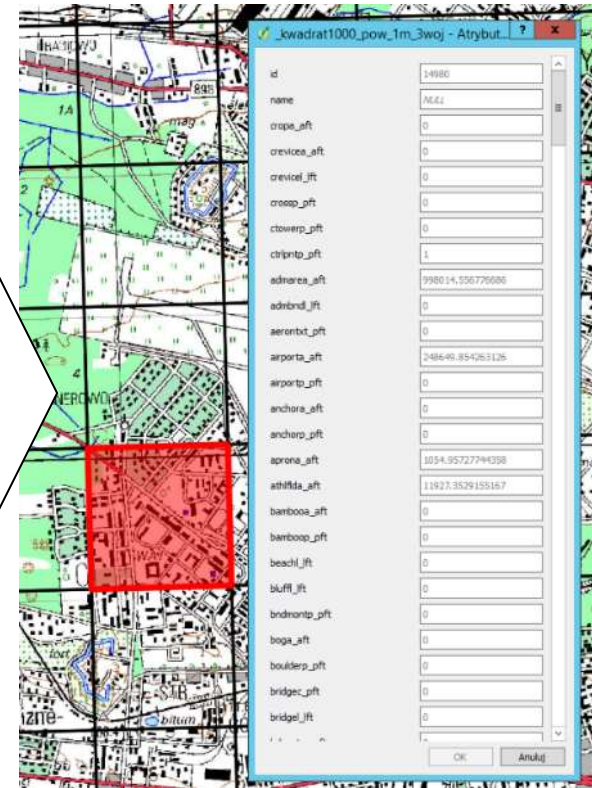


Using data and application

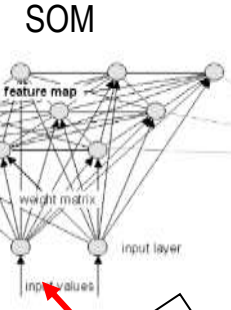
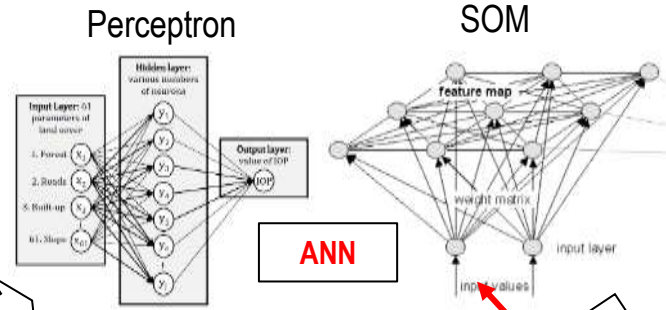
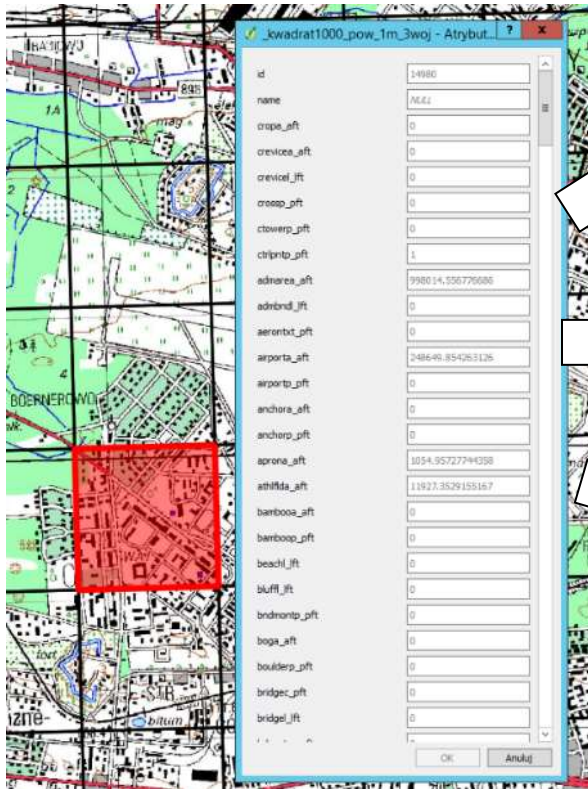
Proprietary software



The final result of this operation was the assigning to each primary field descriptive attributes.



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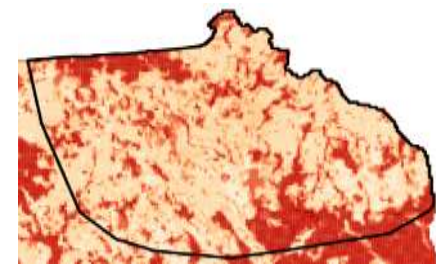
ANN

Feature class	GO		SLOW		NO GO		Example
	Thresh. val. 1	Thresh. val. 2	Thresh. val. 1	Thresh. val. 2	False	IOP	
Forest [%]	30	60	15	0	15	0	
Built-up [%]	20	40	50	2	50	2	
River (area) [%]	30	60	35	1	35	1	
River (line) [m]							0
Road (line) [m]							0
Lake [%]							0
Swamp [%]	30	60					0
Slope [°]	7	14	1	0	1	0	

Thresholds method

Ułatwiający		Ograniczający		Neutralne	
Obiekt	Ivar	Obiekt	Ivar	Obiekt	Ivar
Drogi	0.7	Rzeki	-1.0	Pozniak	0
Ścieżki	0.5			Bodynek	0
Dąbki	0.5			Koman	0
Tunel	0.5			Warstwiec	0
Teren otwarty	0.5	Spadek	-0.4	Elementy kartograficzne (np. opisy)	0

„VRF” method



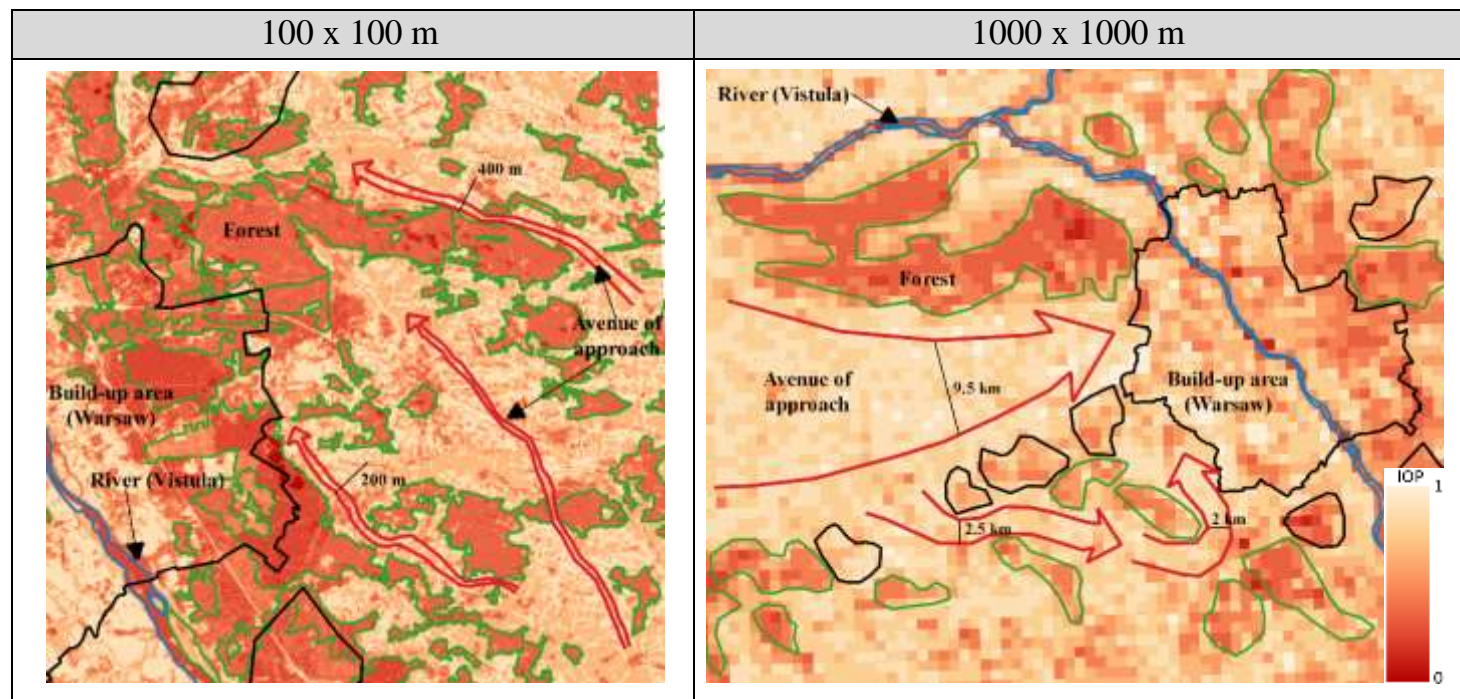
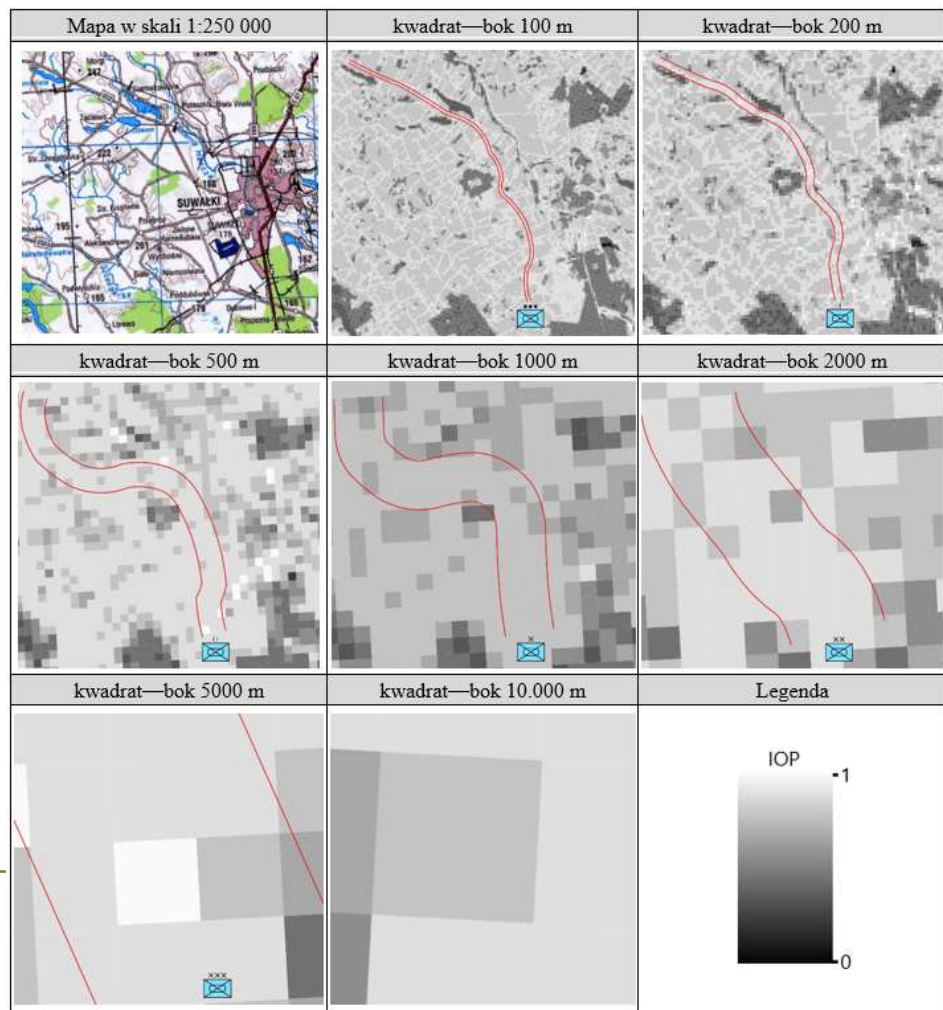
Teaching data

Criteria

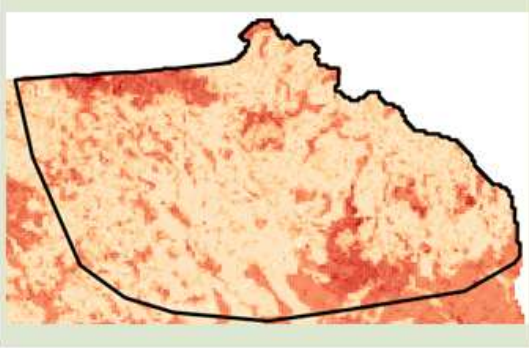
Coefficients

AUTOMATION ! (after gathering a "knowledge base", save time)

- The primary field of the **smallest size** allows for the highlighting of a **higher number** of details and avenues of approach. Taking this into account, it is possible to assign the size of the primary field to the particular level of a unit



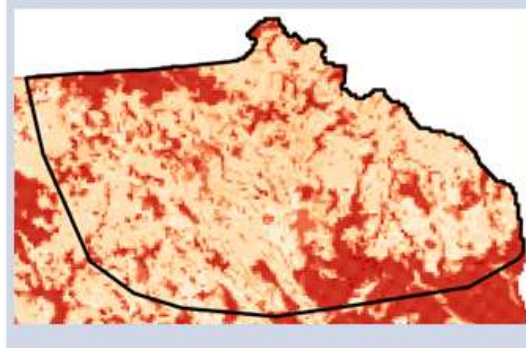
Vector Map Level 2



OSM



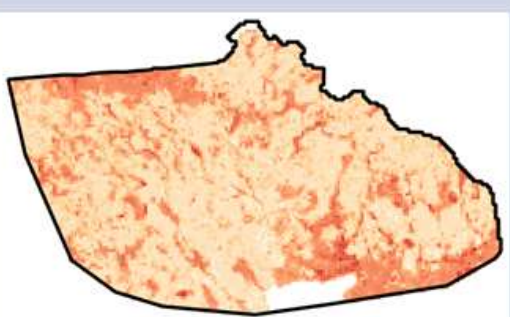
Corine Land Cover



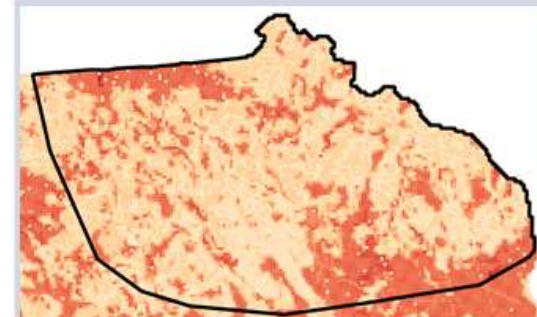
Vector Map Level 1



BDOT10k



BDOO

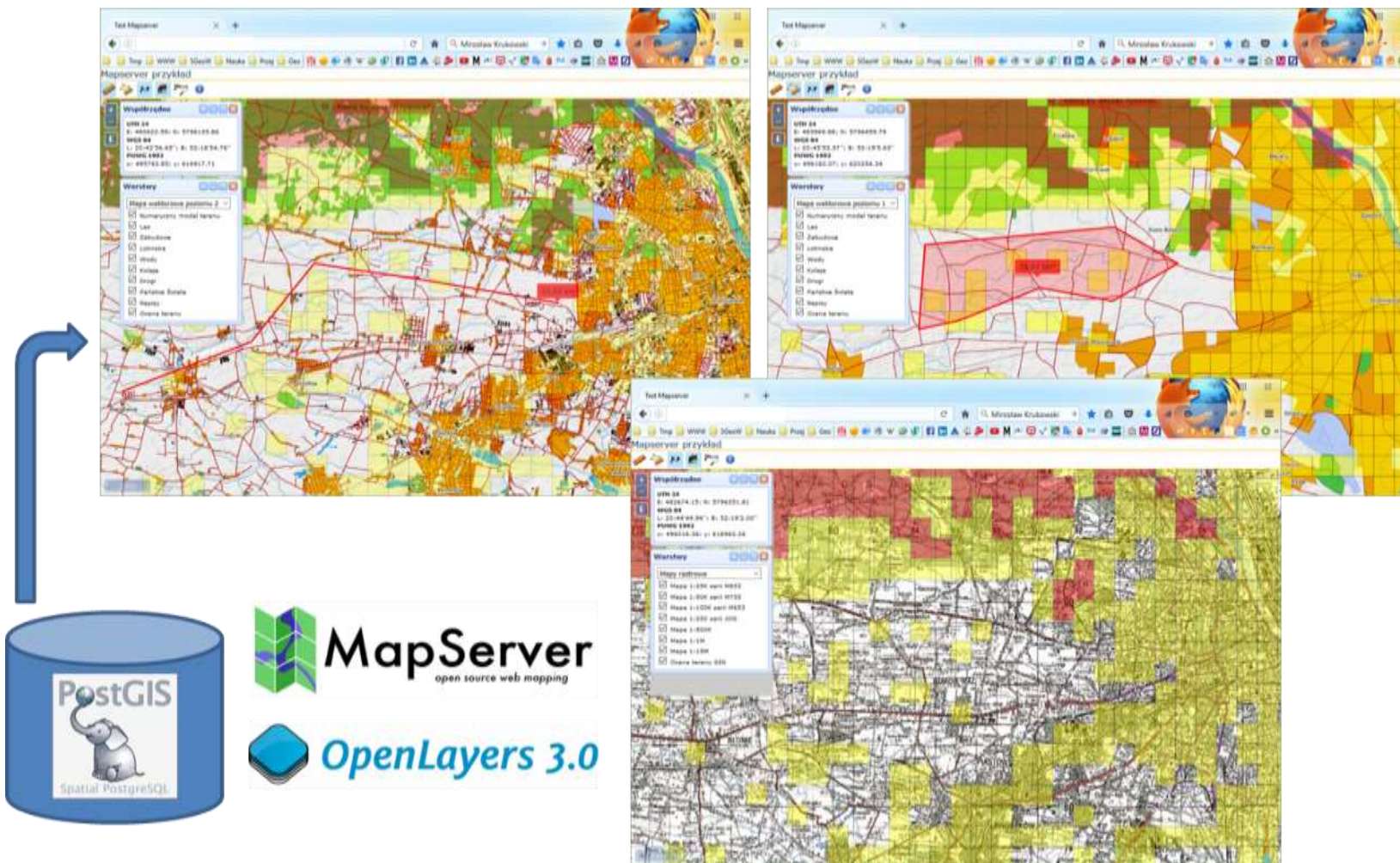


- This process of data preparation, is **fully automatic**, but the preparation time of this data can be very long.
- Taking this into consideration, **parallel processing algorithms** were used.
- 3 hardware configurations have been tested. The preparation of **1 primary** field takes **from 1 to 9 seconds**

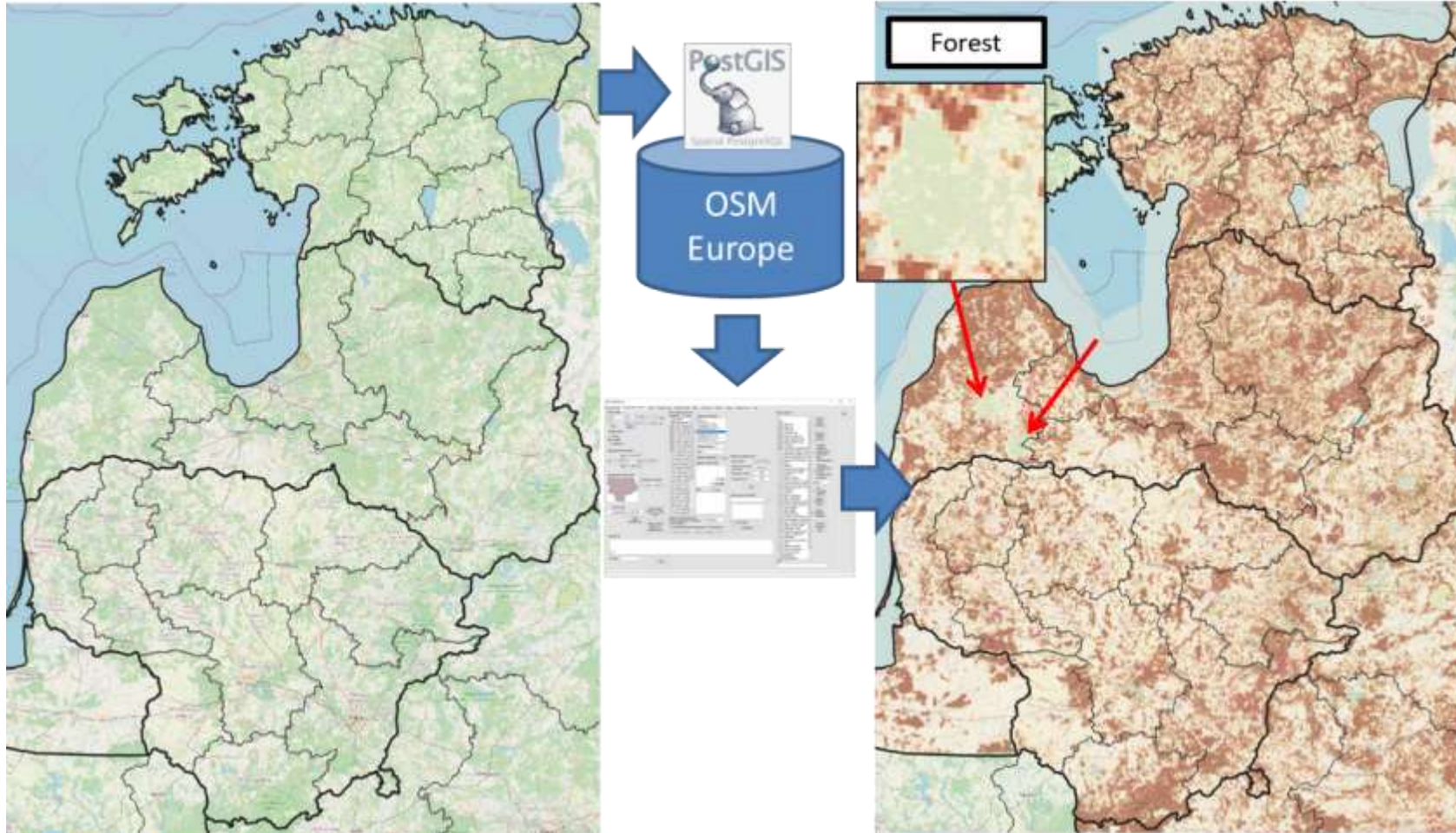
<i>Processor: AMD Athlon II X4 640, 3,0 Ghz (4 cores)</i>							
<i>Memory: 8 GB DDR III, below no. of threads and CPU utilization</i>							
<i>1</i>	<i>CPU</i>	<i>3</i>	<i>CPU</i>	<i>7</i>	<i>CPU</i>	<i>15</i>	<i>CPU</i>
10.1	25	3.6	70	3.0	97	3.0	97
<i>Processor: Intel Xeon e3-1230 v. 5 3,4 Ghz (4 cores)</i>							
<i>Memory: 8 GB DDR IV, below no. of threads and CPU utilization</i>							
<i>1</i>	<i>CPU</i>	<i>3</i>	<i>CPU</i>	<i>7</i>	<i>CPU</i>	<i>15</i>	<i>CPU</i>
6.0	25	1.7	70	1.1	97	1.3	97
<i>Processor: Intel Core i5-6200U, 2.8 Ghz (2 cores, notebook)</i>							
<i>Memory: 8 GB DDR III, below no. of threads and CPU utilization</i>							
<i>1</i>	<i>CPU</i>	<i>3</i>	<i>CPU</i>	<i>7</i>	<i>CPU</i>	<i>15</i>	<i>CPU</i>
15.4	50	8.6	97	9.4	97	12.5	97

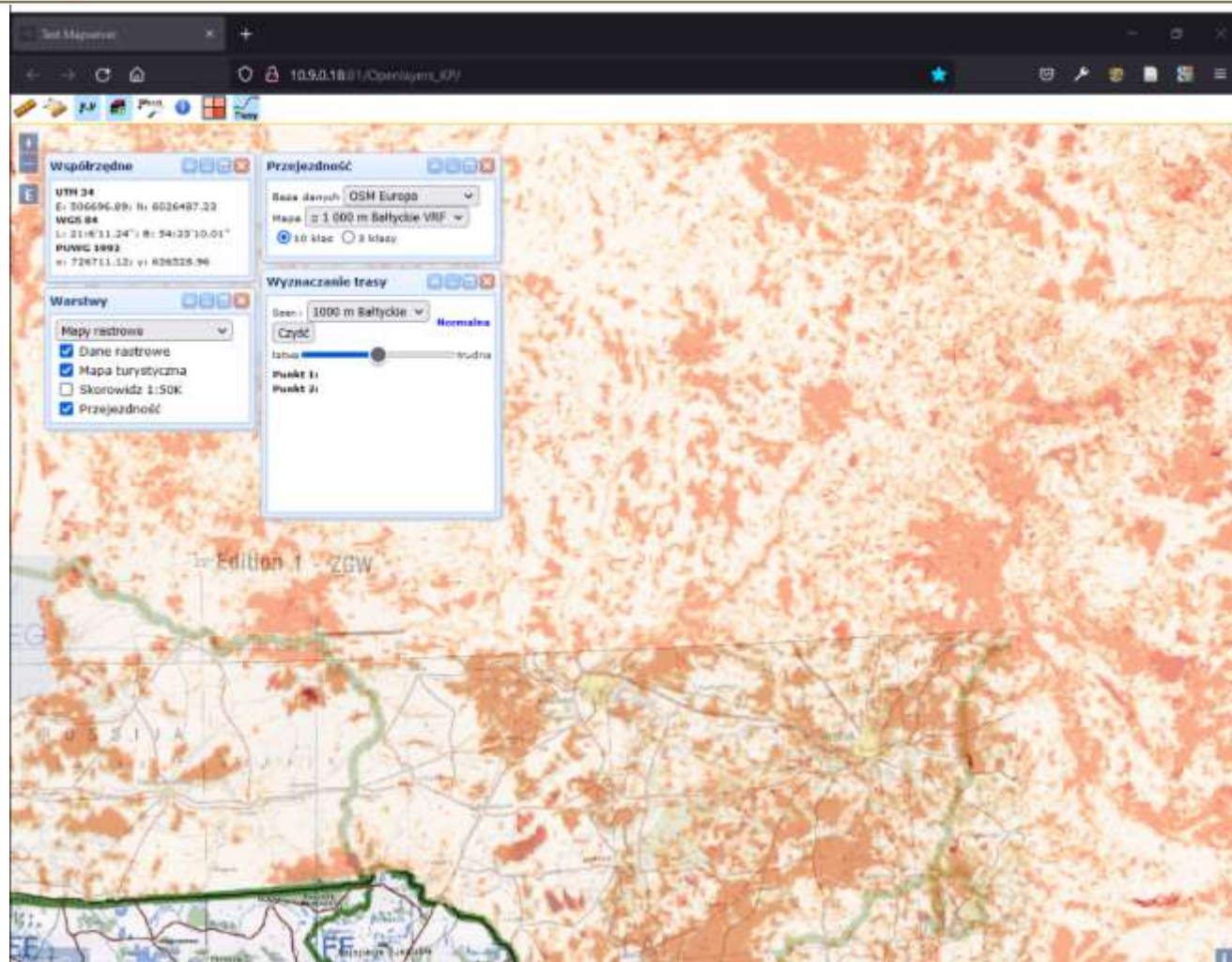
$$\gg 1.1 \text{ s} * 81\ 032 \approx 25 \text{ h}$$

$$\gg 8.6 \text{ s} * 81\ 032 \approx 194 \text{ h} \approx 8 \text{ days}$$



- OSM data has been prepared the map of passability for Baltic Countries





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