Instytut Meteorologii i Gospodarki Wodnej
Państwowy Instytut Badawczy

Development of sensitivity of a flood-endangered system in flood risk managemet

Kształtowanie podatności systemu zagrożonego powodzią w zarządzaniu ryzykiem powodziowym

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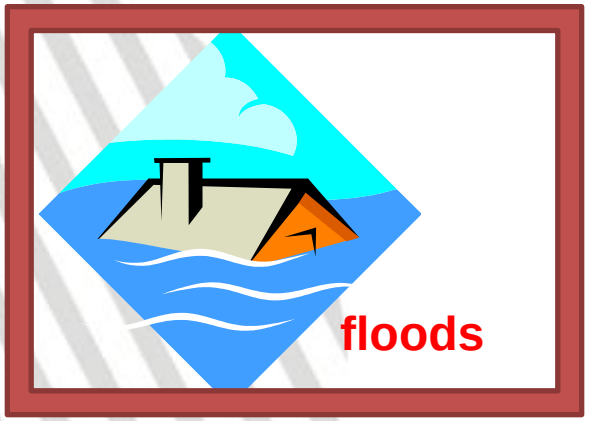
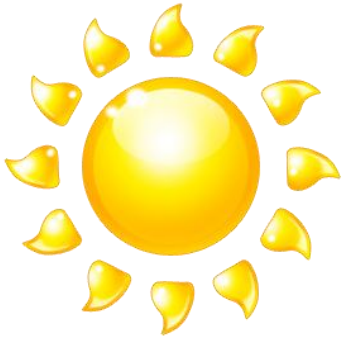
POGODYNKA.PL

Warszawa, 15 października 2015 r.

Examples of natural hazards occurring in Poland:



heat wave



drought

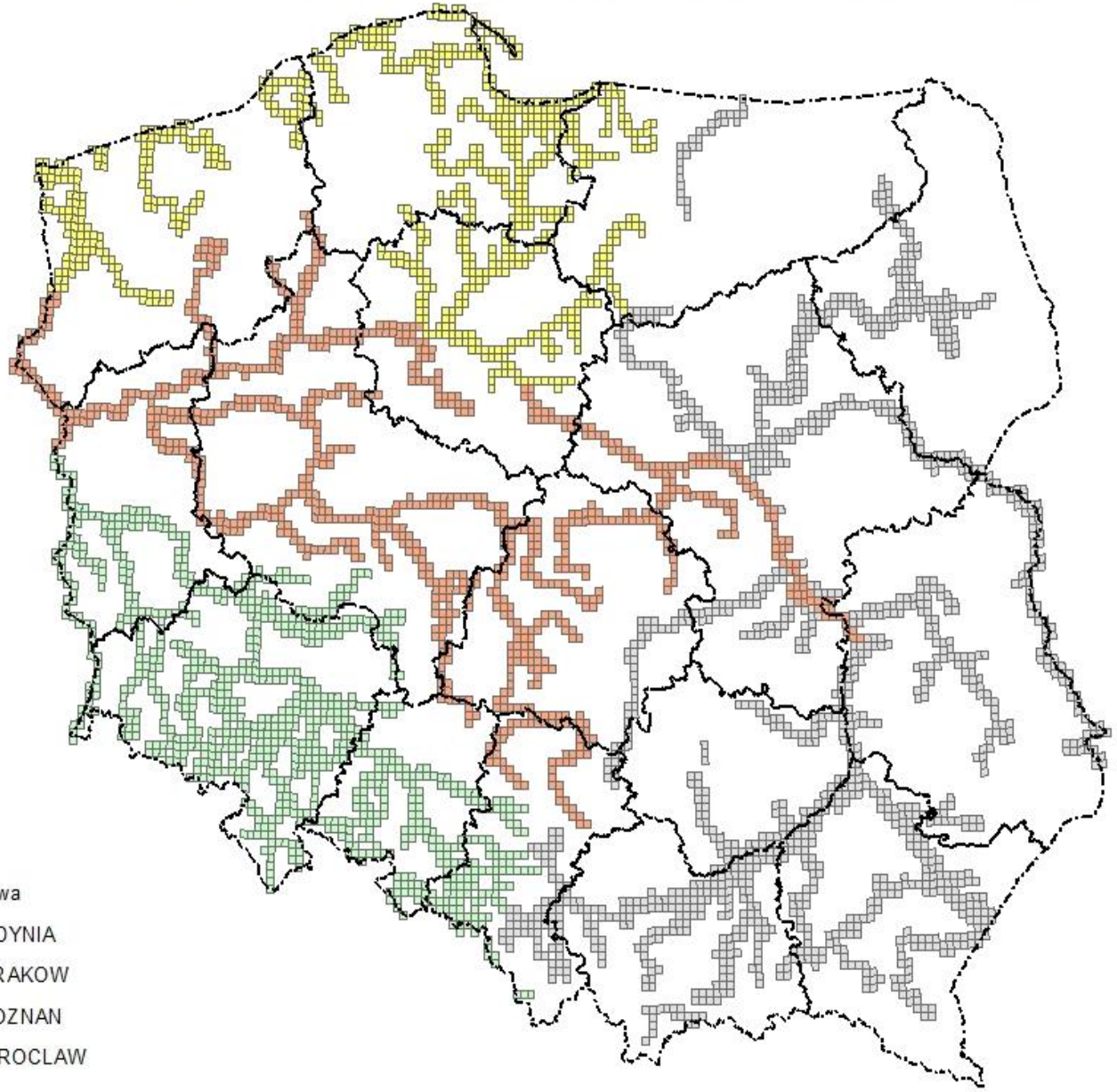
fires

severe frosts

storms and extreme winds

Overview map areas under development in the project ISOK by individual flood modeling centers

253 the main river and water courses in Poland with a total length **14 481 km**

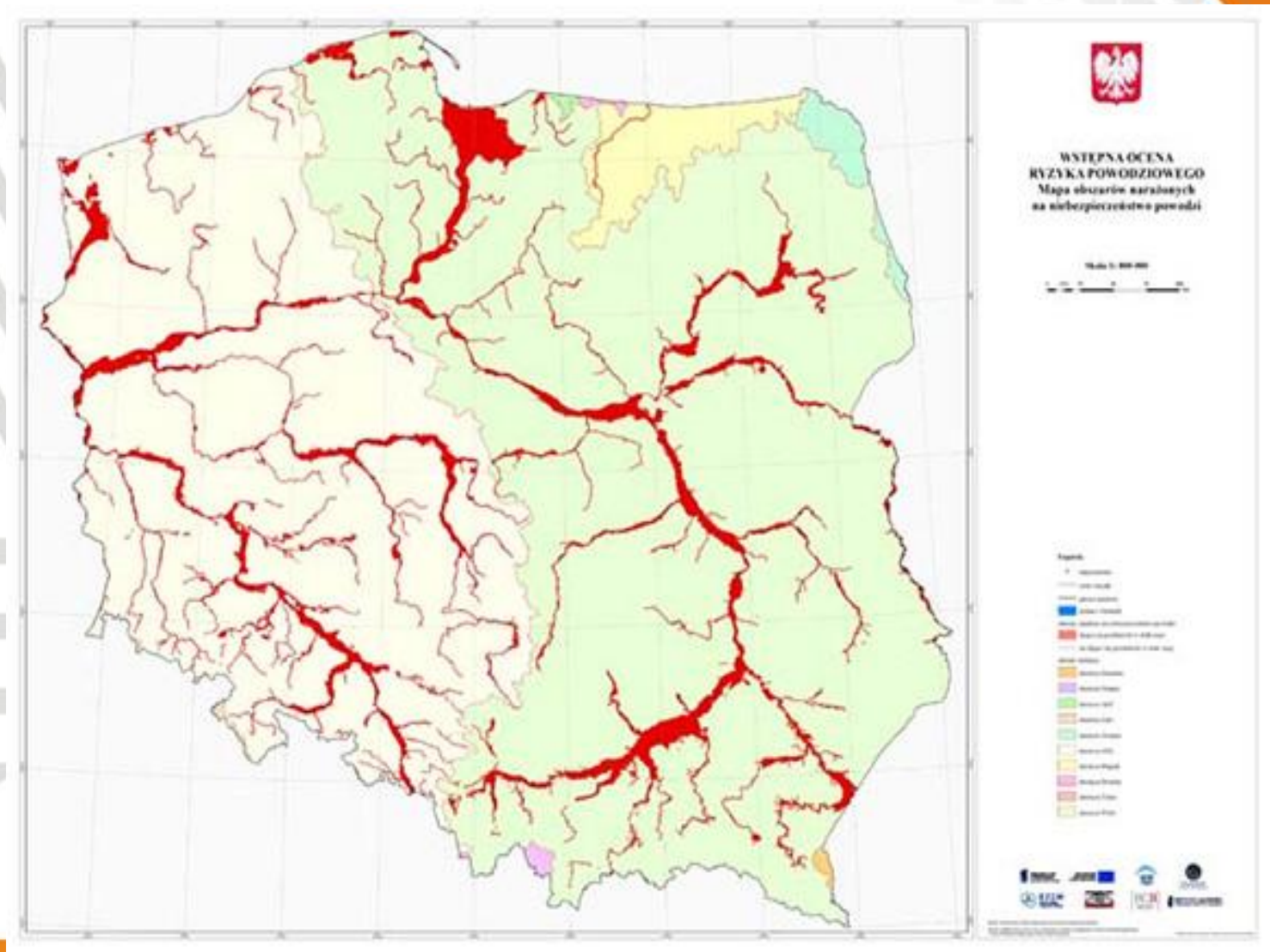


other **586** rivers and water courses with a total length

12 680 km

directed to the II cycle planning

Overview map areas under development in the project ISOK by individual flood modeling centers



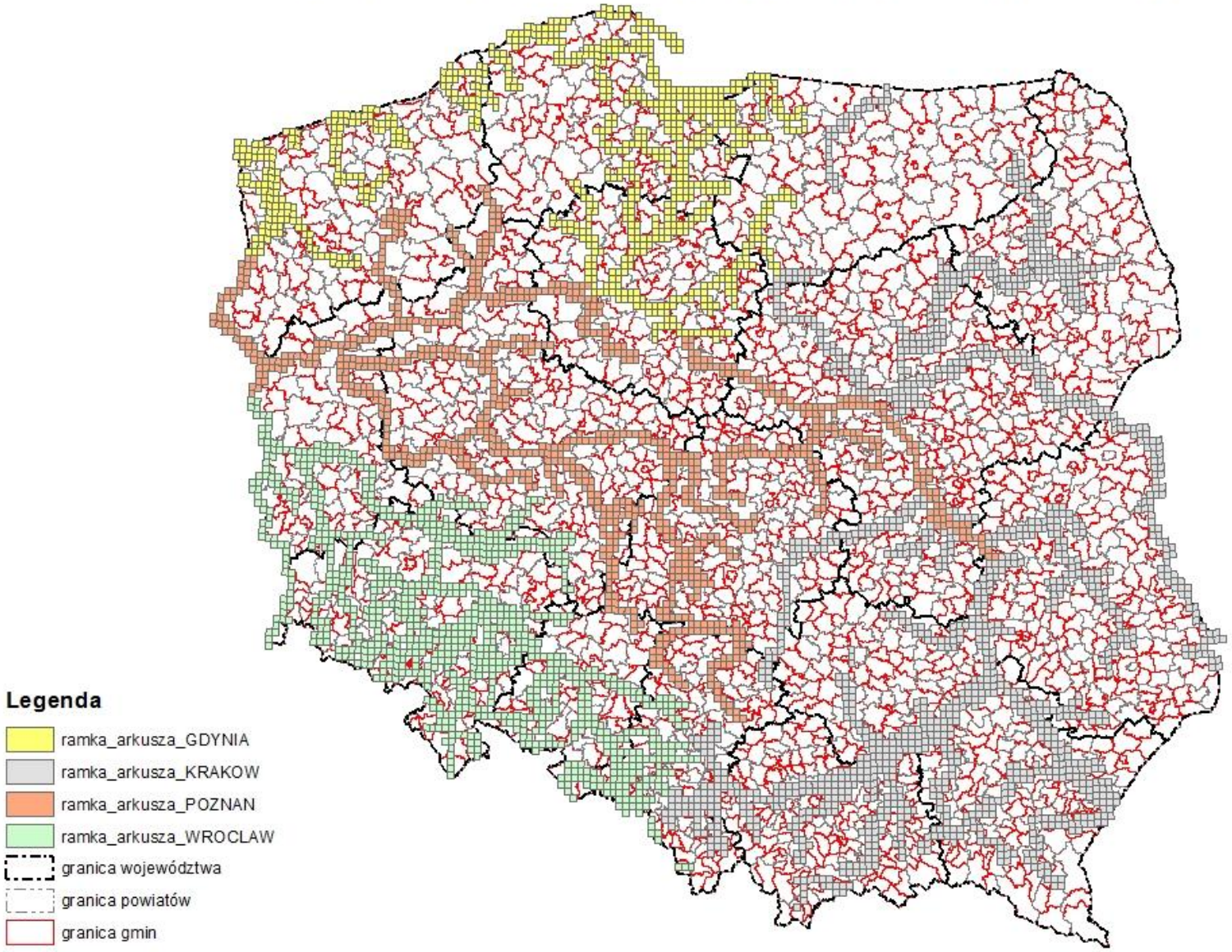
Flood hazard maps (MZP = mapy zagrożenia powodziowego) and **Flood risk maps** (MRP = mapy ryzyka powodziowego) prezents areas at risk of flooding with particular probability of occurence (Directive 2007/60/WE):

(i) Areas in witch the probability of flooding occurrence is **low** and equals **0.2%** (i.e. once per 500 years; a so-called 500-year flood).

(ii) Areas in witch the probability of flooding occurrence is **moderate** and equals **1%** (i.e. once per 100 years; a so-called 100-year flood).

(iii) Areas in witch the probability of flooding occurrence is **high** and equals **10%** (i.e. once per 10 years; a so-called 100-year flood).

Overview map areas under development in the project ISOK by individual flood modeling centers



in accordance with the Law on State administrative division of community is the basic administrative unit

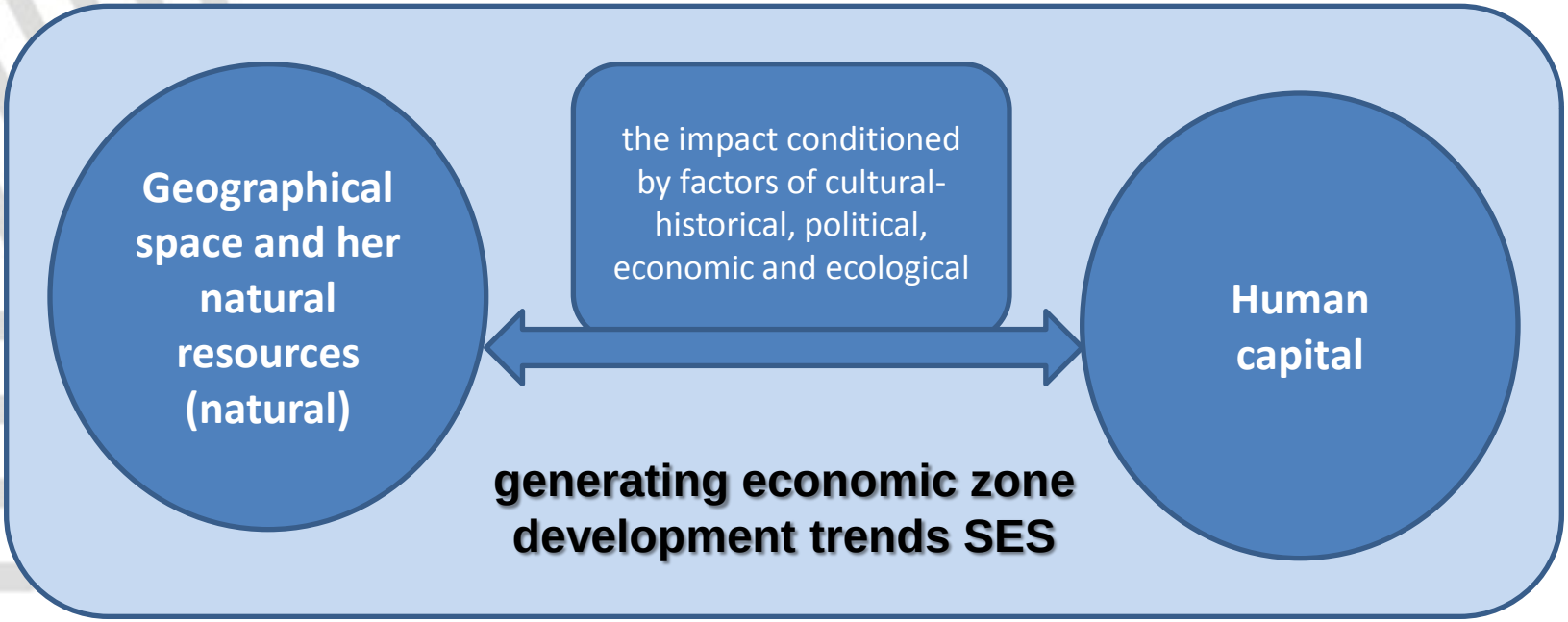
territorial units	the number of elements
voivodships	*16*
subregions	*66*
counties	*314*
communities	***2479***

[1] Ustawa z 5 czerwca 1998 r. o wprowadzeniu zasadniczego trójstopniowego podziału terytorialnego państwa (Dz. U. z 1998 r., nr 96, poz. 1547 z późn. zm).

	Q 10% (high)	Q 1% (moderate)	Q 0,2% (low)
The number of communities affected by flood water at a given probability Q	1287	1301	1307

The concept of social-ecological system
(SES = social-ecological system)

- defined over 40 years ago (Crawford Stanley Holling 1973)



Currently sensitivity/susceptibility is shaped by Ordinance of the Minister of the Environment, Minister of Transport, Construction and Maritime Economy, Minister of Administration and Digitisation and the Minister of the Interior dated 21st December 2012 concerning development of flood hazard maps
and flood risk maps [Dz.U.2013 poz. 104]

water depth h [m]	**value of the loss function f(h) [%]**		
	residential areas	**industrial areas**	**communi-cation areas**
≤ 0,5	20	20	5
0,5 < h ≤ 2	35	40	10
2 <h ≤ 4	60	60	10
> 4	95	80	10

województwo	wartość majątku wg klas użytkowania terenu						
	zabudowa mieszkaniowa [zł/m^2]	tereny przemysłowe [zł/m^2]	tereny komunikacyjne [zł/m^2]	lasy [zł/ha]	tereny rekreacyjno-wypoczynkowe [zł/m^2]	użytki rolne [zł/ha]	
						grunty orne	użytki zielone
dolnośląskie	422,24	473,44	436	80	5,1	1428	674
kujawsko-pomorskie	332,72	461,52					
lubelskie	164,54	508,97					
lubuskie	276,30	639,37					
łódźkie	290,94	829,2					
małopolskie	364,09	606,64					
mazowieckie	509,63	943,83					
opolskie	265,87	474,32					
podkarpackie	201,25	641,34					
podlaskie	162,79	509,85					
pomorskie	399,89	595,82					
śląskie	559,03	549,65					
świętokrzyskie	201,10	537,68					
warmińsko-mazurskie	203,39	504,73					
wielkopolskie	360,56	702,5					
zachodniopomorskie	309,83	326,21					

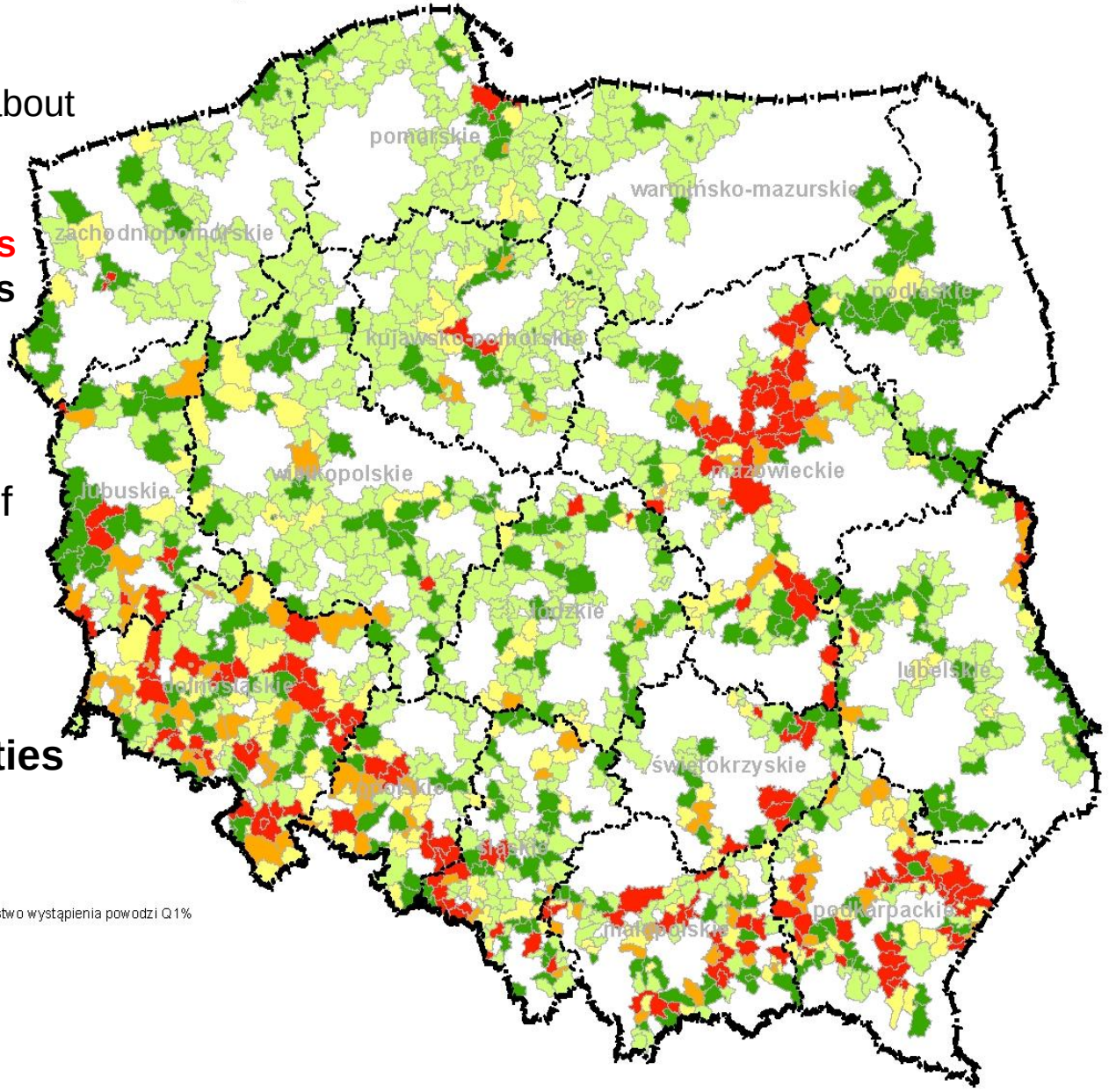
The size of the potential flood losses in communities [mln zł]

losses in comunities [mln zł]	number of comunities	color on the map	the level of threat
below 1 mln zł	586		very lov
<1 – 5) mln	294		lov
<5 – 15) mln	181		moderate
<15 – 30> mln	87		high
above 30 mln zł	153		very high
amount:	1301		

The spatial distribution of losses in communities [mln zł] after the passage of the probability of occurrence flooding Q1%

an average of about
12,3 mln zł
potential flooding losses
in communities

an average of about
9 mln zł
actual flood losses
in communities



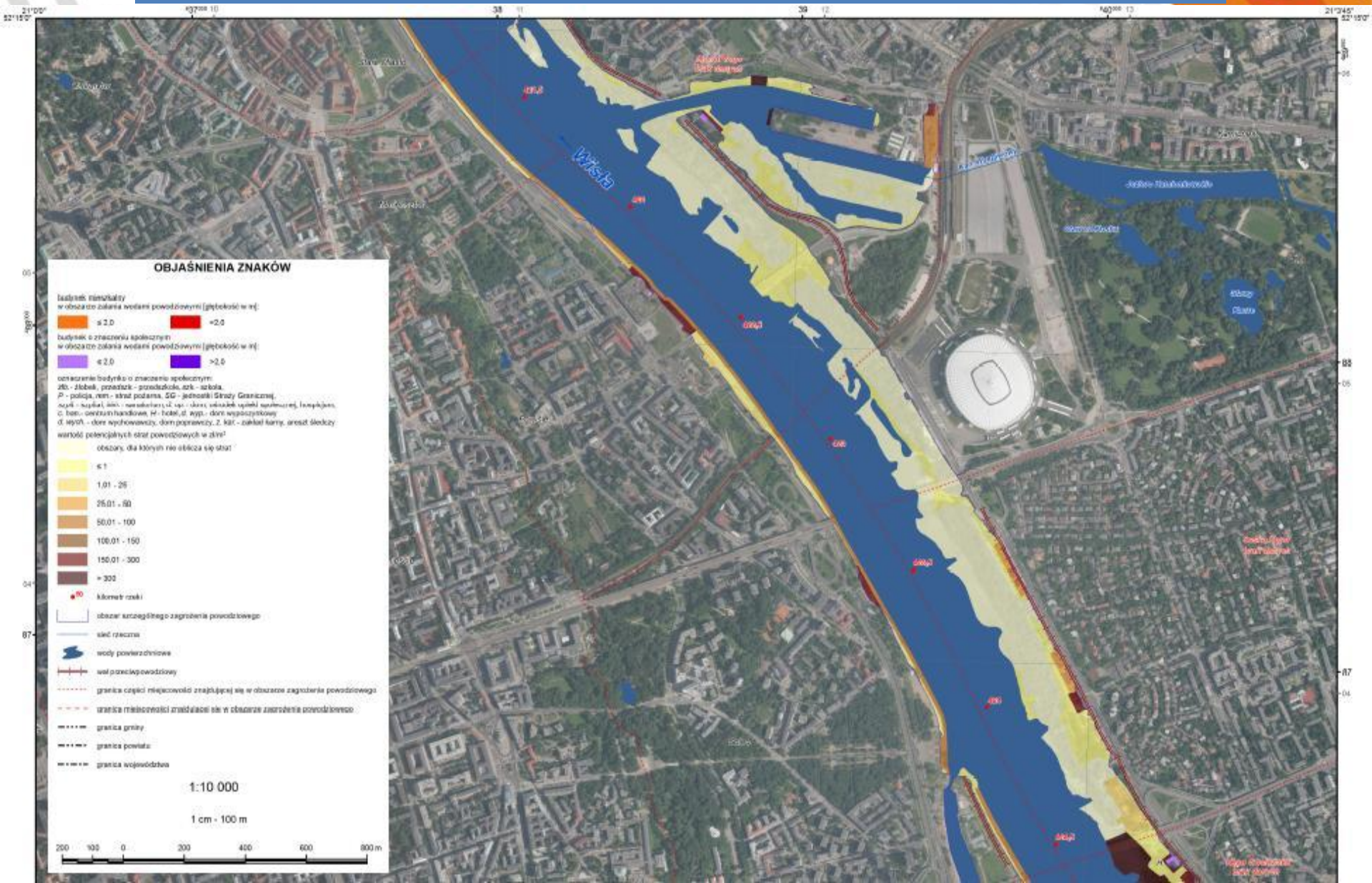
nr	community	count	voivodship	losses in community [mln zł]
1	**Lubomia**	wodzisławski	śląskie	**318,17**
2	**Wyszków**	wyszkowski	mazowieckie	**279,81**
3	**Kędzierzyn-Koźle**	kędzierzyńsko-kozielski	opolskie	**254,95**
4	**Warszawa (m)**	Warszawa	mazowieckie	**200,25**
5	**Sandomierz (g.m.)**	sandomierski	świętokrzyskie	**199,27**
6	**Kuźnia Raciborska**	raciborski	śląskie	**192,16**
7	**Połaniec**	staszowski	świętokrzyskie	**183,02**
8	**Kozienice**	kozieniecki	mazowieckie	**179,45**
9	**Legnica (m)**	Legnica	dolnośląskie	**178,25**
10	**Rząśnik**	wyszkowski	mazowieckie	**172,13**
11	**Maciejowice**	garwoliński	mazowieckie	**164,30**
12	**Cisek**	kędzierzyńsko-kozielski	opolskie	**159,37**
13	**Gorzyce**	wodzisławski	śląskie	**151,72**
14	**Kłodzko (g.w)**	kłodzki	dolnośląskie	**149,78**
15	**Trzebownisko**	rzeszowski	podkarpackie	**149,42**
16	**Rytwiany**	staszowski	świętokrzyskie	**144,39**
17	**Dąbrówka**	wołomiński	mazowieckie	**141,51**
18	**Tryńcza**	przeworski	podkarpackie	**131,41**
19	**Jelenia Góra (m)**	Jelenia Góra	dolnośląskie	**129,78**
20	**Żyraków**	dębicki	podkarpackie	**128,06**
21	**Pilzno**	dębicki	podkarpackie	**124,93**
22	**Prochowice**	legnicki	dolnośląskie	**121,67**
23	**Wiązownica**	jarosławski	podkarpackie	**117,75**
24	**Białobrzegi**	łańcucki	podkarpackie	**114,59**
25	**Kraków**	Kraków	małopolskie	**110,51**
26	**Gdów**	wielicki	małopolskie	**109,84**
27	**Jarosław (g.m.)**	jarosławski	podkarpackie	**107,49**
28	**Obryte**	pułtuski	mazowieckie	**105,80**
29	**Lelis**	ostrołęcki	mazowieckie	**105,23**
30	**Stargard Szczeciński (g.m.)**	stargardzki	zachodniopomorskie	**104,35**
31	**Lewin Brzeski (g.m-w)**	brzeski	opolskie	**104,31**
32	**Joniec**	płoński	mazowieckie	**104,20**
33	**Przemyśl (m)**	Przemyśl	podkarpackie	**104,17**

Table: Summary of communities for which flood losses are greater than 100 million zł [Source: own].

Examples of flood risk maps - negative consequences for the population and the potential flood losses

1) Probability Q10% (high)

(The National Stadium in Warsaw)

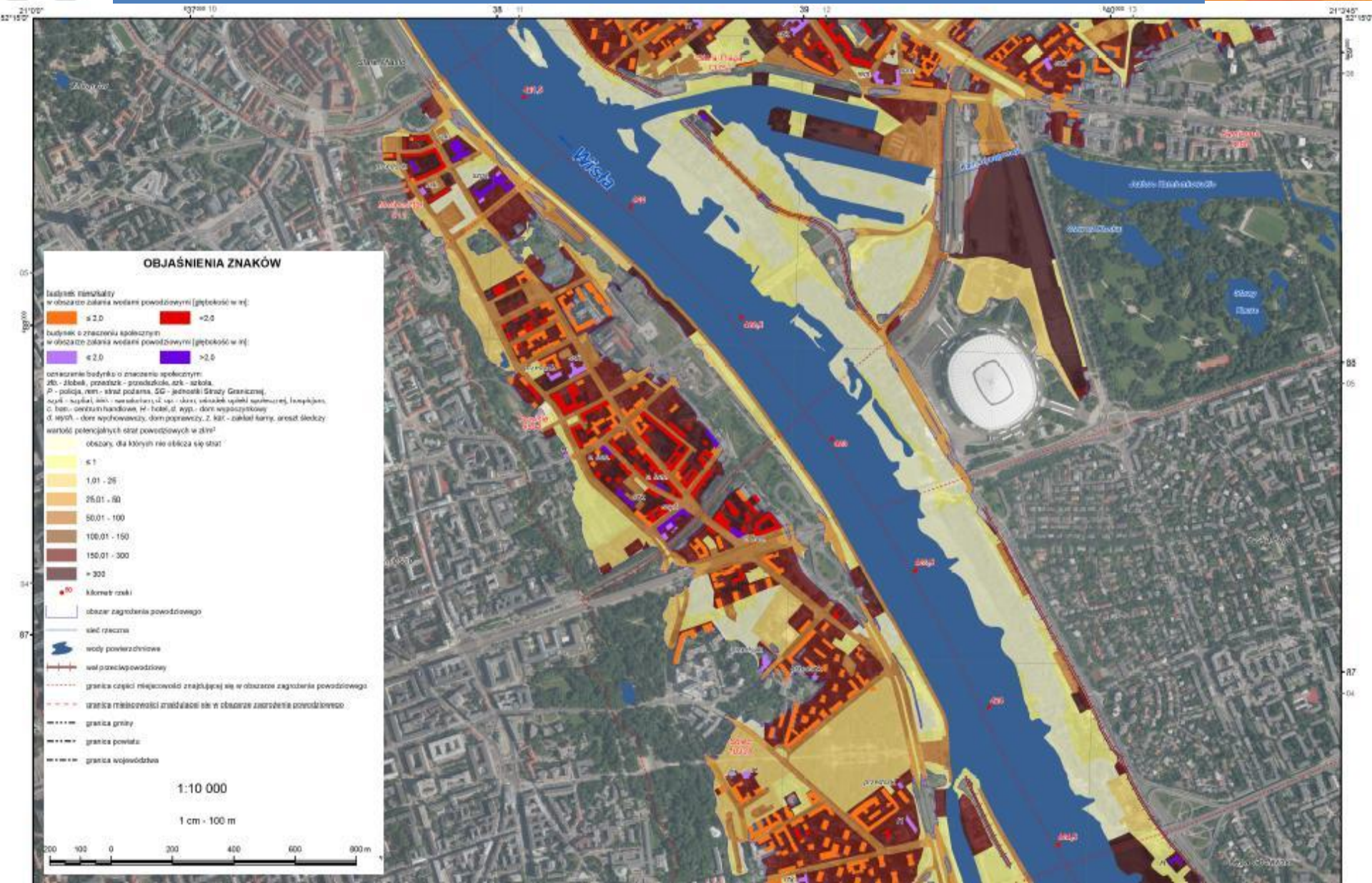


2) Probability Q1% (moderate)

(The National Stadium in Warsaw)

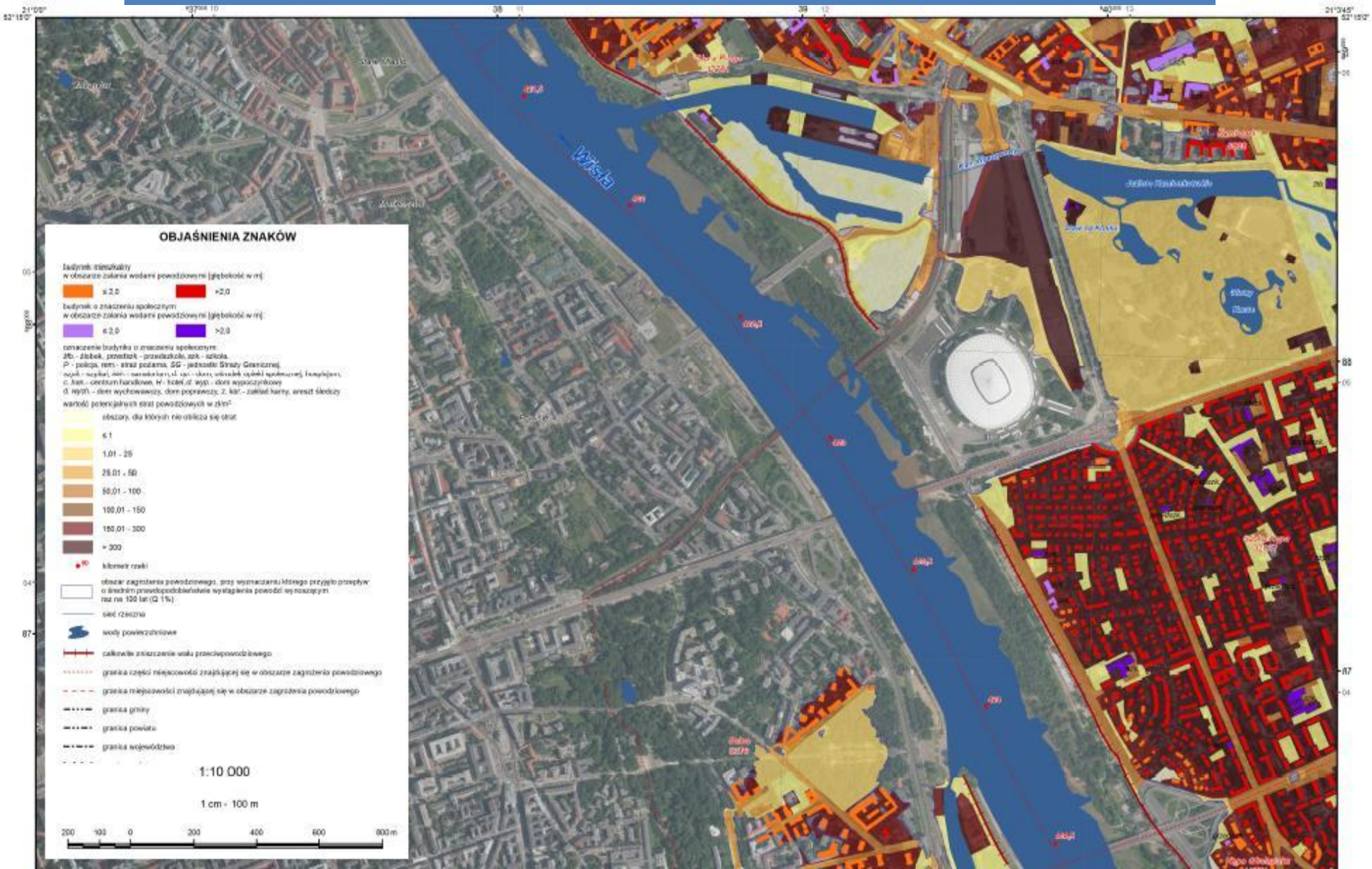
3) Probability Q0.2% (low)

(The National Stadium in Warsaw)



4) Destruction or damage to the embankment

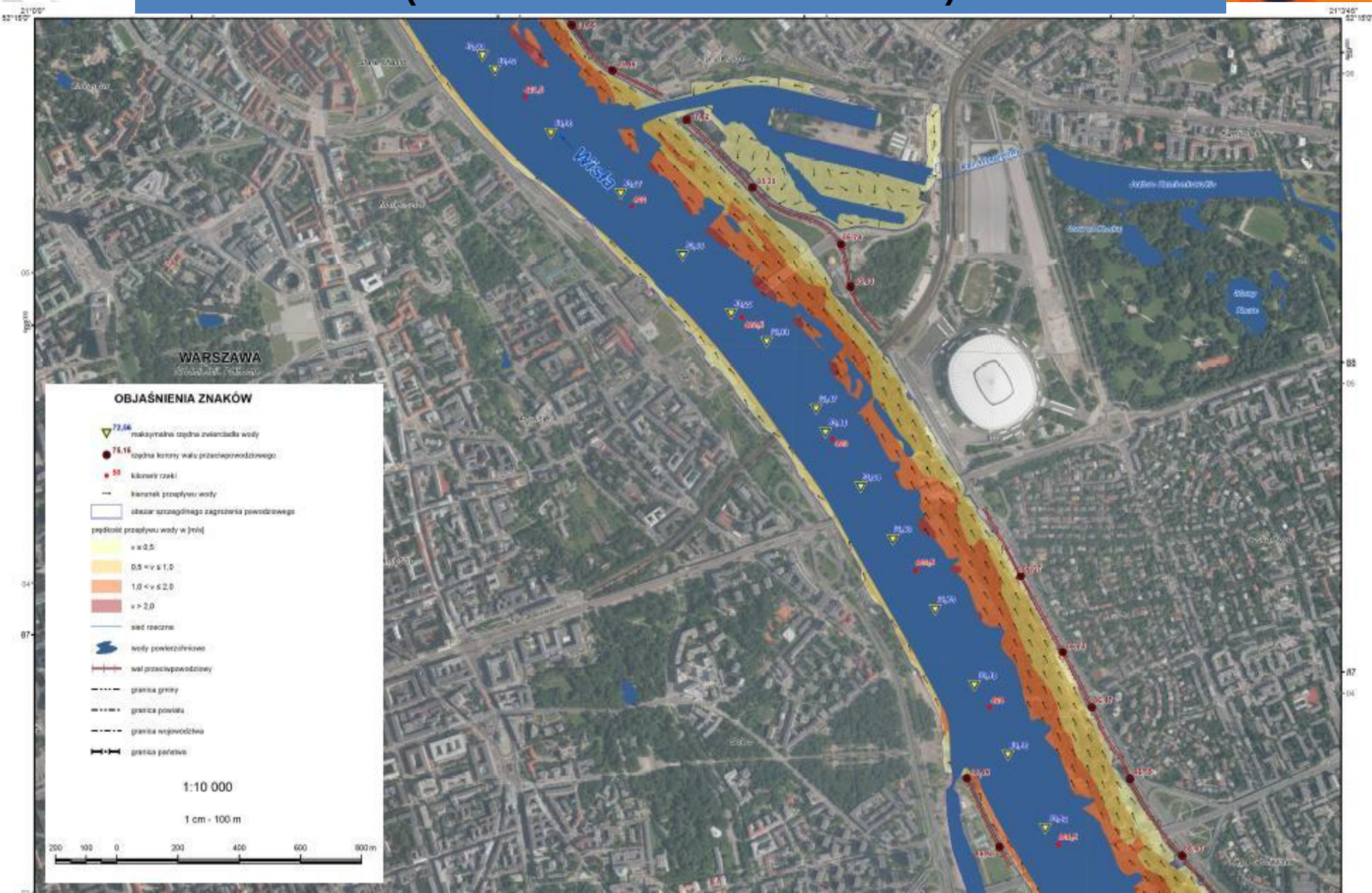
(The National Stadium in Warsaw)



Examples of flood hazard maps, along with the speed of water flow and water flow directions

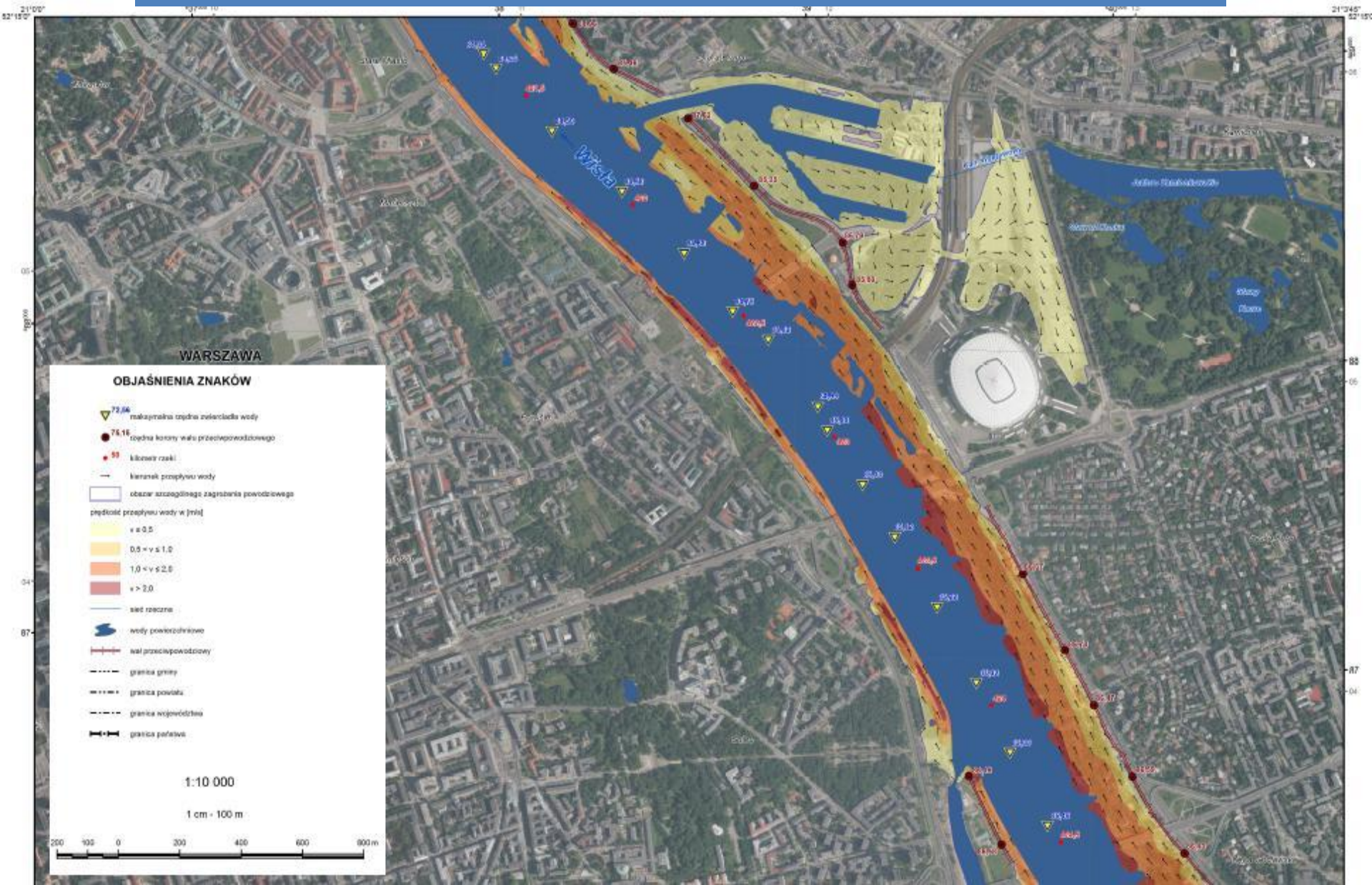
1) Probability Q10% (high)

(The National Stadium in Warsaw)



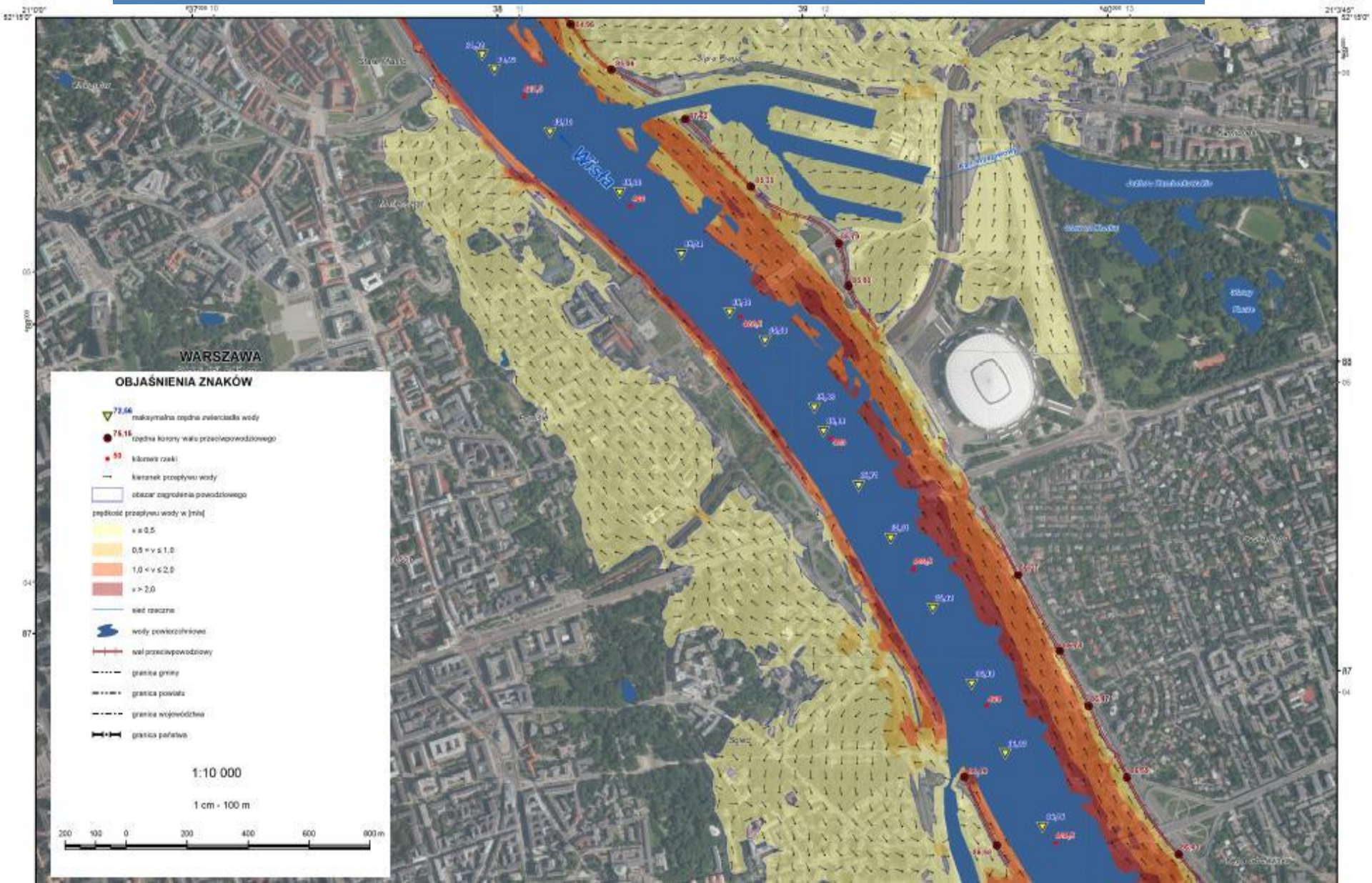
2) Probability Q1% (moderate)

(The National Stadium in Warsaw)



3) Probability Q0.2% (low)

(The National Stadium in Warsaw)



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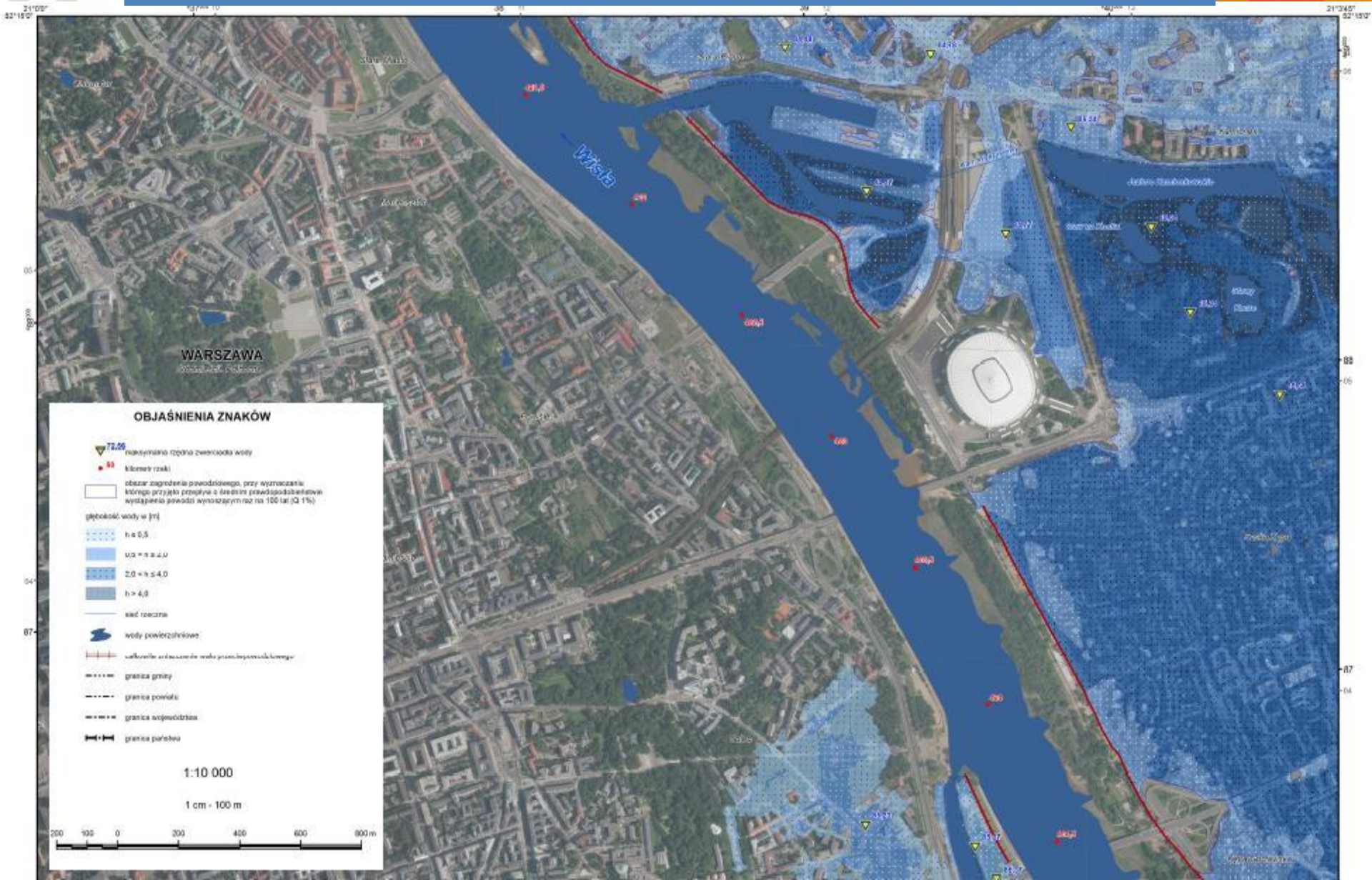

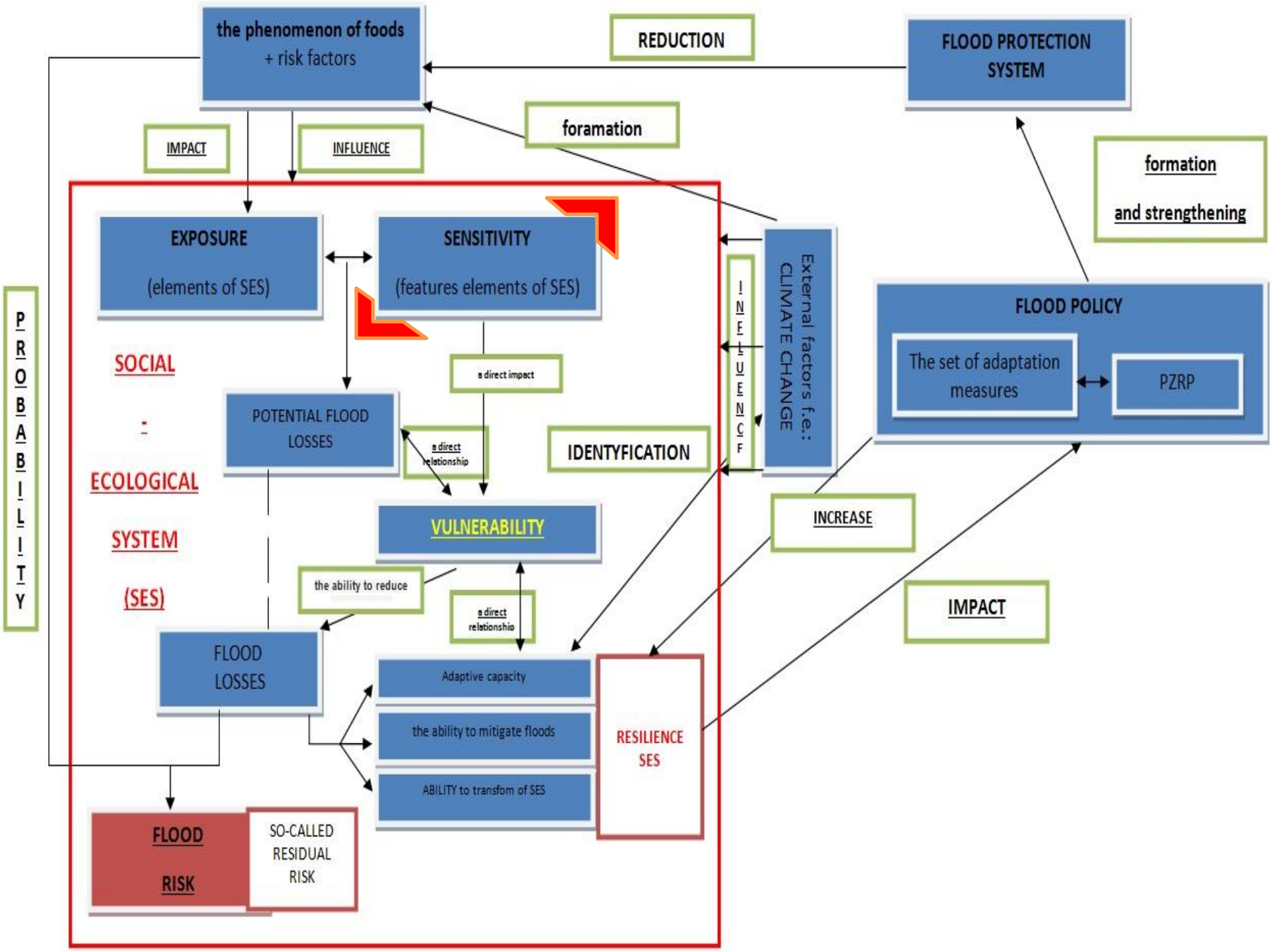
the phenomenon of foods
+ risk factors
REDUCTION
FLOOD PROTECTION SYSTEM
foramation
IMPACT
INFLUENCE
formation
and strengthening
EXPOSURE
(elements of SES)
SENSITIVITY
(features elements of SES)
External factors f.e.: CLIMATE CHANGE
INFLUENCE
FLOOD POLICY
The set of adaptation measures
PZRP
PROBABILITY
SOCIAL
-
ECOLOGICAL
SYSTEM
(SES)
a direct impact
POTENTIAL FLOOD LOSSES
a direct relationship
IDENTYFICATION
INCREASE
VULNERABILITY
the ability to reduce
a direct relationship
IMPACT
FLOOD LOSSES
Adaptive capacity
the ability to mitigate floods
ABILITY to transfom of SES
RESILIENCE SES
FLOOD RISK
SO-CALLED RESIDUAL RISK

Conclusions:

- Sensitivity/ susceptibility is a very important element's of the flood protection system
- Sensitivity/susceptibility constitutes those features and circumstances of the system or its elements which make the system at risk of the adverse effects (losses), and their extent depends on the features of the system's elements
- No loss coefficients or indexation of rates defining potential losses from the moment of publication of the ordinance

Conclusions:

- The results, on the one hand, in the lack of a full image of flood losses in Poland; on the other hand, it transfers the burden to evaluate the losses in the ecosystem into intermediate costs.

Thanks for your attention☺

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