



INSTITUTE OF COMPUTATIONAL  
MODELLING SB RAS

**INVESTIGATION OF ECOLOGICAL  
DANGER OF SIBERIA**

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# Problem

**Danger**

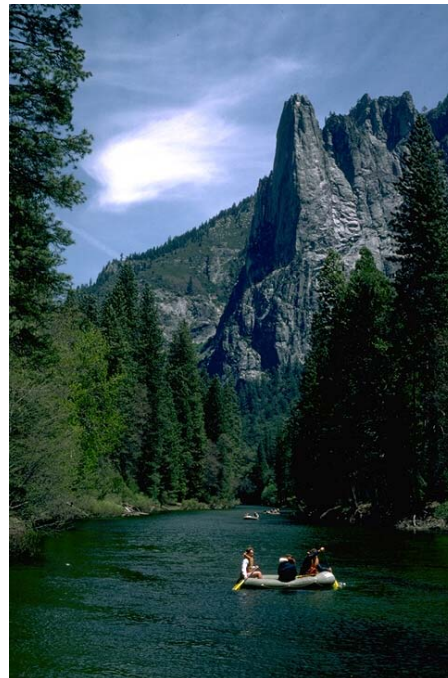
**man-induced**



**natural**



**Environment**

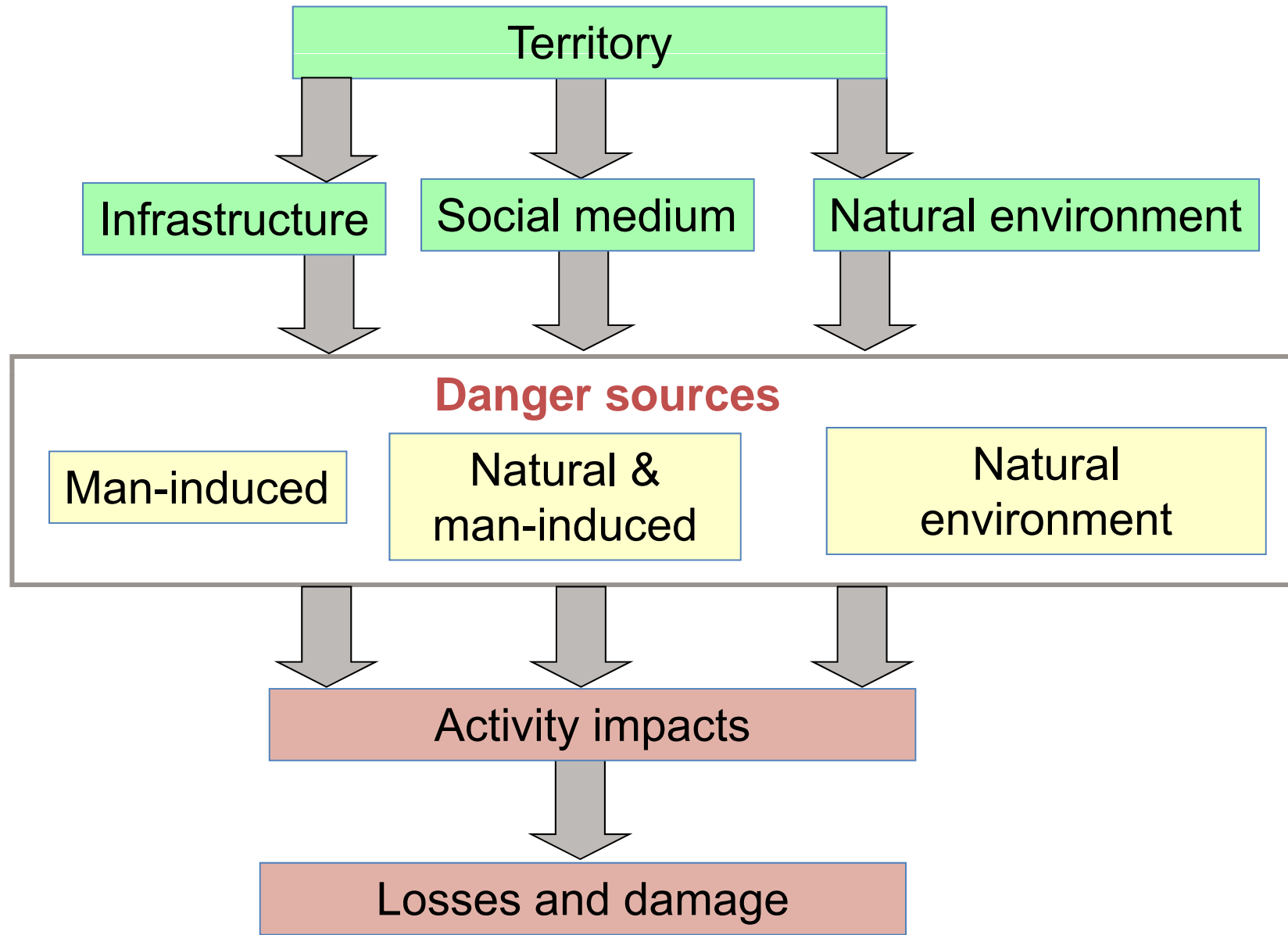


**Risk of degradation or death**

**Risk assessment**

**Risk management**

# Structure of territory dangers



# Natural dangers

Danger	Consequences	Intensity	Damage scale
Flood	Flood of populated area	High	Regional
Earthquake	Destruction of buildings, industrial objects, ecological systems	Low	Regional
Hurricanes	Damage of objects, flora and fauna	Middle	Territorial
Forest fires	Destruction of forest and ecological systems	High	Territorial or local
Strong frost	Damage of communications	Middle	Territorial

# Man-caused damage

Danger	Consequences	Intensity	Damage scale
Accidents on radiation-dangerous objects	Radiation pollution	Low	Regional
Accidents on chemical-dangerous objects	Destruction of buildings and equipment, chemical pollution	Middle	Territorial
Accidents explosive objects	Destruction of buildings and equipment	High	Local
Accidents on fire-dangerous objects	Destruction of buildings and equipment	High	Local
Accidents on hydrological-dangerous objects	Flood of territory	Low	Regional
Destruction of equipment	Destruction of buildings	Low	Local

# Database scheme for analysis

Extreme situations  
(Statistical)

Flood

Natural fires

Earthquake

Monitoring (Daily data)

Air pollution

Water pollution

Radiation pollution

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Dangerous objects

Industrial objects

Transport communications

References

Populated areas

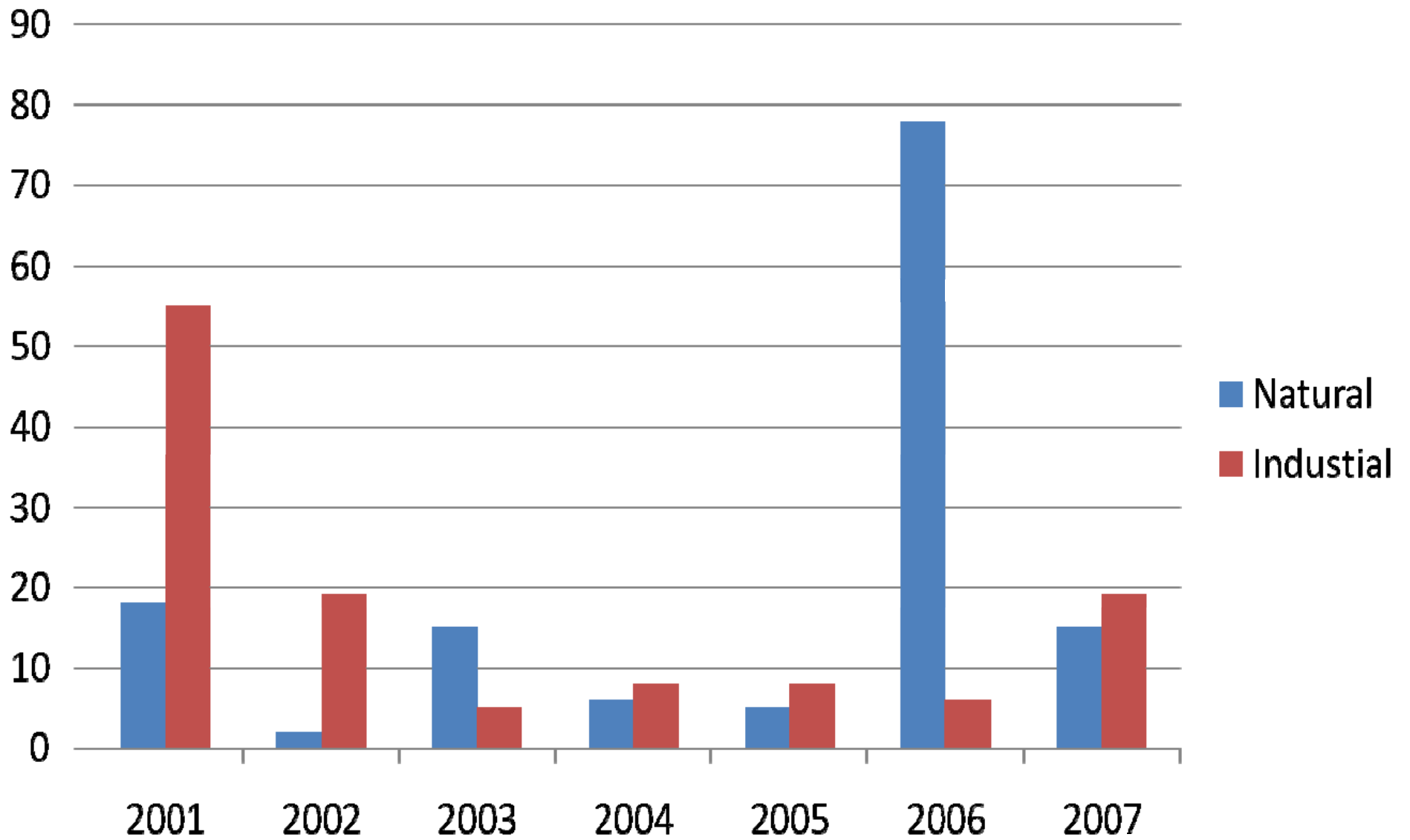
Pollution substances

...

# Natural sources of danger properties

Name	Area of zone probability ES, sq. km	Population in zone ES	Frequency 1/year	Forecasted number of victims and deaths, p/year	Probability of financial damage, euro
Dangerous hydrological events and processes	13.3	1,800,000	30	2000/10	400,000
Dangerous meteorological events and processes:					
-hurricanes	34.8	45,000	3	1000/0	About
-heavy showers	52.0	100,000	2	1000/0	2,400,000
-snowfall	1800	230,000	1	-	
Natural (forest) fires	1500	1,100,000	16	-	500,000

# Dynamic of extreme situations



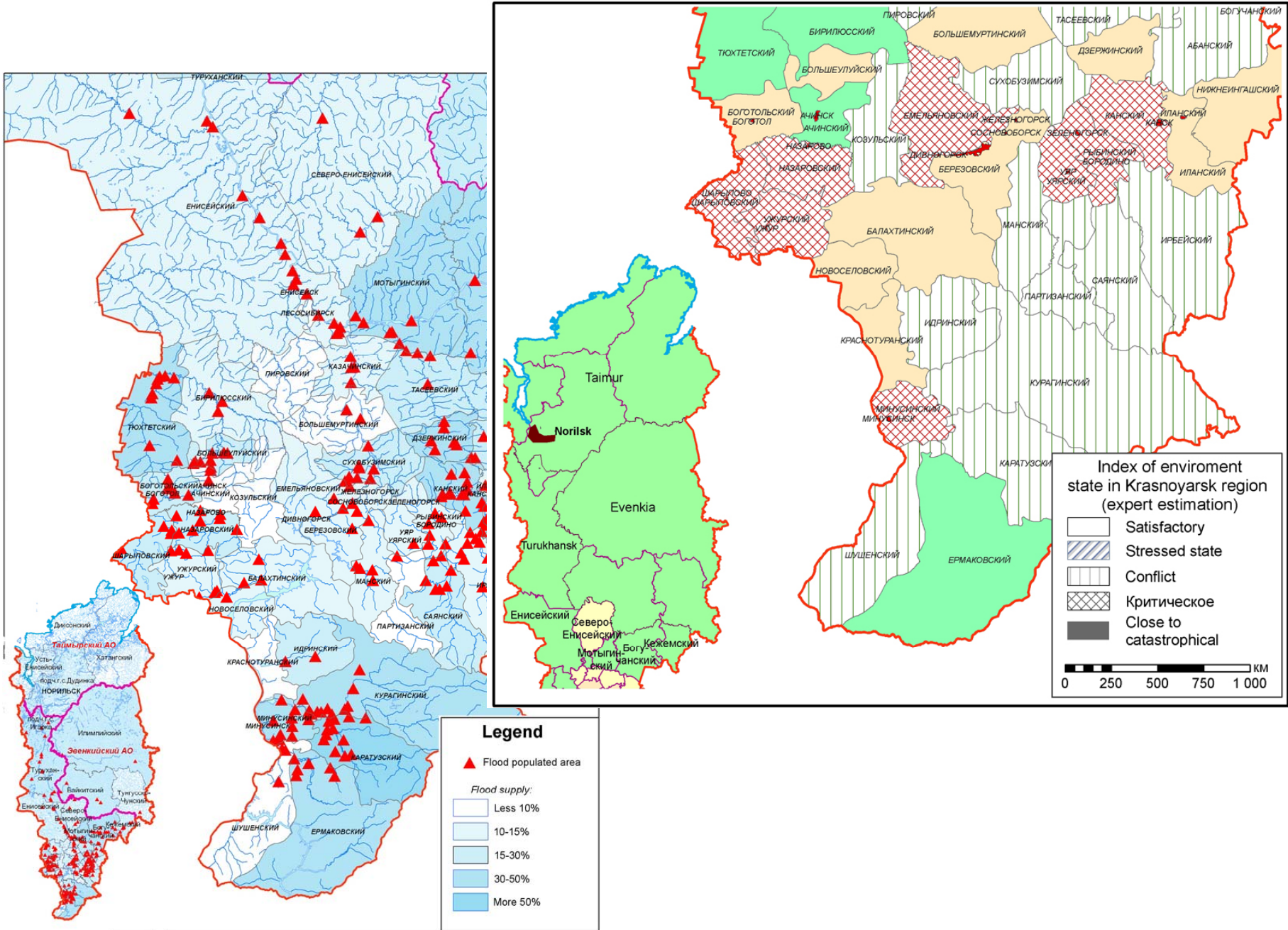
# List of indexes of ecological risk estimation

No	Index name	Type
<b>1 Atmosphere air</b>		
1.1	Index of air pollution by five main pollution substances (IPA <sub>5</sub> )	Basic
1.2	Gross discharge of pollution substances	Basic
1.3	Number of days with exceeding maximum allowable concentration MAC	Basic
1.4	Discharge SO <sub>2</sub>	Advanced
1.5	Discharge NO <sub>x</sub>	Advanced
1.6	Discharge benz(a)pyren	Advanced
<b>2 Water objects</b>		
2.1	Index of surface water pollution	Basic
2.2	Index of underground water pollution	Basic

# Matrix of environmental risk assessment

Risk level	Degree of ecological danger			
	Ecological disaster		Ecological crisis	
<b>Criterion 1</b>				
High	Parameter A <sub>11</sub>	Parameter B <sub>11</sub>	Parameter A <sub>14</sub>	Parameter B <sub>14</sub>
Medium	Parameter A <sub>12</sub>	Parameter B <sub>12</sub>	Parameter A <sub>15</sub>	Parameter B <sub>15</sub>
Low	Parameter A <sub>13</sub>	Parameter B <sub>13</sub>	Parameter A <sub>16</sub>	Parameter B <sub>16</sub>
<b>Criterion 2</b>				
High	Parameter A <sub>21</sub>	Parameter B <sub>21</sub>	Parameter A <sub>24</sub>	Parameter B <sub>24</sub>
Medium	Parameter A <sub>22</sub>	Parameter B <sub>22</sub>	Parameter A <sub>25</sub>	Parameter B <sub>25</sub>
Low	Parameter A <sub>23</sub>	Parameter B <sub>23</sub>	Parameter A <sub>26</sub>	Parameter B <sub>26</sub>
...				

# Examples of mapping



## Conclusions

The main statements, concepts, criteria and a list of environmental risk indicators of Siberian territories have been presented.

The statistical analysis of the information on environmental emergencies, industrial emergencies and dangerous natural phenomena has been carried out.

On the basis of these materials and the calculations of risk value of the ecological danger, schematic maps of natural, industrial and ecological emergencies have been created.

## Conclusions

It has been shown that the main ecological criteria are: the level of area security from industrial and other threats, resource consumption level, state of the environment (air-shed, water basin, soils, forests) natural risk and emergency risk. These criteria should be quantified on the basis of the ecological monitoring data (on-line and retrospective) and the characteristics of the region under consideration.

# Thank you for attention!

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