# Forest fire risk in Poland classification with application of GIS techniques



https://commons.wikimedia.org/wiki/File:Fire-Forest.jpg

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# **Forest fire risk in Poland**

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Aim of research: Classification of forests in Poland according to fire risk Area of the study: Entire territory of Poland Methods:

Modified method of forest classification into Fire Risk Classes worked out by Forest Research Institute (2010)

- **GIS techniques**
- **Final results:** 
  - Classification of forests in Poland into three categories of fire risk (regular grid - resolution 250m/250m)

Classification of counties into three categories of forest fire risk for verification

# **Forest fire risk in Poland**

#### Forest fire risk

https://commons.wikimedia.org/wiki/File:Fire-Forest.jpg

Appearance of the of set of conditions in which fire can occure in forest environment.

#### **Category of forest fire risk**

It refers to forests with similiar level of vulnerability to fire. This level is determined on the basis of several factors.

#### Classification of forest districts in terms of fire risk is obligatory

Method of classification of forest fire risk (Forest Research Institute) in the latest form is obligatory since 2010
 It is obligatory to apply it in Forest Districts in management plans
 It was also applied in administrative spatial units: counties, subregions (NUTS) and voievodships (Szczygieł et al, 2009).

Szczygieł et al., 2009, Klasyfikacja zagrozenia pożarowego lasów Polski, Leśne Prace Badawcze, vol. 70 Pokojska, Forest fire risk in Poland

## Method of classification of forests according to fire risk (worked out by Forest Research Institute; in force)

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- **Four factors** selected as important for forest fire risk
- Influence of each factor is finally expressed in points and is added up.
- The higher total number of points the bigger vulnerability of forest for fire.
- Three categories of fire risk are defined (low, medium, high)

Category of	Number of points	Number of points
forest fire risk	in Forest Research Institute method	in modified method
1 (high)	Higher than 24	Higher than 10
2 (medium)	16 – 24	6 — 10
3 (low)	0 – 15	0 — 6

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## Factors in original method by Forest Research Institute

Factor	Characteristics	
1. Climatic (max. 9 points)	Empirical formula -relative humidity of the air (measured with a height of 0.5 m) in 42 prognostic zones - the percentage of days in a year with forest humidity of less than 15% at 9.00 in 42 prognostic zones.	
2. Forest (max. 10 points)	The percentage area of the different forest habitat types.	
3. Historical (max. 24 points)	The occurrence of forest fires - the density of fires of forest area (in recent 10 years).	
4. Antropogenic (max. 7 points)	The average number of residents per 0.01 km <sup>2</sup> of forest.	

**Empirical formula (Instructions for forest fire protection)** 

 $P = 0,221 \times U_{ds} - 0,59 \times W_{p} + 45,1$ 

 $U_{ds}$  – the percentage of days in a year with bedding humidity of less than 15%  $W_{n}$  – mean relative air humidity f at 9.00.

## Modification of Forest Research Institute method for this research

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	Factor	Charakterystyka	
	1. Climatic (max 4 points)	<ul> <li>Empirical formula (Forest Research Institute)</li> <li>Spatial distribution of relative humidity (38 climatic stations)</li> <li>Percentage of days with humidity of forest litter smaller than 15 % in 42 prognostic areas years 2006-2010 (data published by Forest Research Institute);</li> </ul>	
	2. Forest (max 5 points)	Types of forest according to CORINE CLC 2006 level 3, classified into 3 categories of forest flammability	
	3. Historical (max 9 points)	Number of forest fires in communities years 1998-2008 (source: publ. <i>Szczegółowa identyfikacja grupy docelowej, Grupa</i> <i>Eskadra 2010</i> )	
	4. Antropogenic (max. 3 points)	Density of population in communities	

**Empirical formula (Instructions for forest fire protection)** 

 $P = 0,221 \times U_{ds} - 0,59 \times W_{p} + 45,1$ 

 $U_{ds}$  – the percentage of days in a year with bedding humidity of less than 15%  $W_{n}$  – mean relative air humidity f at 9.00.

# **Climatic factor**

#### **Climatic factor (number of points)**



## **2. Forest factor**

http://hdwallpapersd.com/forest-fire-hd-wallpapers/

## Land use data - CORINE CLC 2006 (EEA)

Class number	Codes of land cover classes	Number of assigned points according to flammability
3	3.1.2 Coniferous forest3.2.4 Transitional woodland-scrub	5
2	3.1.3 Mixed forest	3
1	3.1.1 Broad-leaved forest	1

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## **Forest factor**

#### **Forests in Poland classified into 3 classes of flammability**



#### Green - low, Yellow - medium, Orange - high flammability

# **Historical factor**



Source of forest fire number classes - publication Szczegółowa identyfikacja grupy docelowej .., Grupa Eskadra, 2010:; modified into number of point.

## **Antropogenic factor**

#### Antropogenic factor - points assigned to municipalities



#### Sums of points for pixels representing forests (modifcated method of Forest Research Institute)

https://co



## Forests classified according to fire hazard



## Counties classified according to fire hazard of forests in Poland



# Forest fire risk classification in counties - results and verification

https://commons.wikimedia.org/wiki/File:Fire-Forest.jpg

#### Final map of this research



#### Map by Szczygieł et al, 2009<sup>1</sup>



<sup>1</sup>. Szczygieł et al., 2009, Klasyfikacja zagrozenia pożarowego lasów Polski, Leśne Prace Badawcze, vol. 70

## **GIS** - scope of work, software

## **Application of GIS**

- Aquisition of data (digitalisation, construction of attribute table)
- Analyses (interpolation, conversion vector-raster, transformation of coordinate system, map algebra, reclassification, summary statistics).
- Visualisation

Sofware: Quantum GIS (1.7.4.), SAGA (2.0.4.), Surfer 8.0.



# Thank You for Your attention

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