

2013 Esri International User Conference

July 8–12, 2013 | San Diego, California

**FOREST FIRE OCCURRENCE
PROBABILITY MODEL
IN THE
KARST FOREST MANAGEMENT AREA
SLOVENIA**

dr. Tomaž Šturm

Slovenia Forest Service

www.zgs.gov.si

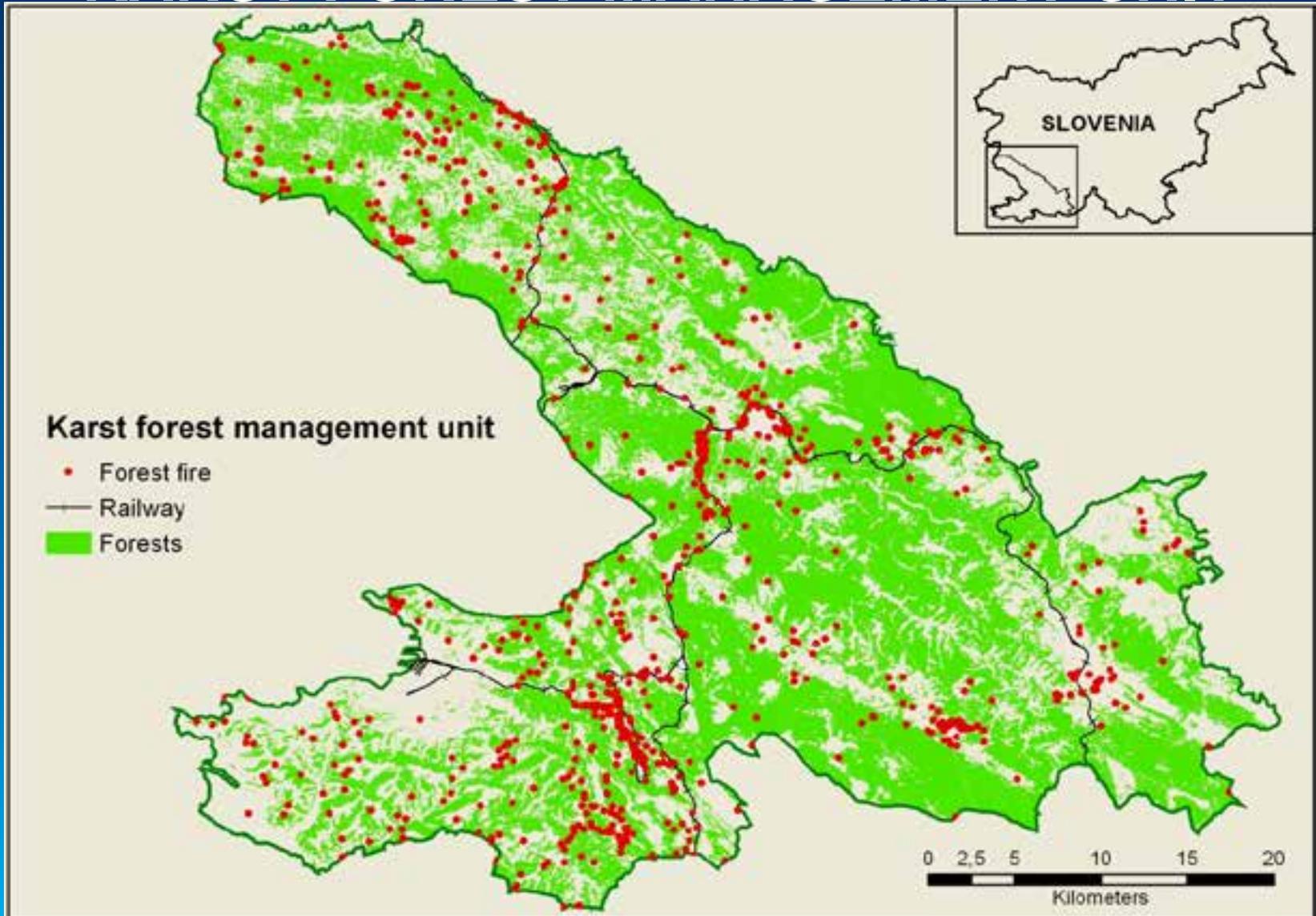
SLOVENIA



KARST FOREST MANAGEMENT UNIT

- 152.476 ha, 57 % forest cover.
- Broadleaves forests prevail (73 %), pine trees dominate on 21 % of the region. The largest shares of tree species in wood stock are black pine (*Pinus nigra*, 23 %) and beech (*Fagus sylvatica*, 18 %). Other dominant tree species are hardwoods (sessile oak, turkey oak, downy oak, hop hornbeam).
- The Karst forest management area concentrates 55 % of all fires in Slovenia and the burnt area represents 95 % of all burnt areas.
- The period between 1995 and 2009 contains 871 forest fires and an affected forest area of 6.047 ha.

KARST FOREST MANAGEMENT UNIT



FOREST FIRE OCCURRENCE PROBABILITY MODEL

Slovenia forest service:

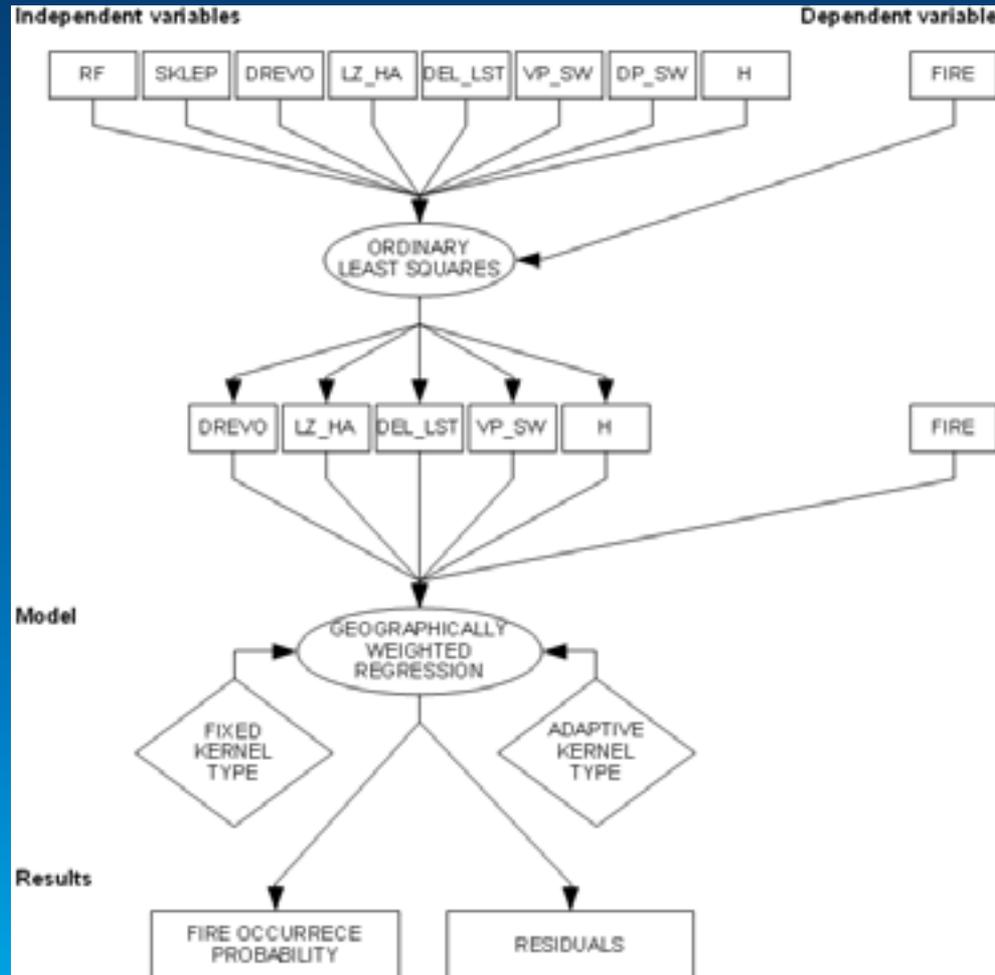
- ✓ data of forest management plans – forest stands,
- ✓ data of fire activity – past, present.

ArcGIS 10.0 → Spatial statistics tools:

- q Ordinary Least Squares,
- q Geographically Weighted Regression.

The purpose is to estimate the probability that a forest fire will happen during a period of time in a certain place (forest stands).

FOREST FIRE OCCURRENCE PROBABILITY MODEL



FOREST FIRE OCCURRENCE PROBABILITY MODEL

Dependent variables:

- ∅ information on the development phase,
- ∅ canopy closure,
- ∅ main tree species regarding to growing stock,
- ∅ growing stock per hectare,
- ∅ the share of hardwoods trees with regard to growing stock,
- ∅ Shannon-Wiener index tree species composition,
- ∅ Shannon-Wiener index size class distribution,
- ∅ elevation of forest stand.

Independent variable:

- ∅ information on the past fire activity in the forest stand.

ORDINARY LEAST SQUARES

AICc	-12310,219
R ²	0,01
Adjusted R ²	0,01

GWR WITH FIXED KERNEL TYPE

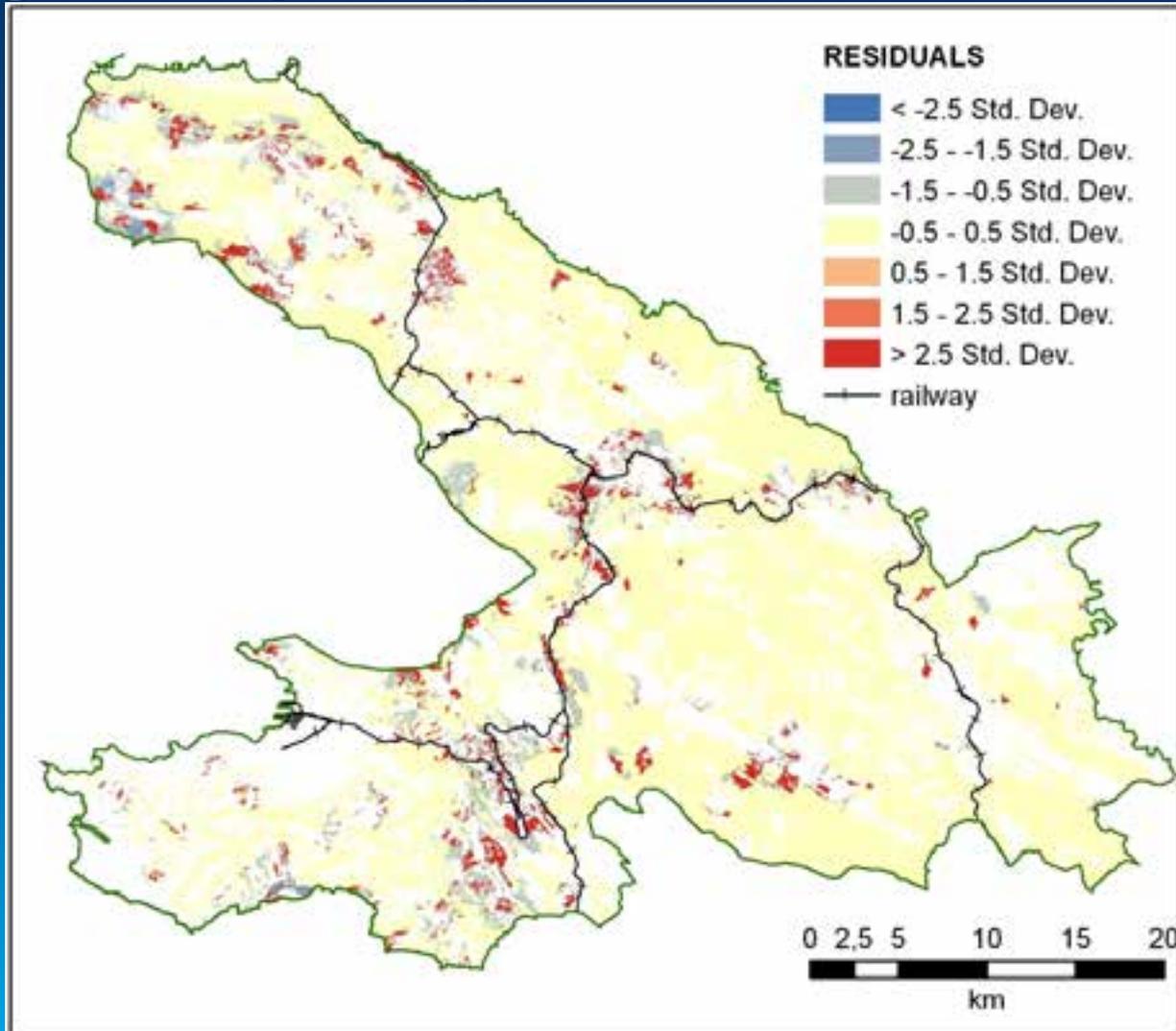
Dependent variables:

- Ø main tree species regarding to growing stock,
- Ø growing stock per hectare,
- Ø the share of hardwoods trees with regard to growing stock,
- Ø Shannon-Wiener index tree species composition,
- Ø elevation of forest stand.

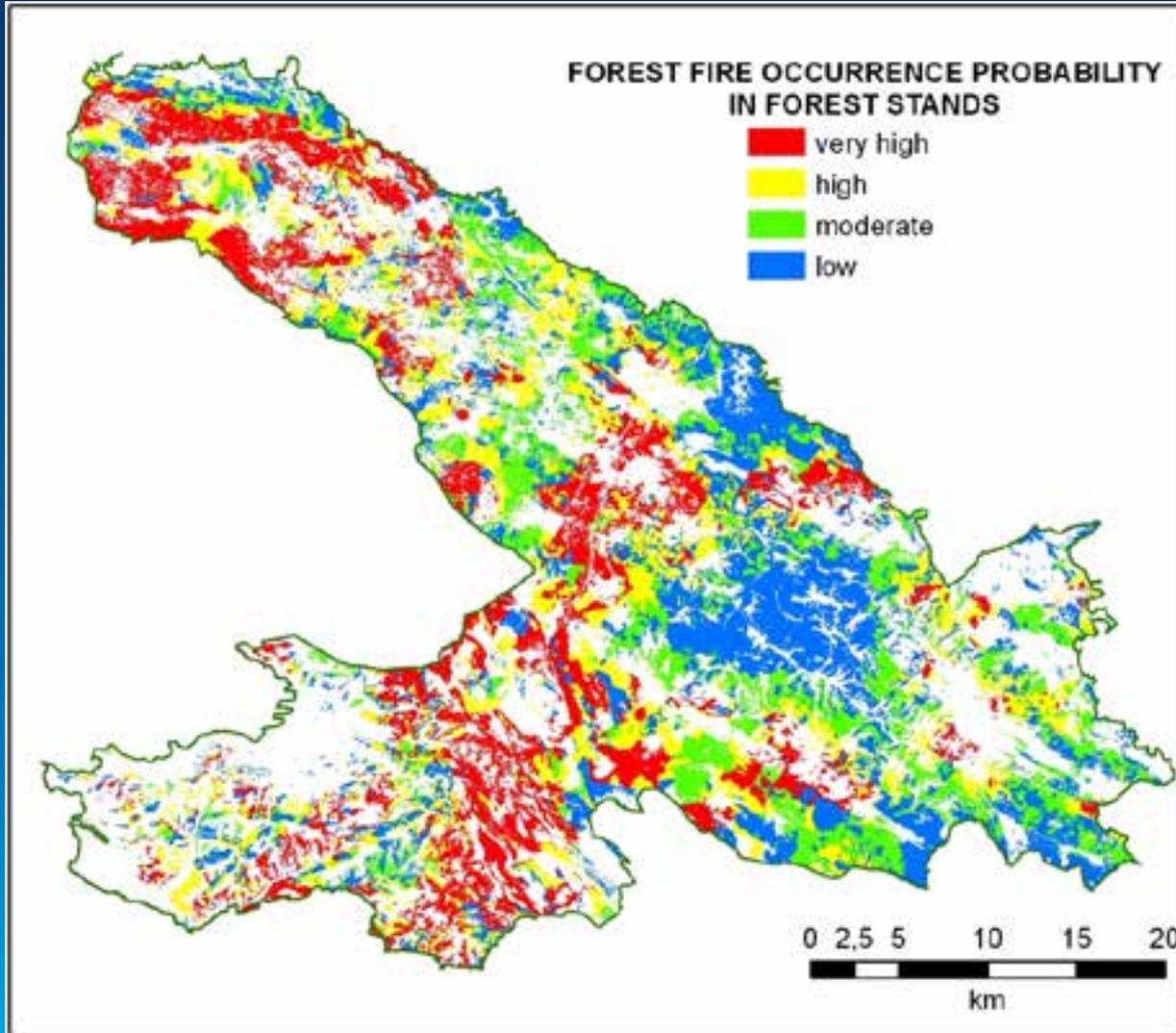
Independent variable:

- Ø information on the past fire activity in the forest stands.

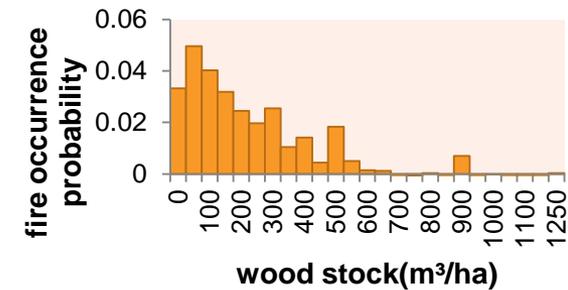
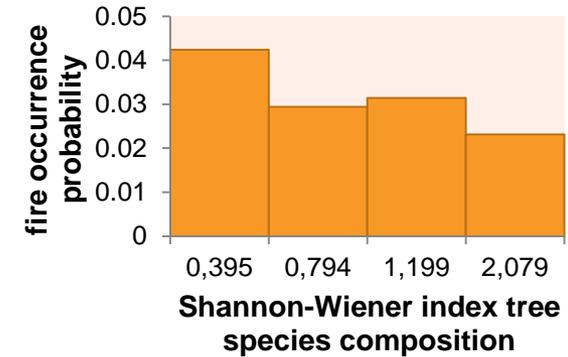
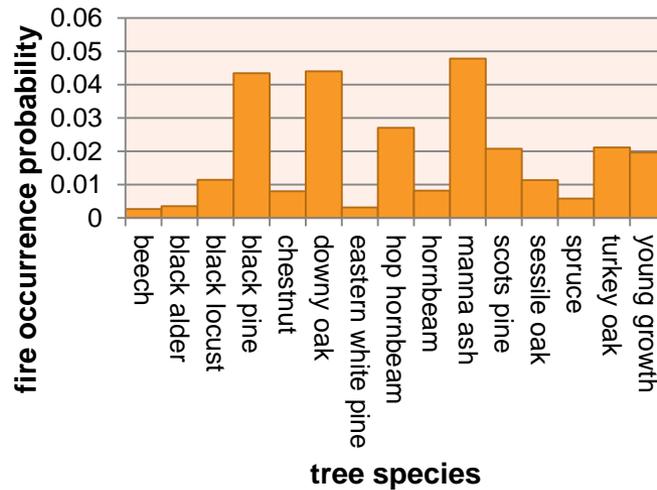
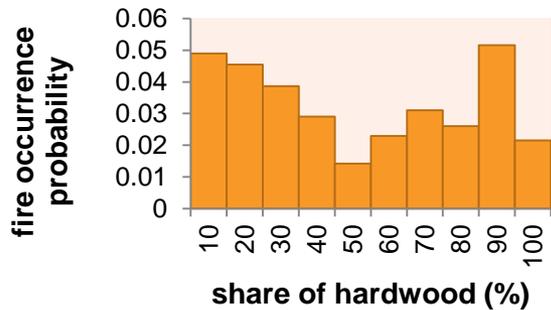
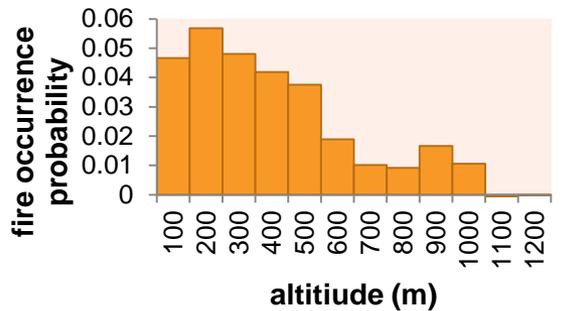
GWR WITH FIXED KERNEL TYPE



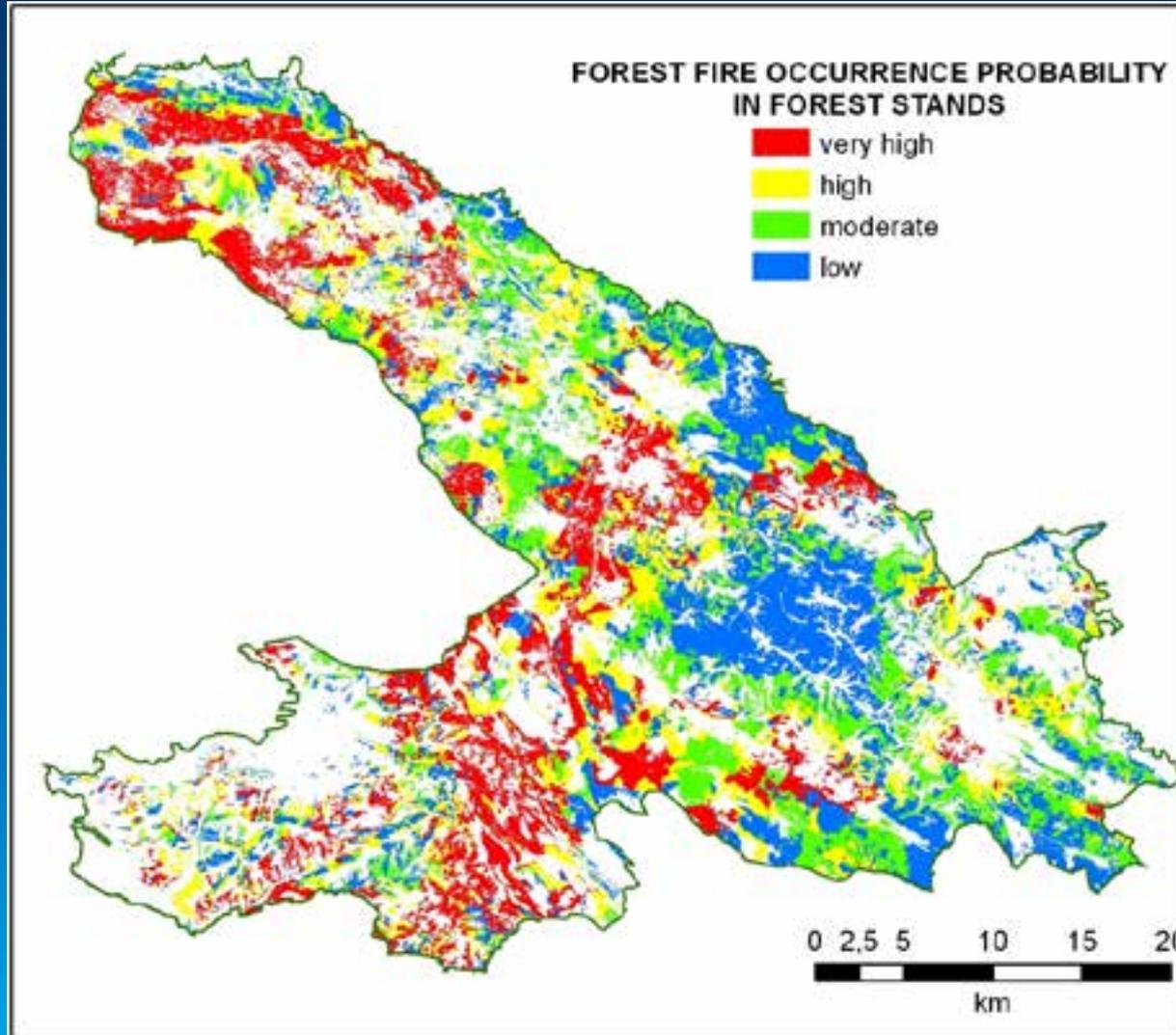
GWR WITH FIXED KERNEL TYPE



FIRE OCCURRENCE PROBABILITY BY FOREST STANDS CHARACTERISTICS



GWR WITH ADAPTIVE KERNEL TYPE



GWR WITH ADAPTIVE KERNEL TYPE

Very high forest fire occurrence probability:

- 991 forest stands,
- 9.887,44 ha (12 %) forests.

Verification:

- 118 forest fires in 2010 and 2011,
- 55 (47 %) started in forests,
- 62 % in forests stands with very high forest fire occurrence probability.

CONCLUSIONS

A combination of spatial statistical methods (OLS,GWR) on the characteristics of forest stands has allowed detailed insight into forest fire occurrence and its characteristics.

The presented model gives us a clue about the endogenous stand factors that affect fire probability, and how the probability can be modified by varying these factors through forest management.

We established that usefulness of forest stand maps overcome their original purpose of collecting and preparing for forest management.

**Thank you for
your attention**

dr. Tomaz Šturm

