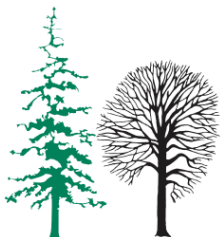
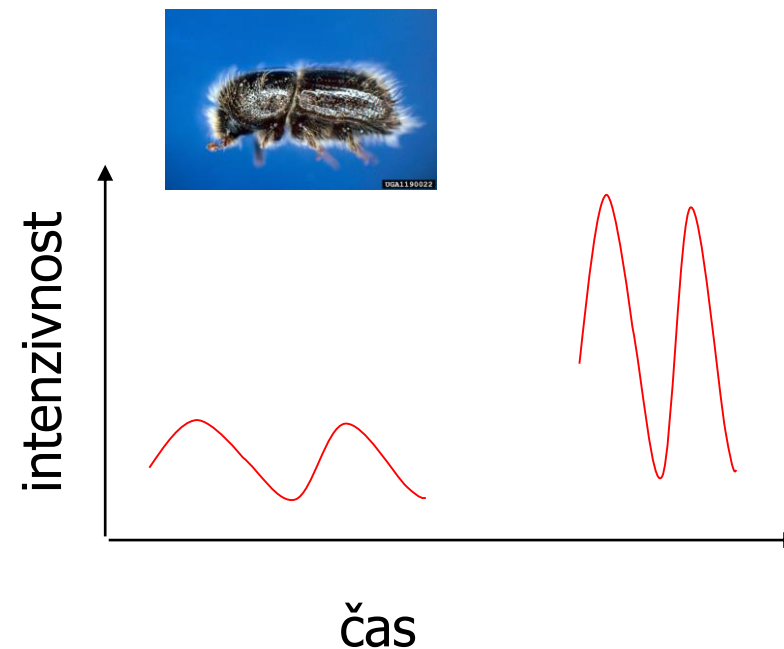
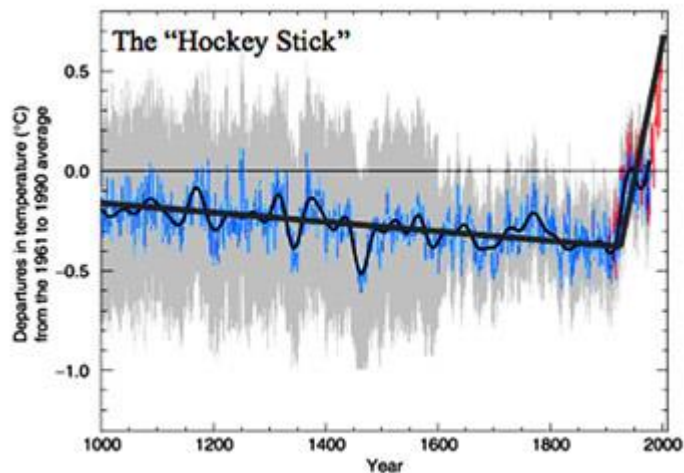


# Modela za kratkoročno napoved sanitarne sečnje smreke in jelke zaradi podlubnikov

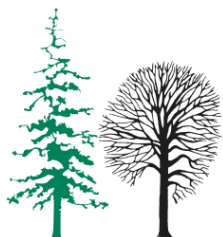
Maarten de Groot & Nikica Ogris



# Razvoj časovne dinamike

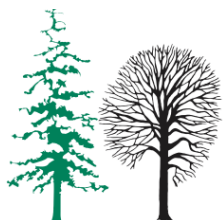
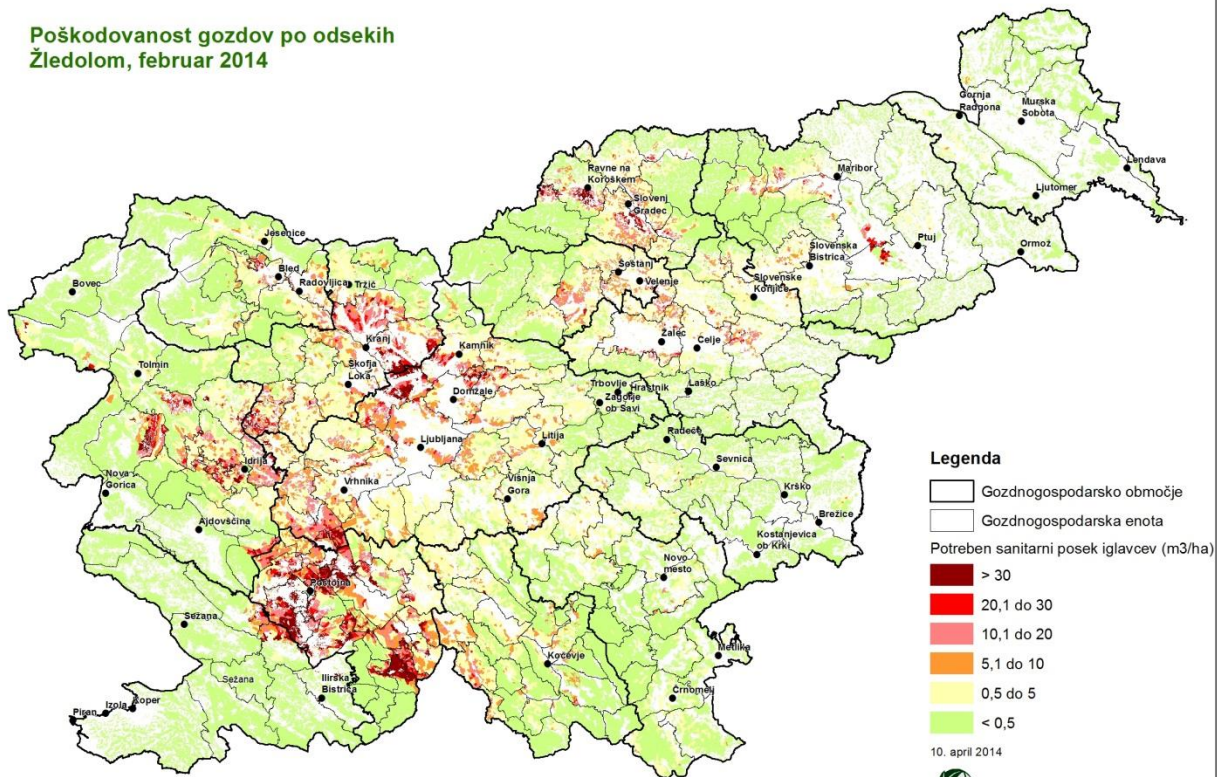


- sajenje smreke zunaj njene naravne razširjenosti



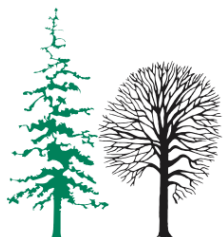
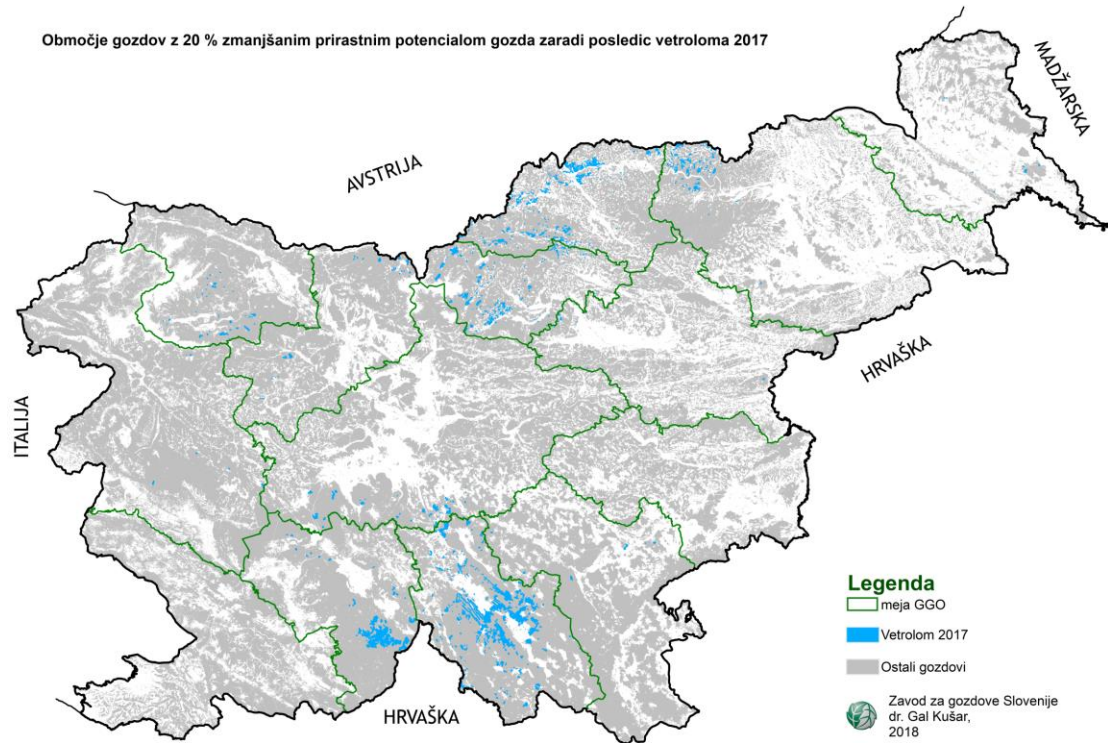
# Žled

Poškodovanost gozdov po odsekih  
Žledolom, februar 2014



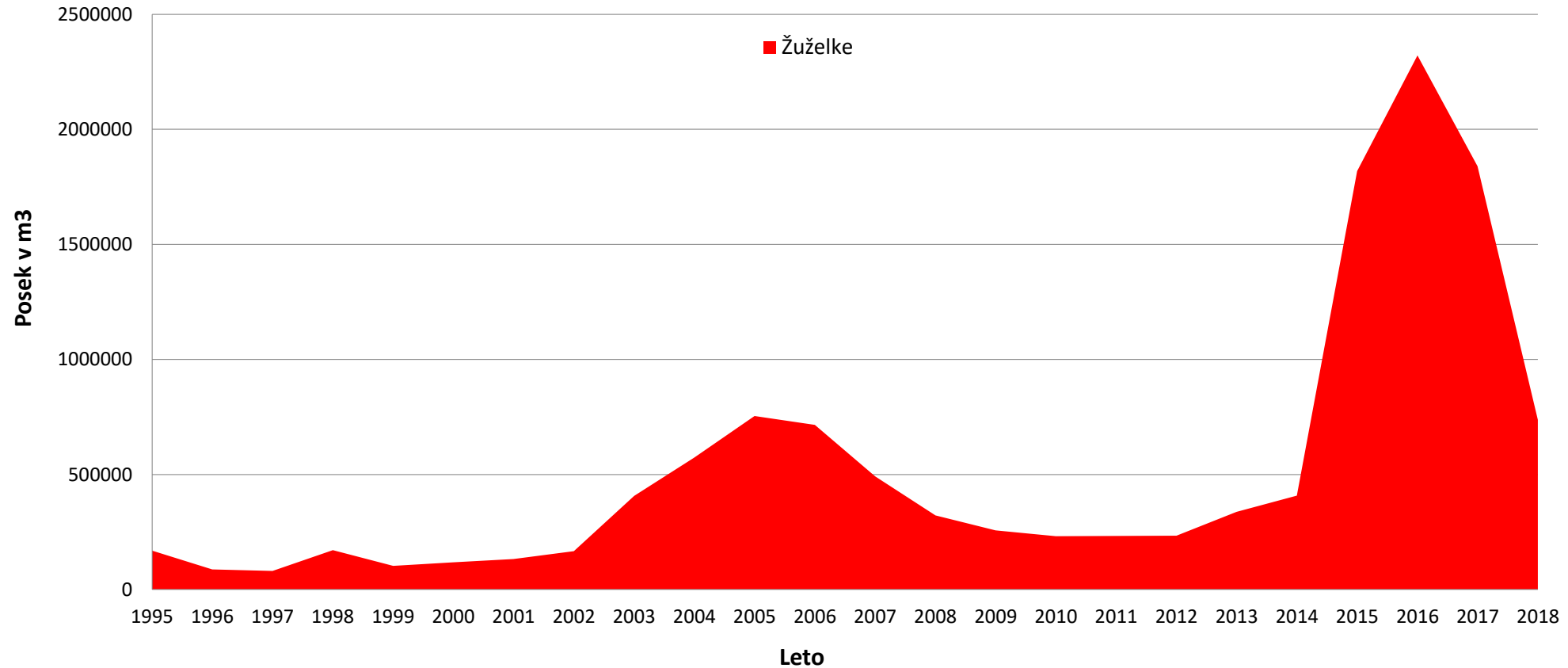
# Druge poškodbe (vetrolom)

Območje gozdov z 20 % zmanjšanim prirastnim potencialom gozda zaradi posledic vetroloma 2017



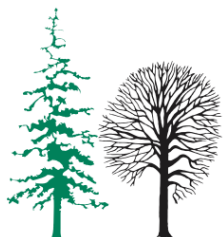
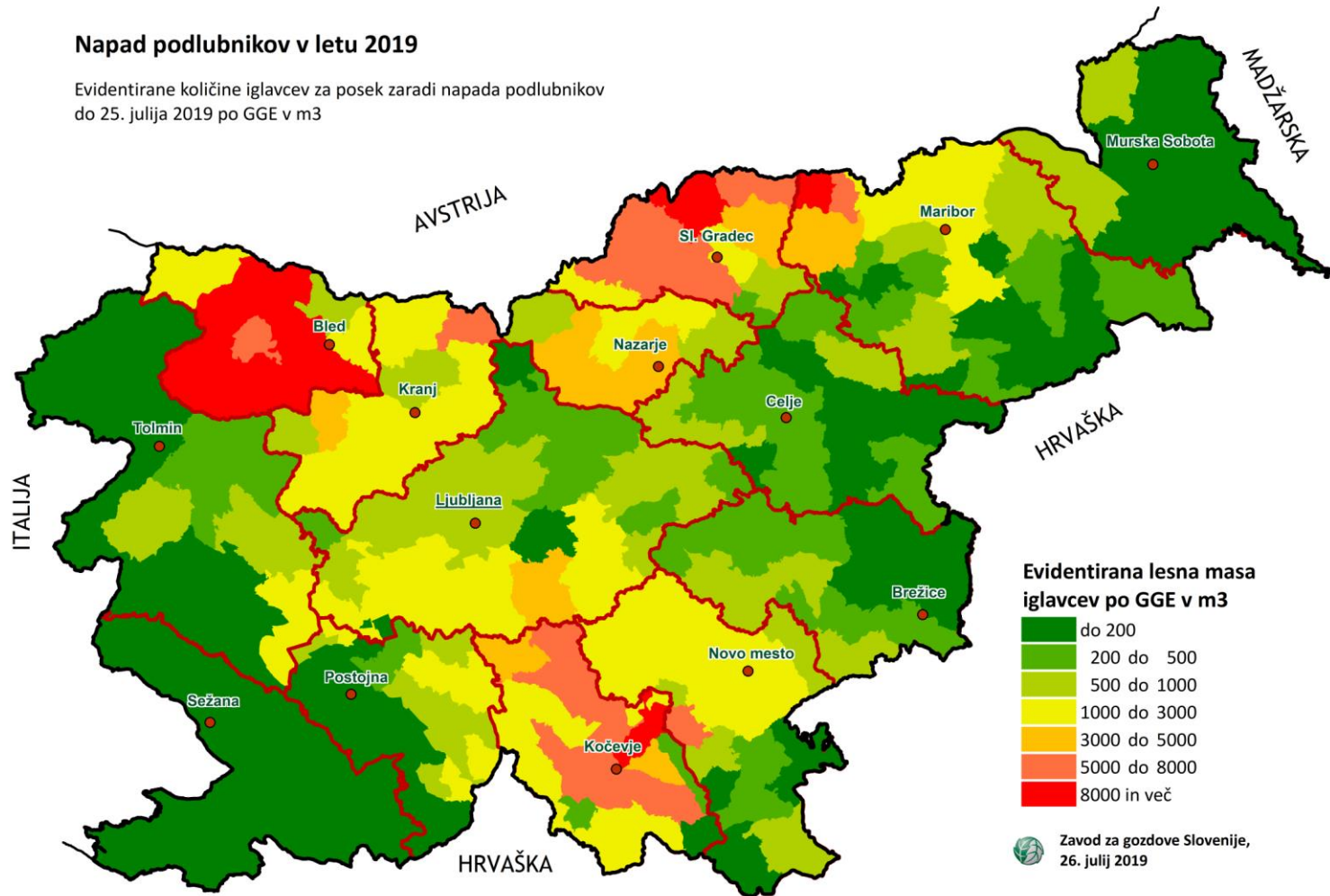
# Namnožitelj podlubnikov

Sanitarni posek v skupni posekani lesni masi v obdobju 1995-2018 po vzrokih poseka



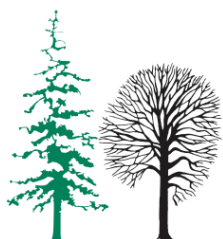
## Napad podlubnikov v letu 2019

Evidentirane količine iglavcev za posek zaradi napada podlubnikov do 25. julija 2019 po GGE v m<sup>3</sup>

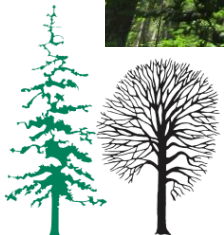


# Smrekovi podlubniki

- Osmerozobi smrekov lubadar (*Ips typographus*)
- Gostitelj: Smreka
- Razširjenost: Evrazija
- Sekundarni in primarni škodljivec smreke



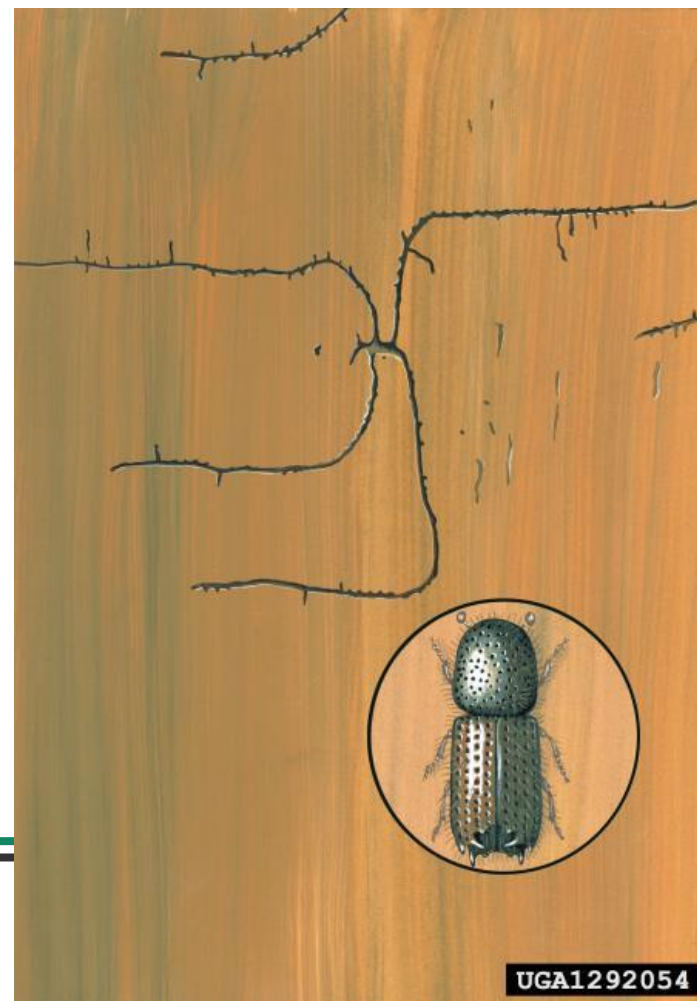
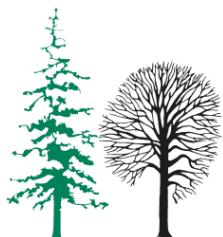
# Problematika jelke - podlubniki





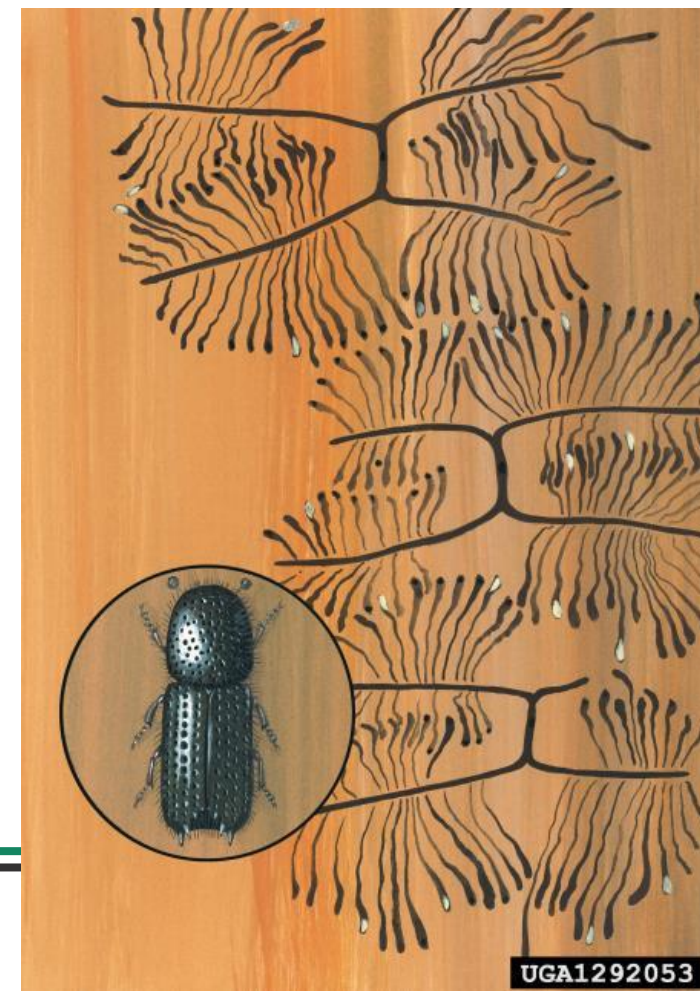
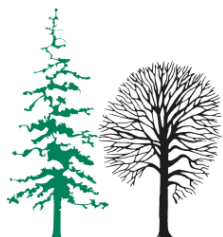
# Jelovi podlubniki

- Ostrozobi jelov lubadar  
(*Pityokteines spinidens*)
- Glavni gostitelj: jelka
- Razširjenost: celotna Evropa
- sekundarni in primarni škodljivec jelke



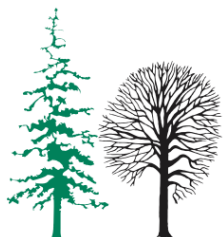
# Jelovi podlubniki

- krivozobi jelov lubadar  
(*Pityokteines curvidens*)
- Glavni gostitelj: jelka
- Razširjenost: celotna Evropa
- sekundarni in primarni škodljivec jelke



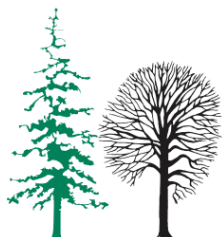
# Kaj lahko storimo?

- **Pravočasno zaznavanje**
- Hitro odzivanje
- Trajnostno upravljanje



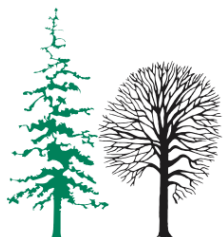
# Cilji

- Razvoj modela za kratkoročno napoved sanitarne sečnje smreke in jelke zaradi podlubnikov



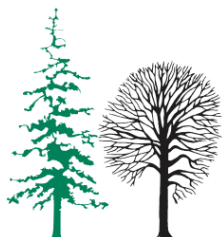
# Podatkovne zbirke

- Podatkovna zbirka o lesni zalogi – ZGS  
– 1996-2016
- Rastrska karta količine padavin
- Pedološka karta
- Digitalni model višin – GURS

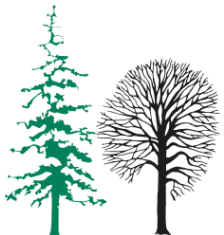
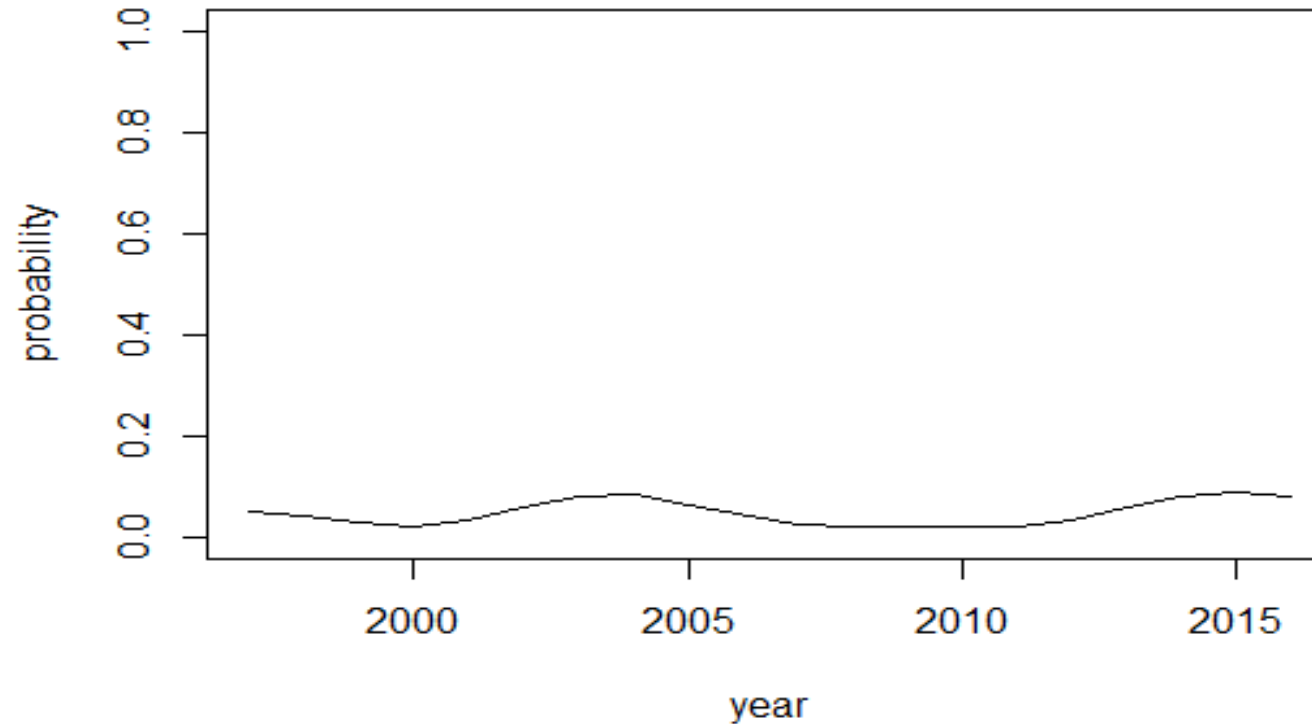


# Statistična analiza

- GLM
- Projekcija na Slovenijo v 2017
- Validacija

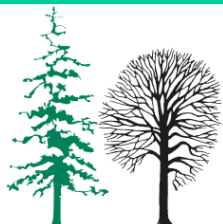


# Dinamika jelovih podlubnikov



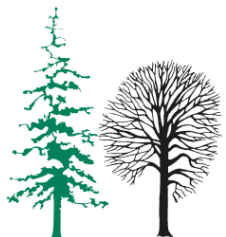
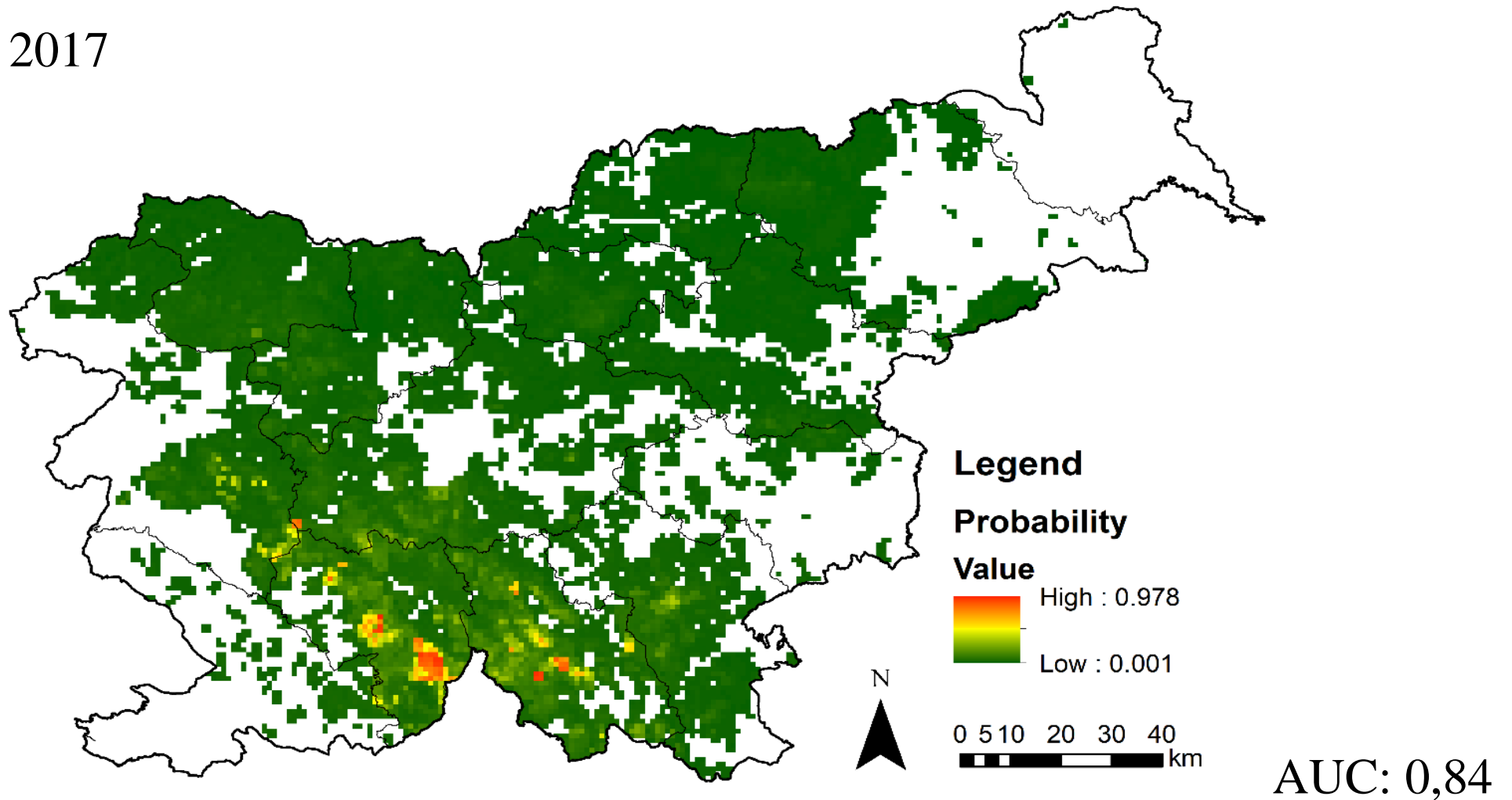
# Model za jelove podlubnike

Spremenljivke	Ocena	Stand. napaka	z vrednost	Pr(>  z )	Stat. značilnost
(Prestrzanje)	5,63E+00	3,64E-01	15.478	< 2e-16	***
Lesna zaloga jelke	2,56E-02	4,71E-04	54.377	< 2e-16	***
cbind(x, y)x	-7,23E-06	4,45E-07	-16.267	< 2e-16	***
cbind(x, y)y	-1,27E-05	4,85E-07	-26.249	< 2e-16	***
Nadmorska višina	-1,67E-03	1,04E-04	-16.007	< 2e-16	***
Naklon	-1,05E-02	1,50E-03	-6.994	2.68e-12	***
Fosfor	-3,98E-02	7,51E-03	-5.295	1.19e-07	***
Globina tal	-6,40E-03	4,54E-04	-14.101	< 2e-16	***
Kationska izmenjevalna kapaciteta tal	-2,98E-02	2,41E-03	-12.372	< 2e-16	***
Delež nasičenosti tal z bazami	1,85E-02	1,20E-03	15.478	< 2e-16	***
SPI	-3,22E-01	3,31E-02	-9.742	< 2e-16	***
Temperatura zraka	-3,60E-01	1,93E-02	-18.672	< 2e-16	***
log(1 + sanitarni posek jelke zaradi žuželk v tekočem letu)	1,33E+00	2,94E-02	45.238	< 2e-16	***
log(1 + posek oslabele jelke zaradi abiotских poškodb v tekočem letu)	1,14E-01	3,37E-02	3.374	0.000742	***
log(1 + sanitarni posek jelke zaradi abiotских poškodb v tekočem letu)	3,15E-01	2,14E-02	14.766	< 2e-16	***

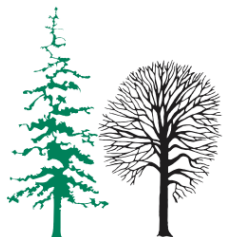
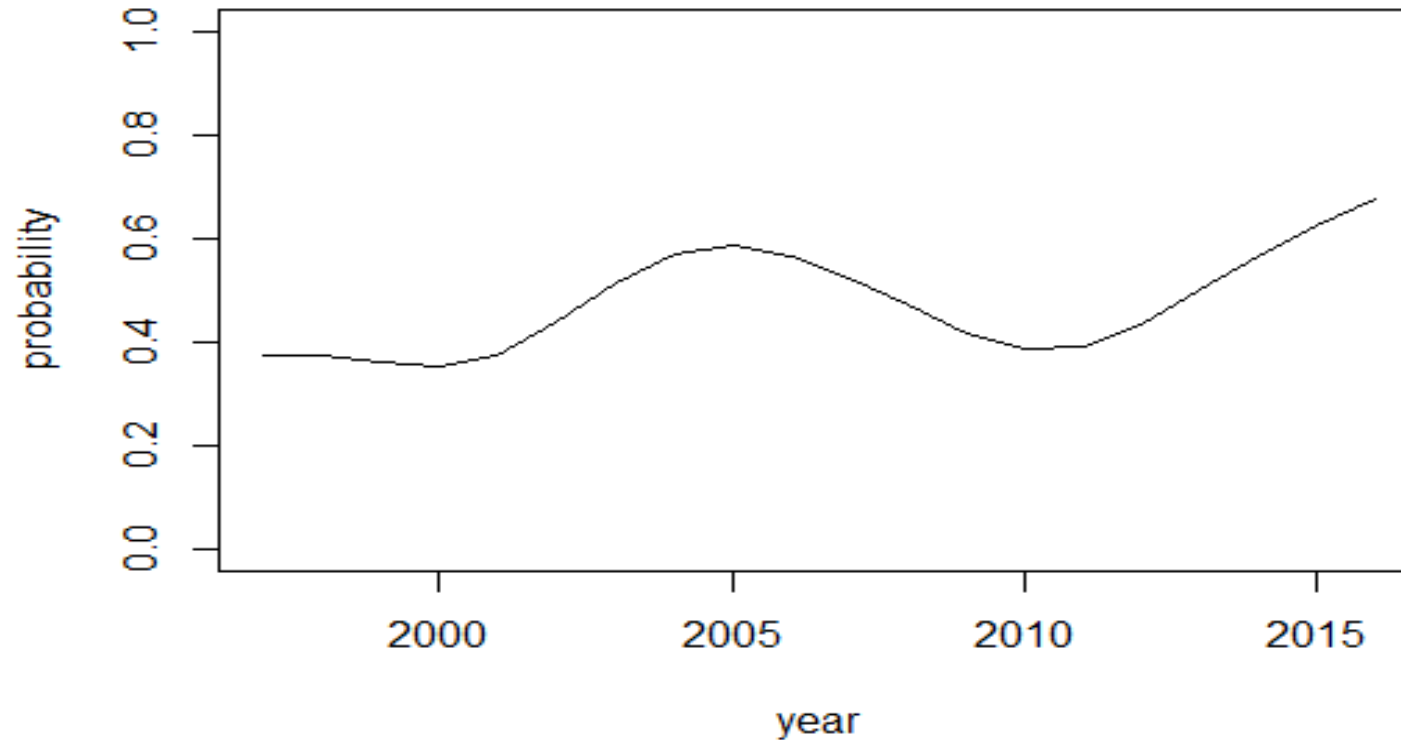




2017

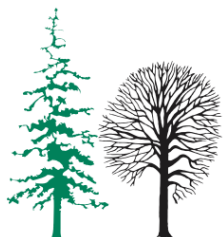


# Dinamika osmerozobega smrekovega lubadarja

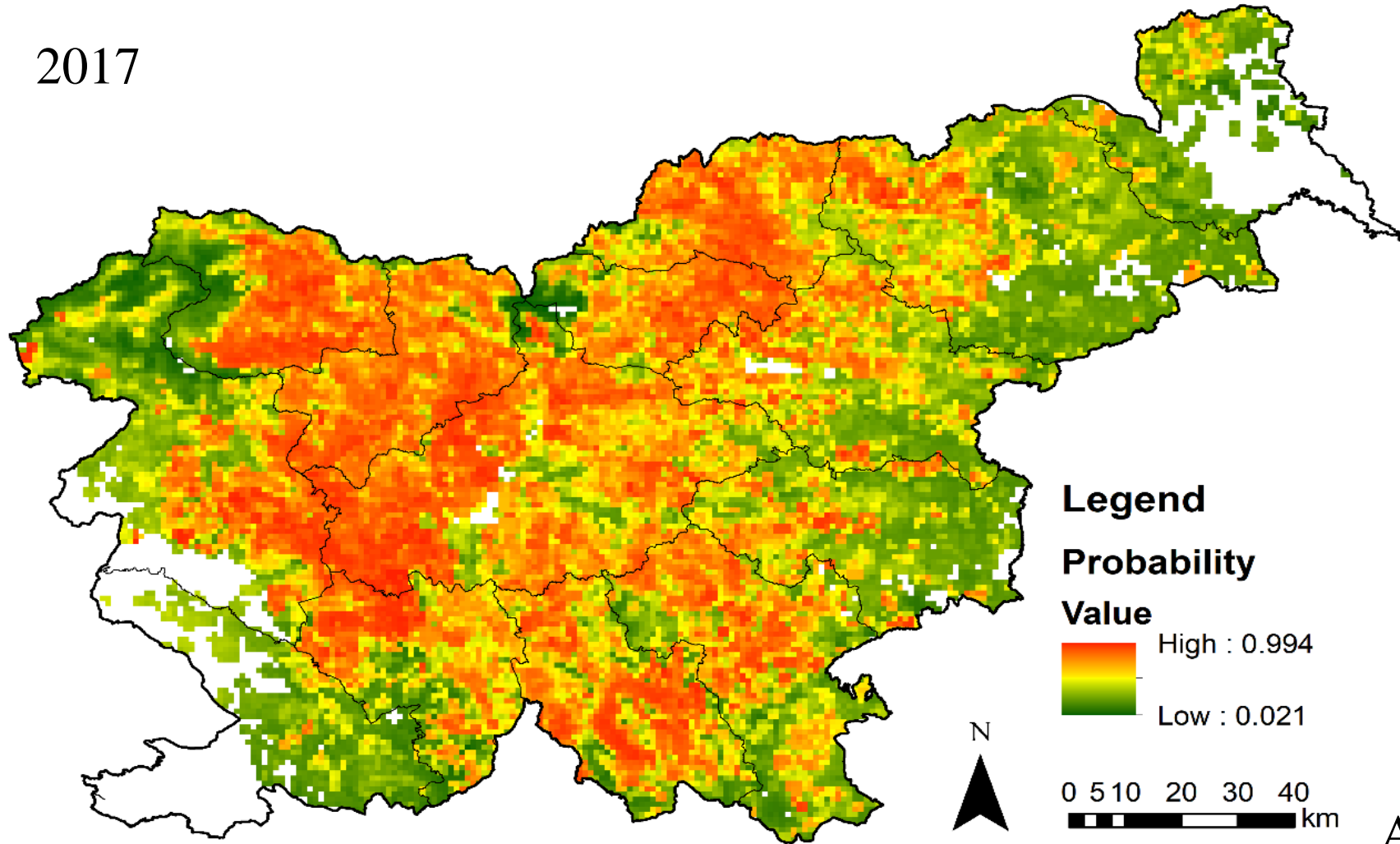


# Model za osmerozobega smrekovega lubadarja

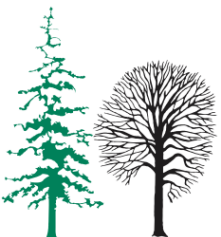
Spremenljivke	Estimate	Std. Error	z value	Pr(>  z )	
(Prestrezanje)	-2,41E+00	9,84E-02	-24.499	< 2e-16	***
Lesna zaloga smreke	2,37E-02	1,77E-04	134.256	< 2e-16	***
$\text{cbind}(x, y)_x$	-4,43E-06	1,16E-07	-38.169	< 2e-16	***
$\text{cbind}(x, y)_y$	4,00E-06	1,54E-07	25.918	< 2e-16	***
Naklon	-8,21E-03	5,00E-04	-16.421	< 2e-16	***
Fosfor	-5,39E-02	1,99E-03	-27.112	< 2e-16	***
Kationska izmenjevalna kapaciteta tal	-1,77E-02	8,04E-04	-22.056	< 2e-16	***
Delež nasičenosti tal z bazami	1,14E-02	3,61E-04	31.657	< 2e-16	***
SPI	-3,88E-02	1,08E-02	-3.580	0.000344	***
Temperatura zraka	2,66E-01	3,55E-03	74.851	< 2e-16	***
$\log(1 + \text{sanitarni posek smreke zaradi žuželk v tekočem letu})$	1,38E+00	9,30E-03	147.871	< 2e-16	***
$\log(1 + \text{posek oslabiljene smreke zaradi abiotiskih poškodb v tekočem letu})$	5,04E-02	1,35E-02	3.732	0.000190	***
$\log(1 + \text{sanitarni posek smreke zaradi abiotiskih poškodb v tekočem letu})$	5,50E-01	8,93E-03	61.542	< 2e-16	***



2017

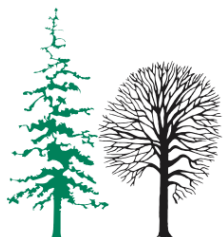


AUC: 0,89



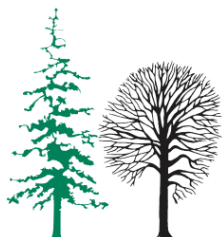
# Zaključki

- Izdelani 2 napovedi
- Pomembni dejavniki za jelove podlubniki so:
  - jelka
  - sanitarna sečnja zaradi jelovih podlubnikov
  - sanitarna sečnja zaradi abiotičnih dejavnikov
  - klimatski dejavniki



# Zaključki

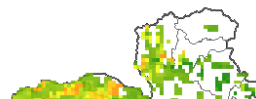
- Pomembni dejavniki za smrekove podlubnike so:
  - smreka
  - sanitarna sečnja zaradi smrekovih podlubnikov
  - sanitarna sečnja zaradi abiotičnih dejavnikov
  - klimatski dejavniki



# Interaktivna spletna aplikacija

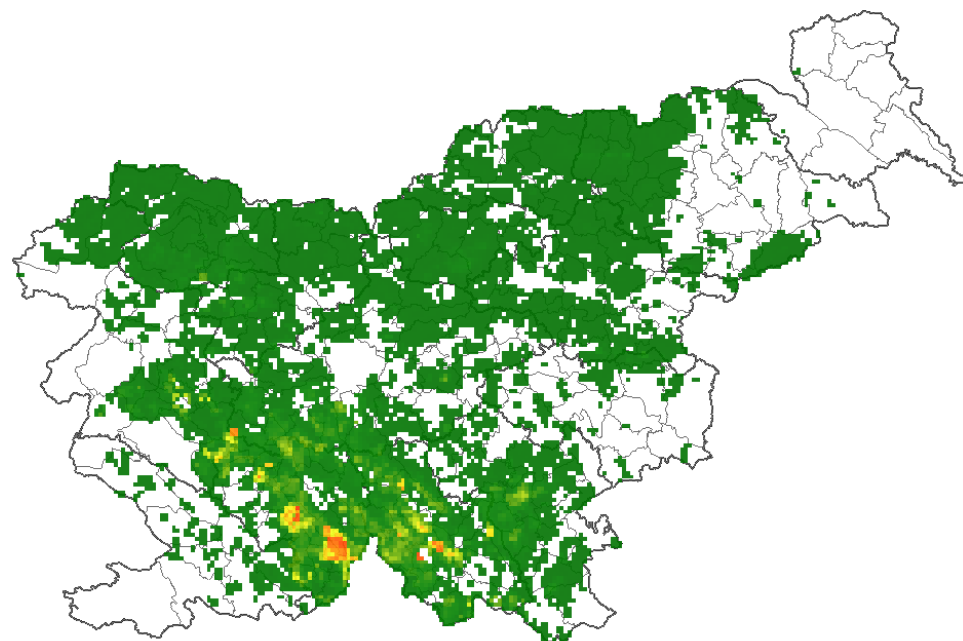
Najdi Tiskanje

Merilo: 1,000,000

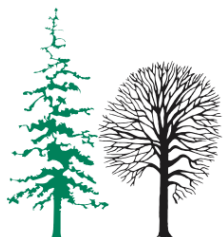


Najdi Tiskanje

Merilo: 1,000,000



0 15 30km

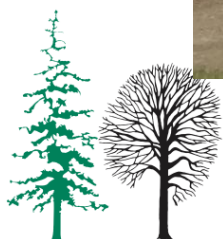


GOZDNI  
SLO

0 15 30km



**Hvala!!**



**GOZDARSKI INŠTITUT SLOVENIJE**  
*SLOVENIAN FORESTRY INSTITUTE*