

National Forest Inventory in Slovenia (history and current design)

Mitja Skudnik and Gal Kušar



Ljubljana, 23.4.2024

FOREST INVENTORY IN SLOVENIA – POINT SAMPLING

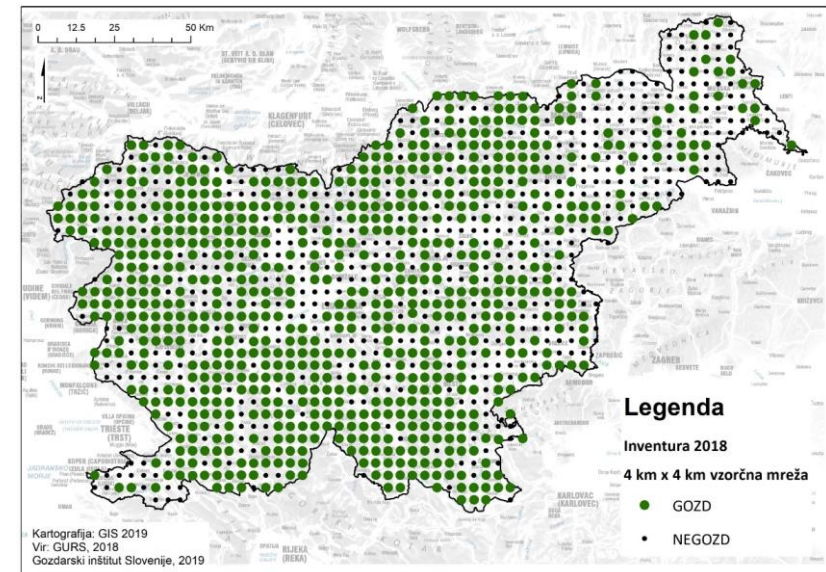
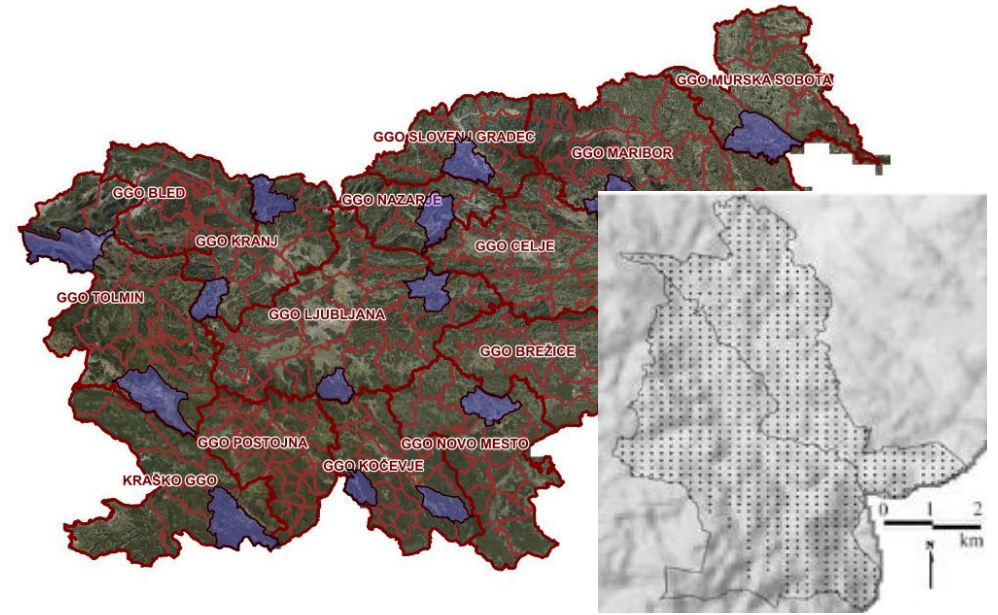
Two separate systems:

1. forest inventories for forest management (iGGN)

updates information on the state of forests in 1/10 forest management units (SFS)

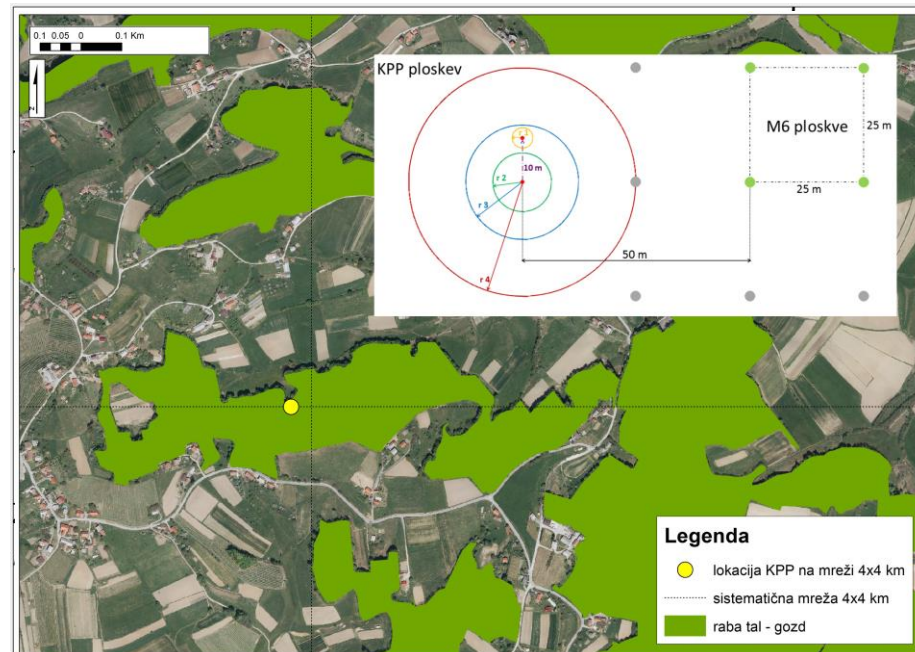
2. national forest inventories (NGI or MGGE in our case).

Data for national and international reporting on the state and development of forests (FORESTRY POLICY).



HISTORY OF LARGE-SCALE FOREST INVENTORY IN SLOVENIA

- Start in year 2000 (Forest and Forest Ecosystem Condition Survey)
- Sampling: centric systematic sampling on grid 4 km x 4 km
- Plots remeasured in years 2007, 2012 and 2018 (plan 2024)
- 2020 new sampling design -> NFI



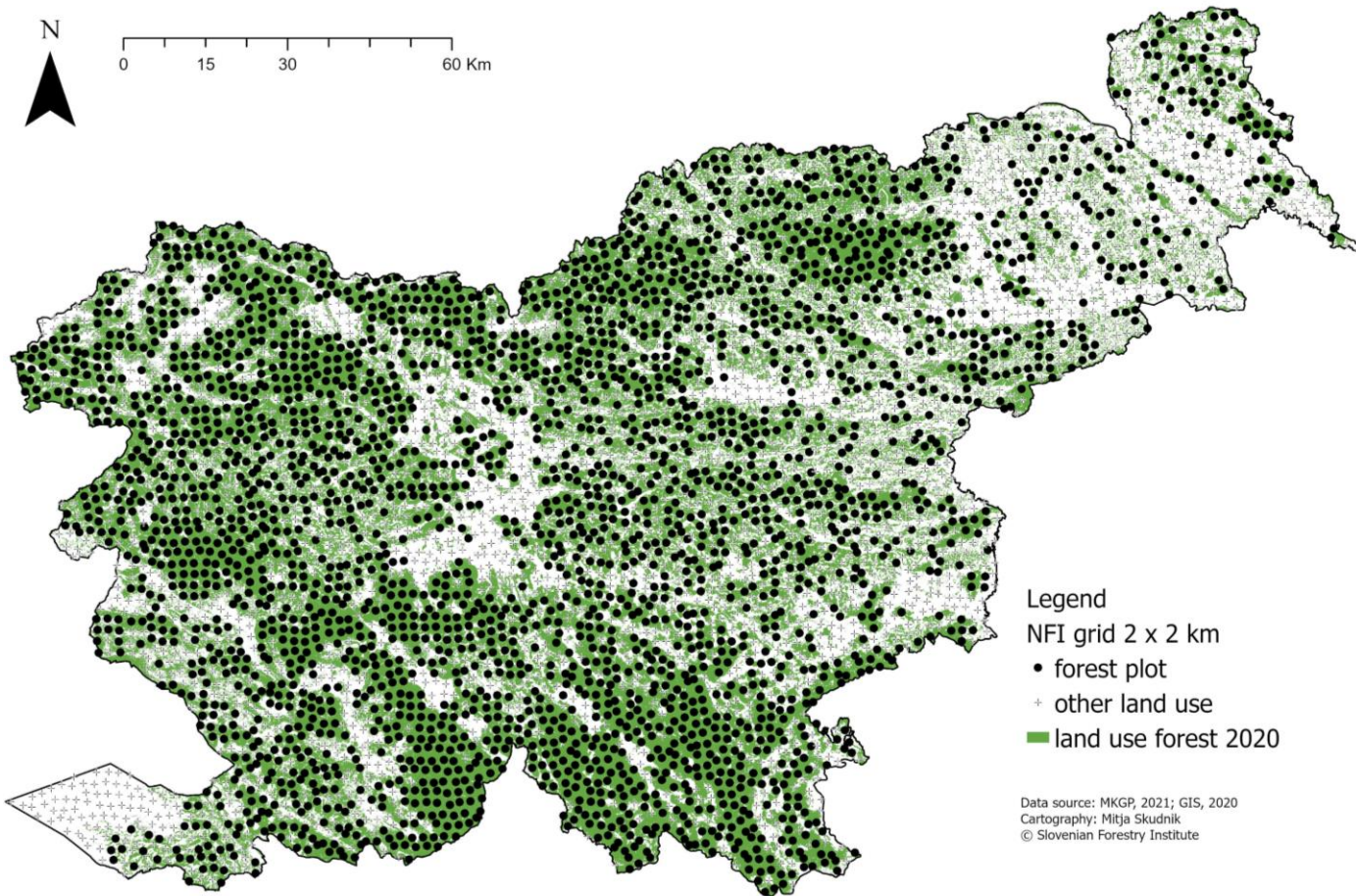

 Monitoring gozdov
 in gozdnih ekosistemov
 Priročnik za terensko snemanje podatkov

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Large-scale FI	■							■					■								■	■	■	■	■	■

Pdf available on:

<http://eprints.gozdis.si/566/>

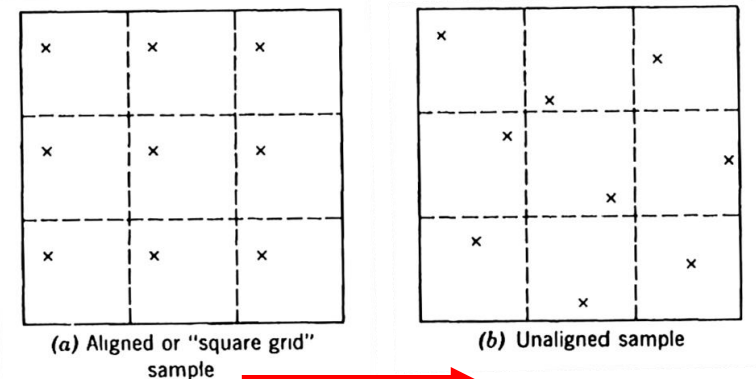
NEW SAMPLING DESIGN in 2020



- Unaligned systematic sampling (USS)
- Sampling density 2 km x 2km

WHY USS?

- USS identified as the most precise sampling design under the assumption of common types of spatial correlation
- increased precision in case of periodicities



ORGANISATION OF NFI SINCE 2020

- Interpenetrating panel system
- Yearly panel on grid 4 km x 4 km (1/4 of plots on grid 2 km x 2 km)
- 5-year inventory cycle

2020 – NFI panel 1 (cycle 1)

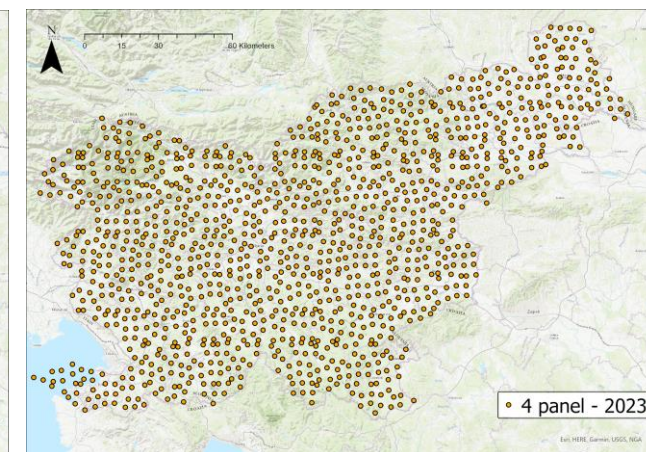
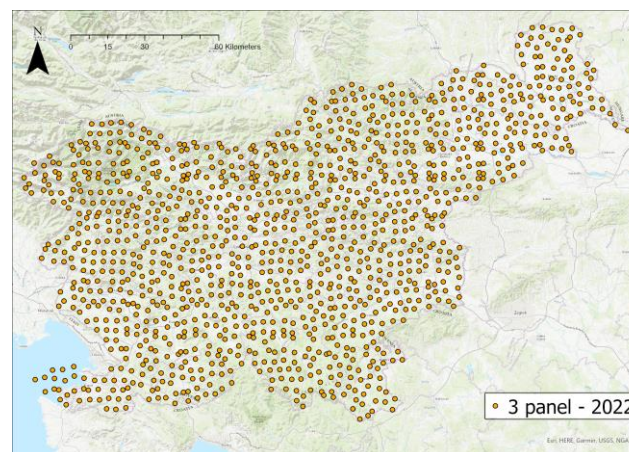
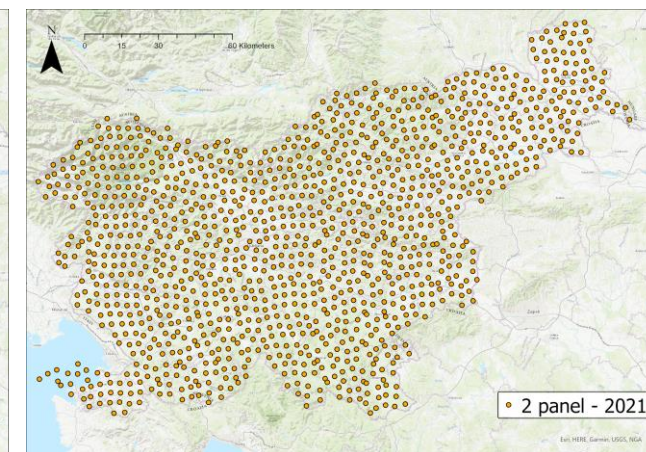
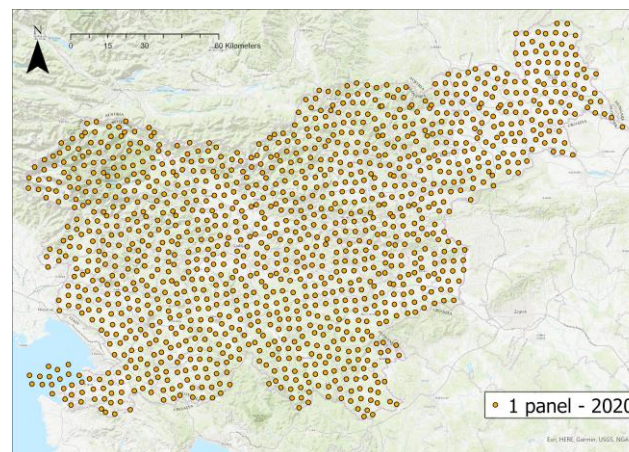
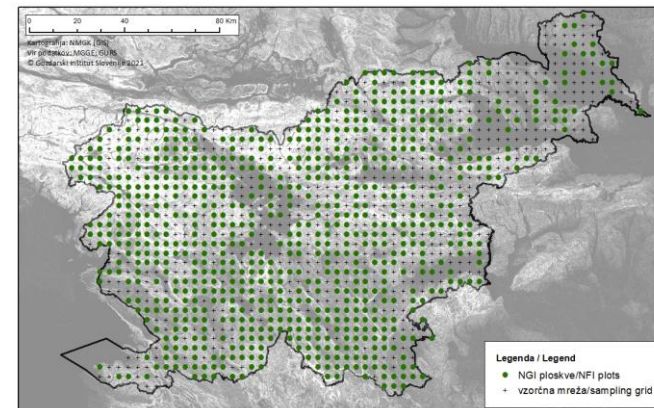
2021 – NFI panel 2

2022 – NFI panel 3

2023 – NFI panel 4

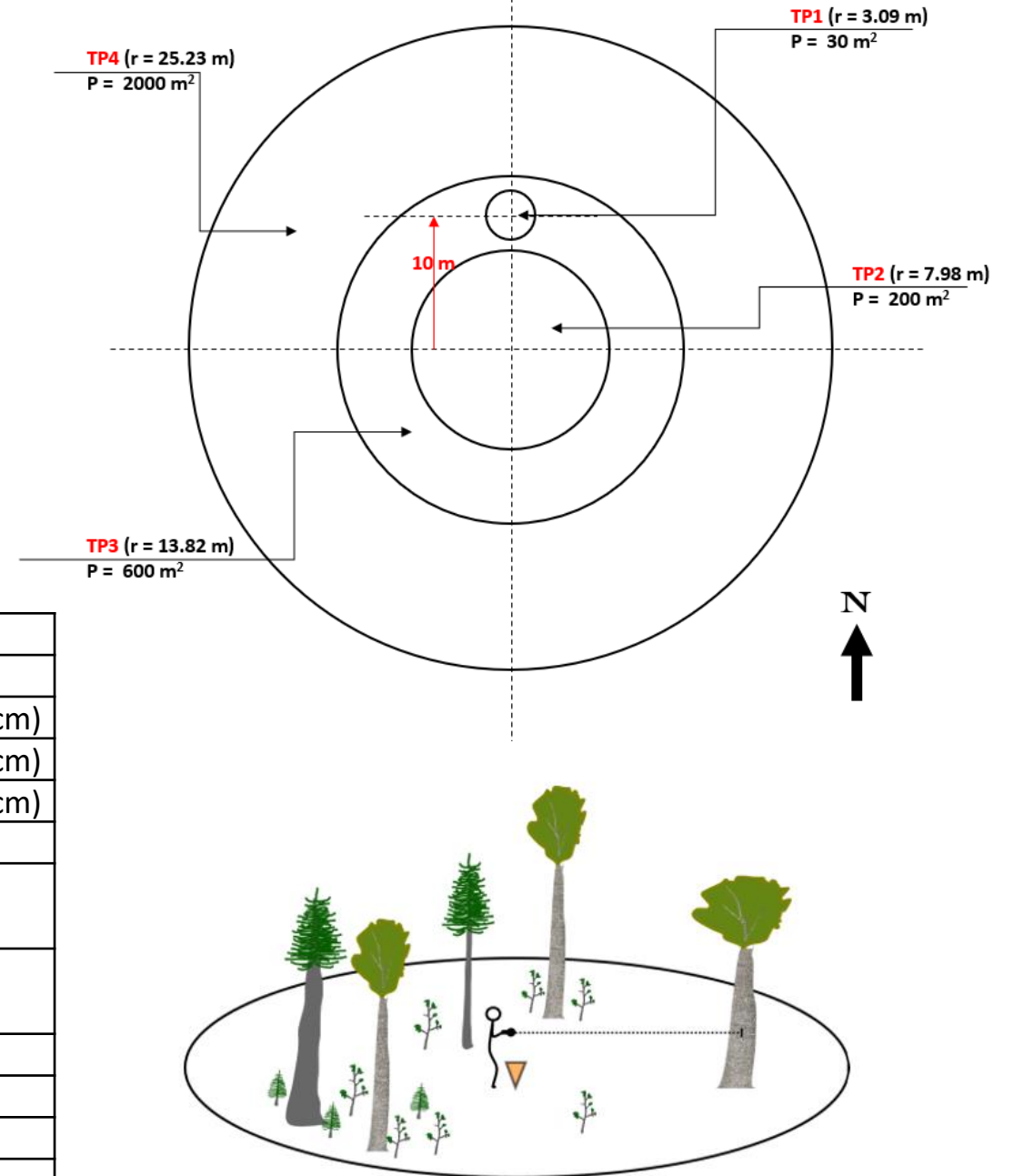
2024 – NFI panel 5 (old grid)

2025 – NFI panel 1 (cycle 2)



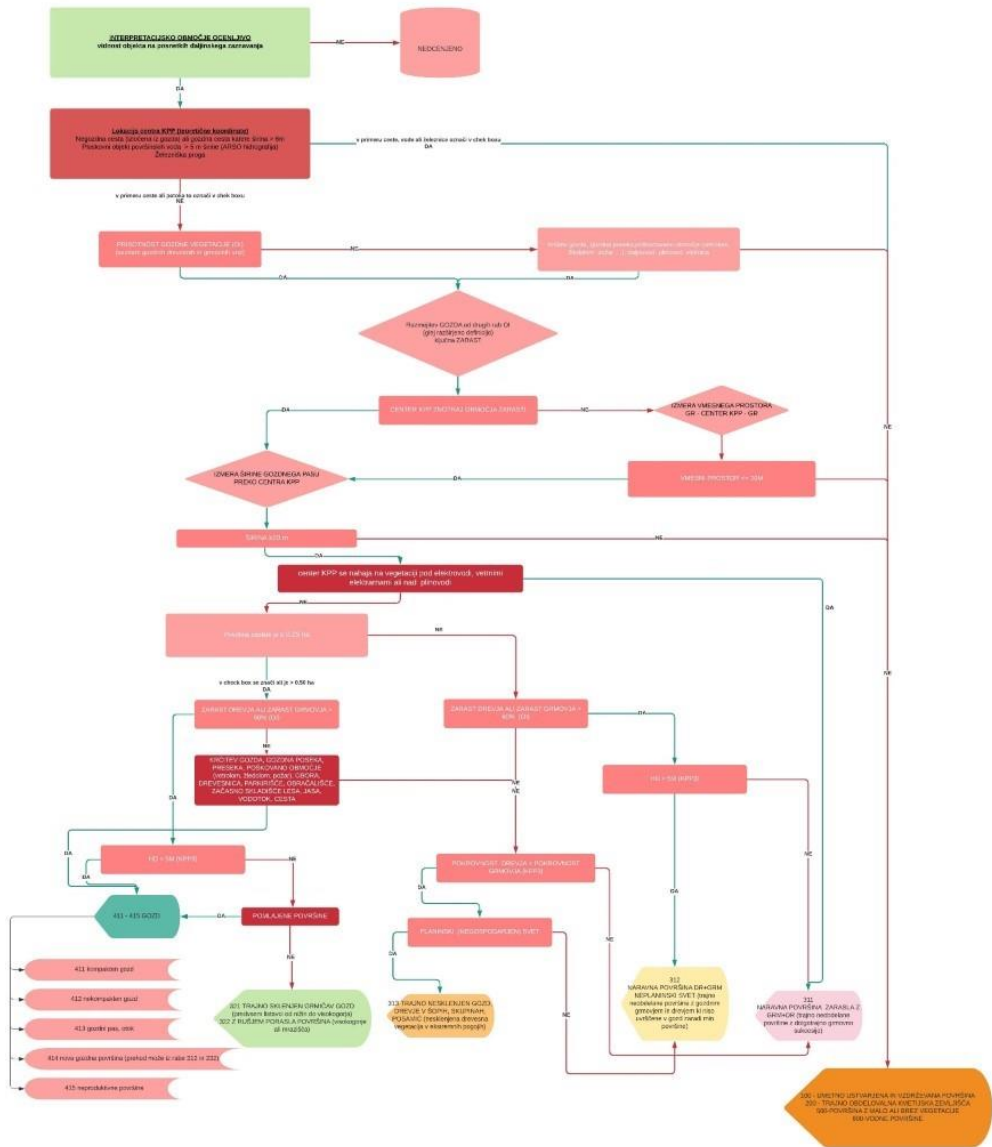
PLOT CONFIGURATION

- Internationally harmonized indicators
- Detailed field manual
- Permanent circular plots with fixed radii



Indicator	Subplot and thresholds
Live trees $d_{1,3} < 10$ cm in $h \geq 1,3$ m	TP1
Live trees $d_{1,3} \geq 10$ cm	TP2 ($d_{1,3} \geq 10$ cm), TP3 ($d_{1,3} \geq 30$ cm)
Standing dead tree	TP2 ($d_{1,3} \geq 10$ cm), TP4 ($d_{1,3} \geq 30$ cm)
Lying dead tree	TP2 ($d_{1,3} \geq 10$ cm), TP4 ($d_{1,3} \geq 30$ cm)
Stump	TP2 ($d_{1,3} \geq 10$ cm, $h \geq 20$ cm)
Snag	TP2 ($d_{1,3} \geq 10$ cm, $h \geq 50$ cm), TP4 ($d_{1,3} \geq 30$ cm, $h \geq 50$ cm)
Coarse woody debris (deadwood biomass)	TP2 ($d_{1,3} \geq 10$ cm, $h \geq 50$ cm), TP4 ($d_{1,3} \geq 30$ cm, $h \geq 50$ cm)
Plot characteristics	TP4
Stand characteristics	TP4 and surrounding
Horizontal forest structure	TP4
Vertical forest structure	TP4

FOREST / OTHER WOODED LAND / NO FOREST



MANUAL FOR FIELD WORK

Digitalni repozitorij raziskovalnih organizacij Slovenije



Izpis gradiva

Naslov: **Nacionalna gozdna inventura : interna navodila za terensko delo (2020-2024) : (ver. 02 / 2022) : dopolnitve 13. 5. 2022**

Avtorji: Skudnik, Mitja (Avtor)
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 Pisek, Rok (Avtor)
 Pintar, Anže Martin (Avtor)
 Kušar, Gal (Avtor)
 Guček, Matjaž (Avtor)
 Grah, Andrej (Avtor)
 Kovač, Marko (Avtor)
 Grah, Andrej (Sodelavec pri raziskavi)
 Guček, Matjaž (Sodelavec pri raziskavi)
 Kovač, Marko (Sodelavec pri raziskavi)
 Kušar, Gal (Sodelavec pri raziskavi)
 Pintar, Anže Martin (Sodelavec pri raziskavi)
 Pisek, Rok (Sodelavec pri raziskavi)
 Poljanec, Aleš (Sodelavec pri raziskavi)
 Žlogar, Jure (Sodelavec pri raziskavi)

Datoteke: PDF - Predstavitvena datoteka, [prenos](#) (4,71 MB)
MD5: 87B9DC9C594BD394A31EC99A56FEC7CC

Jezik: Slovenski jezik

Tipologija: 2.06 - Slovar, enciklopedija, leksikon, priročnik, atlas, zemljevid

Organizacija: SciVie - Gozdarski inštitut Slovenije

Ključne besede: nacionalna gozdna inventura, monitoring, terenske meritve, trajne vzorčne ploskve, navodila

Leto izida: 2020 - 2020

Objavi

Podobna

1. Značiln
v siste
gozdn

Podobna

1. Gozdn
2. Gozda
stalne
Natura
3. Gozdn
4. Presoj
na stal
5. Navod
MOTI

Postavite r
povzetka. K
sproži pren

NACIONALNA GOZDNA INVENTURA

INTERNA NAVODILA ZA TERENSKO DELO (2020-2024)

(ver. 02 / 2022)

Dopolnitve 13. 5. 2022

Urednik: dr. Mitja Skudnik

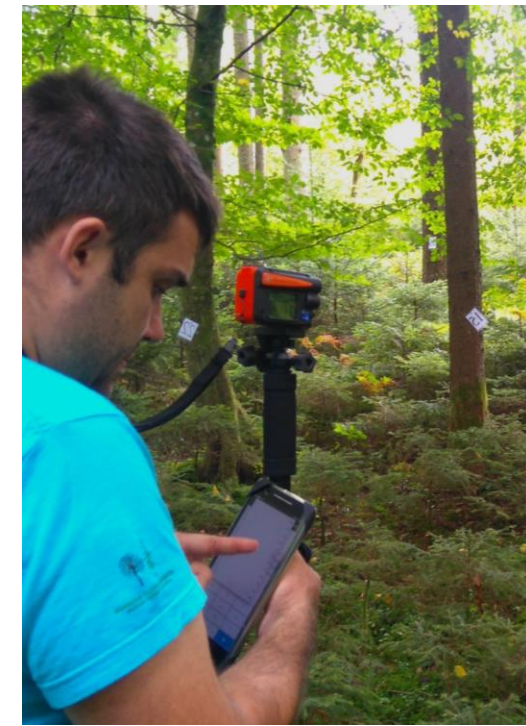
Avtorji: dr. Mitja Skudnik, Andrej Grah, mag. Matjaž Guček, dr. Marko Kovač, dr. Gal Kušar,
Anže Martin Pintar, mag. Rok Pisek, dr. Aleš Poljanec, Jure Žlogar

GIS

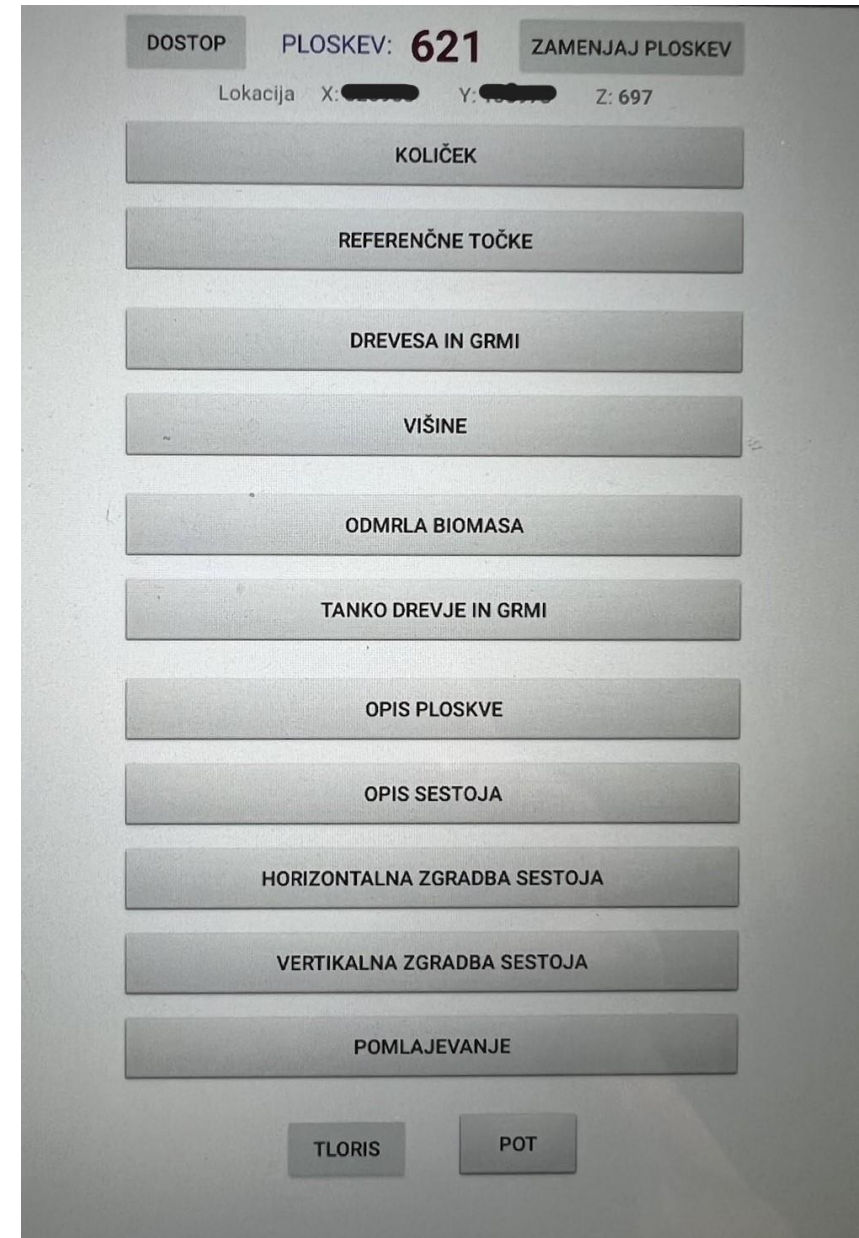
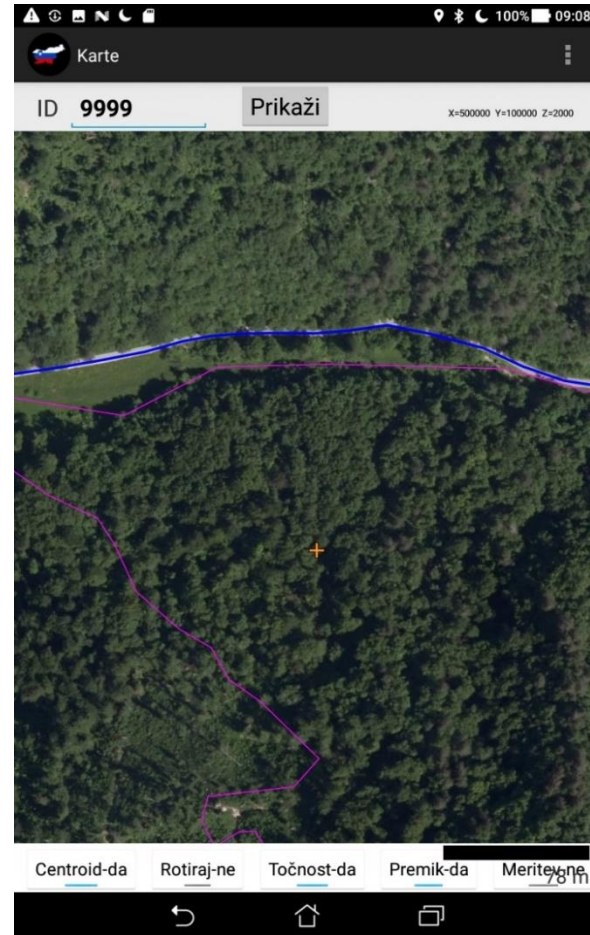
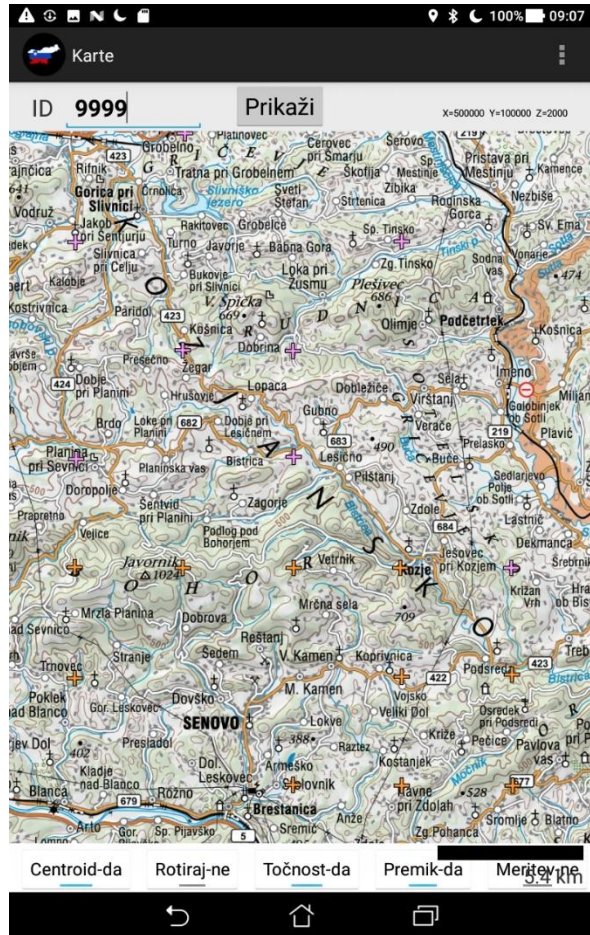
Ljubljana 2020

FIELD WORK

- Well-trained permanent field teams (6)
- “Modern” field equipment
- Independent quality control

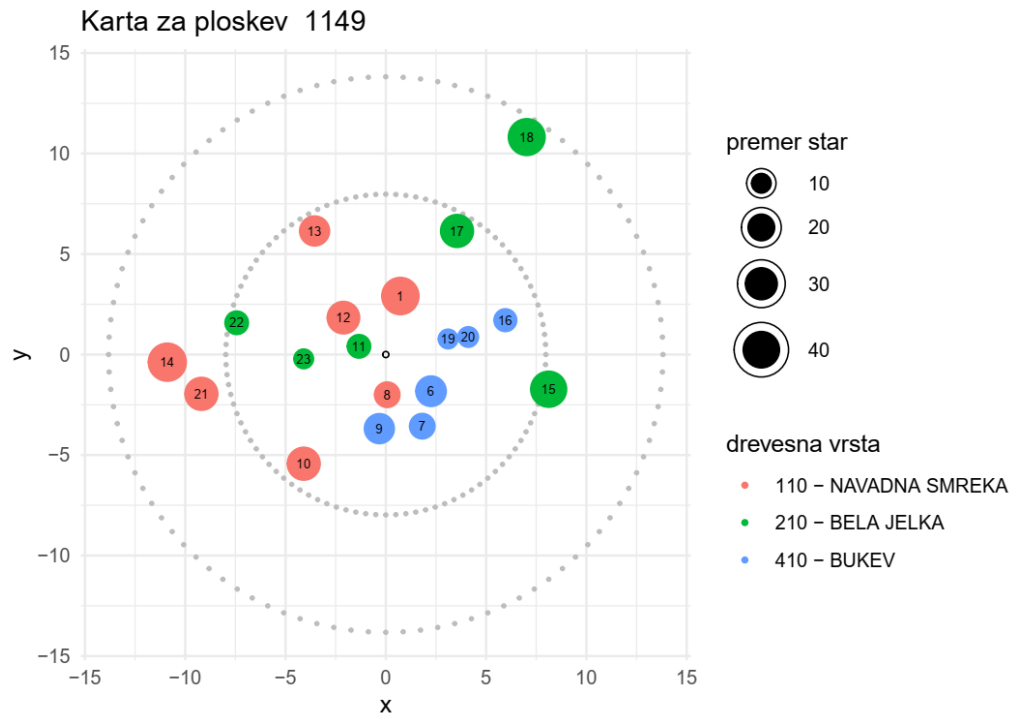


LOCATION OF THE PLOT



LOCATION OF THE PLOT

Zeno mobile application (RTK correction)



TREE MEASUREMENTS

23:35

Dodaj drevo

R2 = 79dm R3 = 138dm

AZIMUT: _____ ° HD: _____ dm SD: _____ dm

DV: izberi... ▼


PREMER: izberi... ▼ cm

SOCIALNI: izberi... ▼

MORFOLOGIJA:

1 - NORMALNO RASLO DREVO **SPREMENI**

POTRDI




09:08 100%

Drevesa

+ DREVO R2=79dm R3=138dm

	AZIM	DIST	ZSD	DV	PREMER	
U	57	37	20	410 - BUKEV	10.7	P
U	104	49	21	410 - BUKEV	10.4	P
U	209	61	22	410 - BUKEV	11.8	P
U	288	64	23	410 - BUKEV	10.7	P
U	321	61	24	710 - BELI GABER	11.8	P
U	3	26	25	410 - BUKEV	12.7	P
U	8	81	2	410 - BUKEV	12.7	P
U	65	16	4	710 - BELI GABER	13.6	P
U	65	128	3	410 - BUKEV	38.5	P
U	66	35	5	410 - BUKEV	13.3	P
U	94	130	12	410 - BUKEV	35.3	P
U	120	4	7	710 - BELI GABER	11.1	P
U	120	27	6	730 - MAKLEN	12.4	P
U	175	51	8	410 - BUKEV	16.2	P
U	205	76	9	410 - BUKEV	16.5	P
U	206	21	13	410 - BUKEV	12.0	P



NFI

ZSD: 3 DV: 410 - BUKEV

LOKACIJA: izberi... ▼

VRSTA: ▼

POVZROČITELJ: ▼

DODAJ

IZBRIŠI	LOKACIJA	VRSTA	POVZROČITELJ
X	KORENIČNIK	RAZPOKA do 1m	KAMENJE/SKALE

HEIGHT MEASUREMENTS

Seznam dreves za višine

AZIM	DIST	ZSD	DV	PREMER	VIŠ	VIŠ.DEBLA	
65	16	4	710 - BELI GABER	13.6			U
65	128	3	410 - BUKEV	38.5	274	145	U
94	130	12	410 - BUKEV	35.3			U
214	40	14	410 - BUKEV	10.8			U
250	125	10	410 - BUKEV	41.0	226	49	U
325	18	11	410 - BUKEV	12.7	159	100	U

Vnos višine

AZIM: 65 DIST: 128 ZSD: 3 DV: 410 - BUKEV

VIŠINA DREVEVA: dm

VIŠINA DEBLA: dm

POTRDI

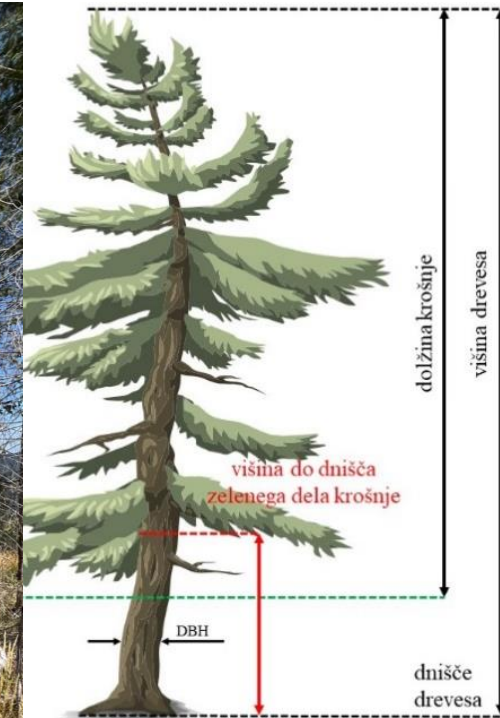


tarifa 1	60-več	U
	50-60	
	40-50	
	30-40	
	20-30	
	10-20	
tarifa 2	60-več	U
	50-60	
	40-50	
	30-40	
	20-30	
	10-20	
tarifa 3	60-več	U
	50-60	
	40-50	
	30-40	
	20-30	
	10-20	
tarifa 4	60-več	U
	50-60	
	40-50	
	30-40	
	20-30	
	10-20	



DREVEVA IN GRMI

VIŠINE



DEADWOOD



ODMRLA BIOMASA



23:36 4G 21

Odmrla biomasa

R2 = 79dm R4 = 252dm

TIP: izberi...

DV: izberi...

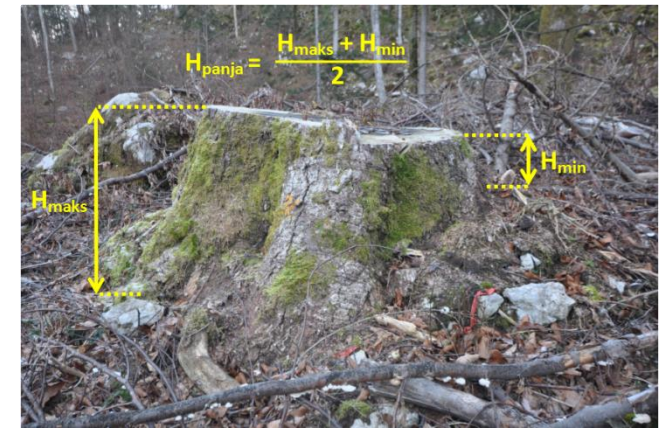
PRISOTNOST SKORJE: izberi...

TEKSTURA LESA: izberi...

DODAJ

IZBRIŠI	TIP	DV	PP	H	SP	L	P	T
X	KOS 710 - BELI GABER			23	25.5	90 - 61	> 90 -	U
X	ŠTR 310 - RDEČI BOR			120	34	60 - 31	90 - 61	U
X	PAN 710 - BELI GABER			32	20	90 - 61	90 - 61	U
X	SUŠ 510 - GRADEN	25				90 - 61	90 - 61	U
X	POD 640 - VELIKI JESEN	18				<= 30	> 90 -	U

Prisotnost skorje	Tekstura lesa
1	1
2	2
3	3
4	4



SMALL TREES

23:37 49

Tanko drevje

R1 = 3,09 m

DV: izberi... ▼

GV: izberi... ▼

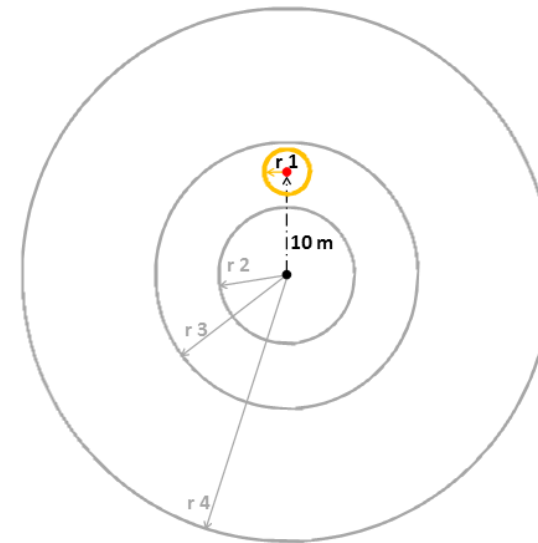
D1,3: izberi... ▼ cm

H: izberi... ▼ m

DODAJ

IZBRIŠI	DV	D1,3	H		ŠT.	
X	610 - GORSKI JAVOR	1,5	4,5	-	1	+
X	3 - NAVADNA LESKA	4,0	5,0	-	1	+
X	3 - NAVADNA LESKA	0,5	3,0	-	1	+
X	3 - NAVADNA LESKA	0,5	2,5	-	1	+
X	640 - VELIKI JESEN	0,5	1,5	-	5	+
X	640 - VELIKI JESEN	3,5	6,0	-	1	+
X	610 - GORSKI JAVOR	6,0	7,0	-	1	+
X	640 - VELIKI JESEN	1,0	2,0	-	1	+
X	3 - NAVADNA LESKA	2,0	2,5	-	1	+

TANKO DREVJE IN GRMI



Znak ploskve	TP1
Radij ploskve [m]	3,09
Površina ploskve [ar]	0,3
Stoječe živo drevje	0 cm < D _{1,3} < 10 cm; H ≥ 1,3 m

STAND

23:38

Opis sestoja

Primorsko bukovje na flisu 64%
Preddinarsko-dinarsko toploljubno bukovje 33%
Predalpsko gorsko bukovje 3%

NARAVNOST 4: 31 - SPREMENJENI GOZDOVI

tnp: NE var: NE rez: NE

GOSPODARJENJE 4: 1 - NEGOSPODARJENO

TIP 4: 4 - drugi pretežno listnati gozdovi, če niso izpolnjeni pogoji pod 1-3 in je listavcev > 75 %

NEGOVANOST 4: 4 - NENEGOVAN OGROŽEN SESTOJ

ZGRADBA 4: 5 - VELIKOPOVRŠINSKA RAZNOMERNA (RAZNODOBNA)

SKLEP SESTOJA 4: 4 - VRZELAST

Št. dreves po debelinskih razredih:

10 - 19.9 5 kos
20 - 29.9 3 kos
30 - 39.9 2 kos
40 - 49.9 1 kos
50 - 59.9 2 kos

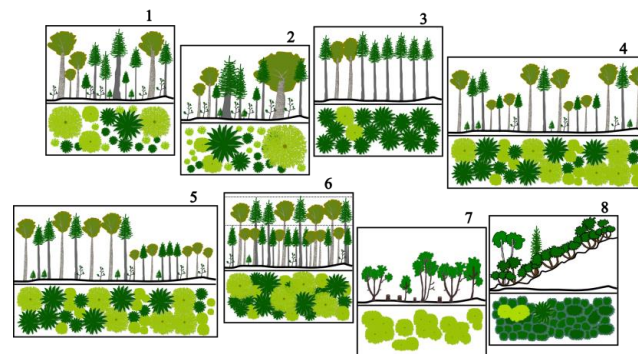
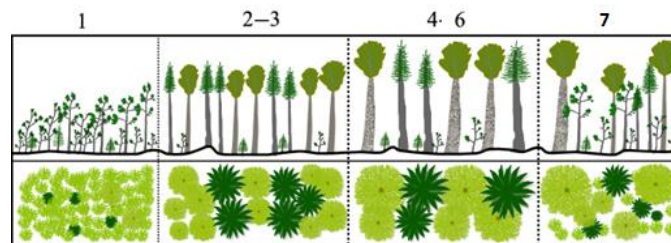
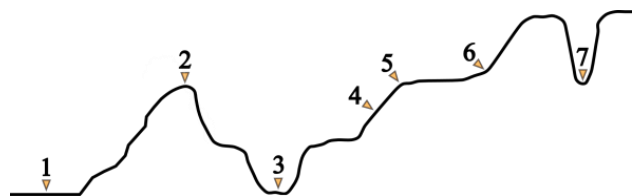
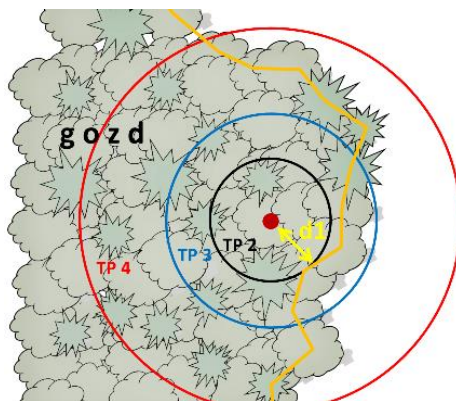
RAZVOJNA FAZA 4 TIP STAROST NAČIN DOLOČITVE

PRIMARNA: 3 - MOČNEJ.. 4 - 61-80 3 - STROKO..

SEKUNDARNA: 1 - MLADOV.. 1 - <=20 3 - STROKO..

DELEŽ R.FAZ (PRIM:SEK): 70

POTRDI



OPIS PLOSKVE

OPIS SESTOJA

23:38

Opis ploskve

RABA: GOZD CENTER ZNOTRAJ RABE: DA

RELIEF: 4 - POBOČJE

POPISOVALEC: ms ph

SKALOVITOST 4: 1 - BREZ SKAL

KAMNITOST 4: 1 - BREZ KAMNOV

CENTER PLOSKVE JE:

ZNOTRAJ merjene rabe

ZUNAJ merjene rabe

4 - PRISOTNA DVA ROBA - center ZNOTRAJ linijskega objekta

D1: 10 dm

D2: 50 dm

POTRDI

HORIZONTAL STRUCTURE

HORIZONTALNA ZGRADBA SESTOJA

23:38

Horizontalna struktura sestoja

STATISTIKA DV IZ MODULA DREVESA:

3 kos	570 - OREH	23 %
3 kos	640 - VELIKI JESEN	23 %
2 kos	610 - GORSKI JAVOR	15 %
1 kos	110 - NAVADNA SMREKA	7 %
1 kos	310 - RDEČI BOR	7 %
1 kos	682 - LIPA	7 %

+ DODAJ PREOSTALE DV NA TP4 D>= 10CM

210 - BELA JELKA, 830 - ČRNA JELŠA

0 5 10 20 30 40
50 60 70 80 90 99

DELEŽ DV V ZG. SLOJU SESTOJA TP4:

DV: izberi... DELEŽ: izberi... **DODAJ**

IZBRIŠI	DV		DELEŽ	
X	640 - VELIKI JESEN	-	40	+
X	570 - OREH	-	20	+
X	610 - GORSKI JAVOR	-	20	+



VERTICAL STRUCTURE

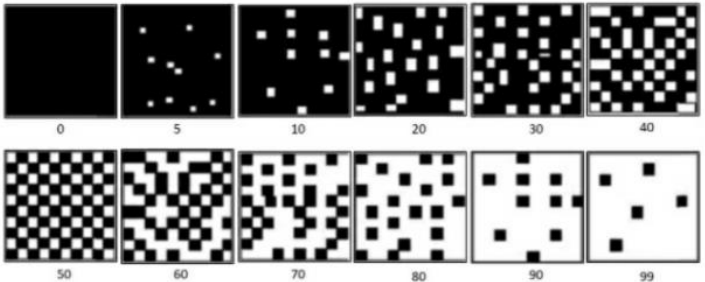
VERTIKALNA ZGRADBA SESTOJA

23:39 4G+

Vertikalna zgradba sestoja

STRUKTURA SESTOJA 3: 2 - VEČSLOJEN SESTOJ

POKROVNOST 3: 90



SLOJEVITOST 3 DELEŽ POKROVNOSTI OBLIKA SKLEPA

ZGORNJI SLOJ: 40

SREDNI SLOJ: 40

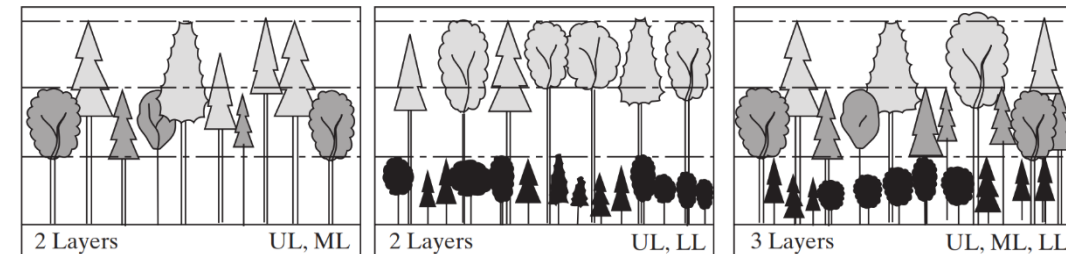
SPODNJI SLOJ: 30

1 - SLOJEVIT

2 - RAZPRŠEN/RAZNO..

2 - RAZPRŠEN/RAZNO..

POTRDI



Povzeto po WSL Lfi.CH 2017

SOIL SAMPLING

23:39

Pomlajevanje

SESTOJ V OBNOVI: 1 - SESTOJ NI V OBNOVI

DELEŽ POKR. POMLADKA 3: 5 - 26-50 %

NASTANEK POMLADKA 3: 1 - NARAVEN

ZAŠČITA POMLADKA 3: 1 - NEZAŠČITEN POMLADEK

0	5	10	20	30	40
50	60	70	80	90	99

POTRDI

POMLAJEVANJE

TLA

POT



13:29

Edit Attributes

Foto tla 1

Foto tla 2

Foto tla 3

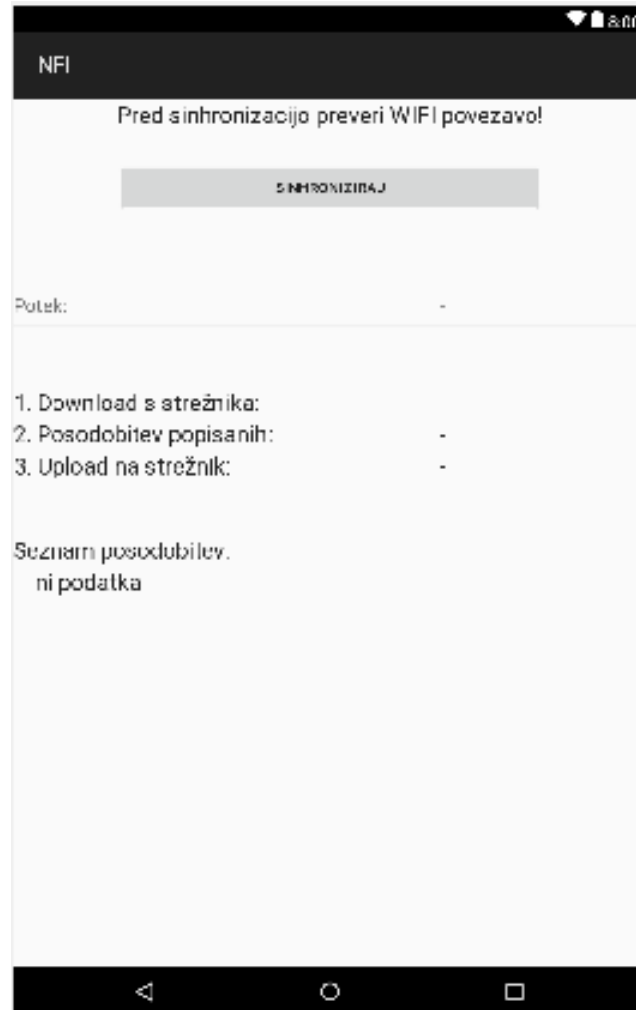
Foto tla 4

Foto tla 5

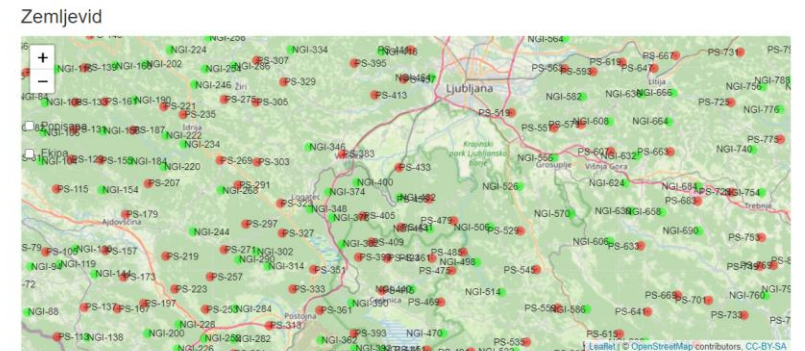
Cancel | OK

FIELD WORK - DATA SYNCHRONIZATION

- Regular daily synchronization of data from field computers to SFI data server
- Daily updated work overview in webapp – access to teams and others involved in NFI



NGI 2022 - stanje včeraj ob 22. uri



Stanje popisov

Prikaži 25 zapisov

PS	število	popisanih	procent
NGI	414	247	59.7
PS	355	249	70.1

PS: število: popisanih: procent:

Prikazujem 1 do 2 od 2 zapisov

Prehodna 1 Naslednja

Stanje po ekipah

Prikaži 25 zapisov

ekipa	število	popisanih	procent
AMP	42	41	97.6
JŽ	115	57	49.6
MB	135	97	71.9
MF	135	79	58.5
RK	92	80	87.0
ZGS	250	142	56.8

ekipa: število: popisanih: procent:

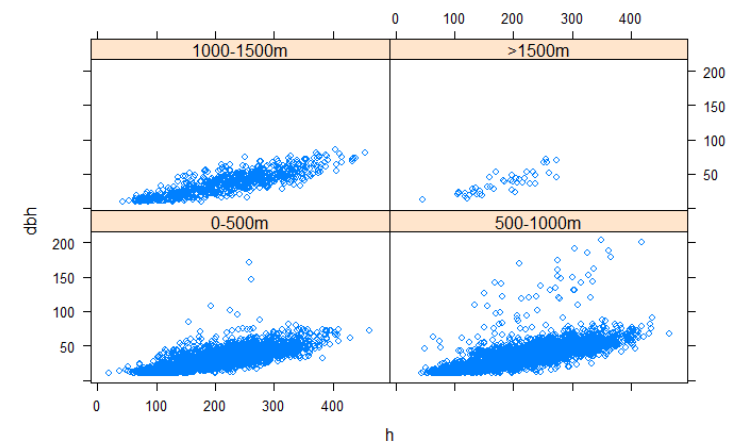
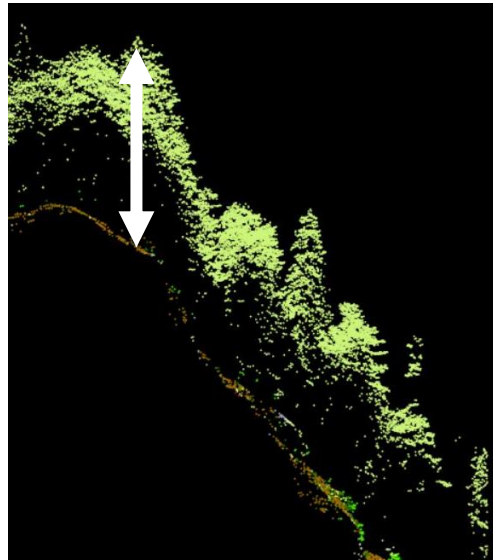
Prikazujem 1 do 6 od 6 zapisov

Prehodna 1 Naslednja

Stanje po ekipah in tipu ploskve

INACCESSIBLE NFI PLOTS

- Use of aerial images and lidar data
- Individual tree volume calculation
- height-diameter relationships (5908 trees)
- Mod DBH \rightarrow volume functions \rightarrow tree volume estimate



DATABASE STRUCTURE

Data base -> MySQL

Internal GIS MySQL server

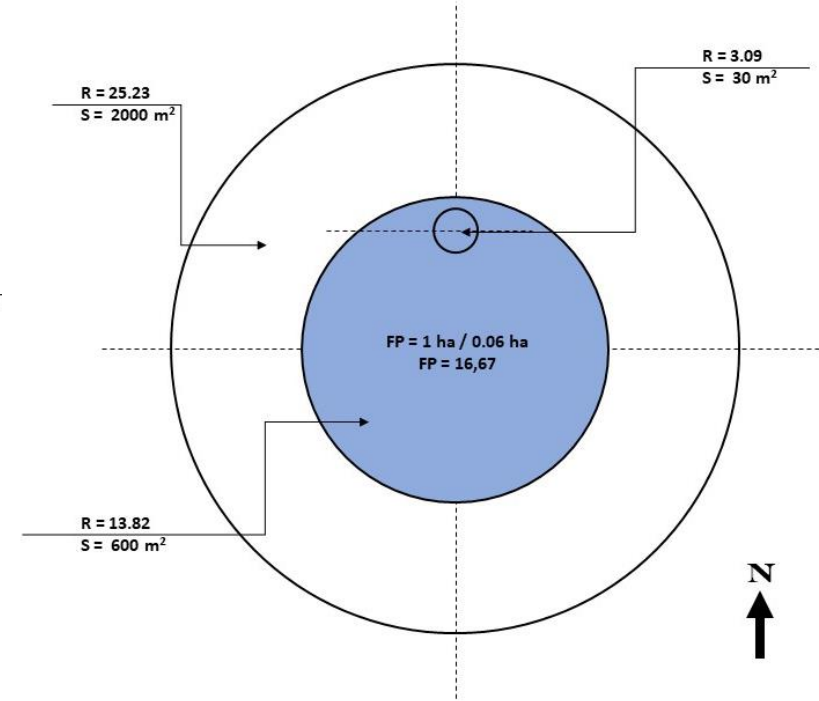
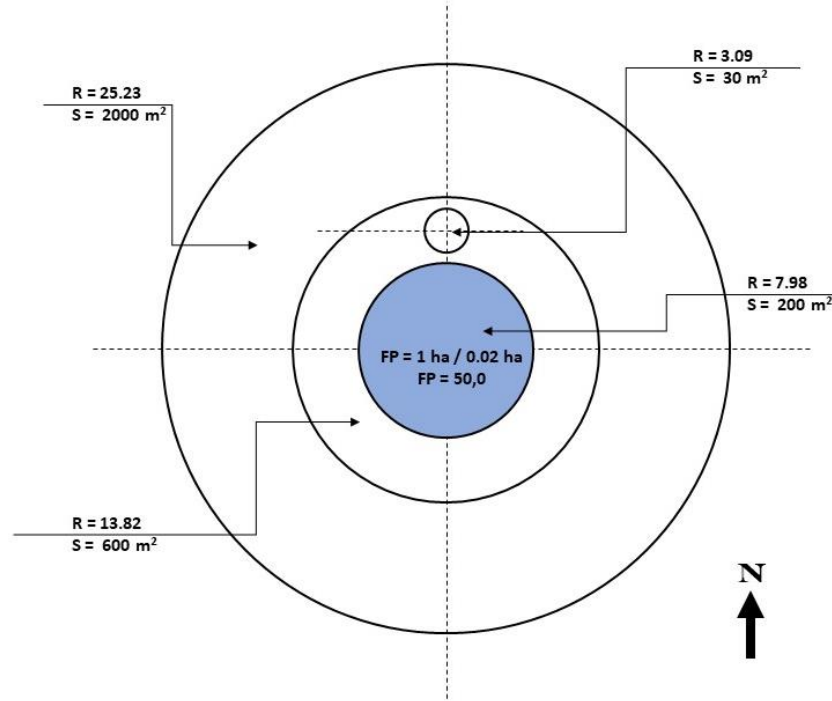
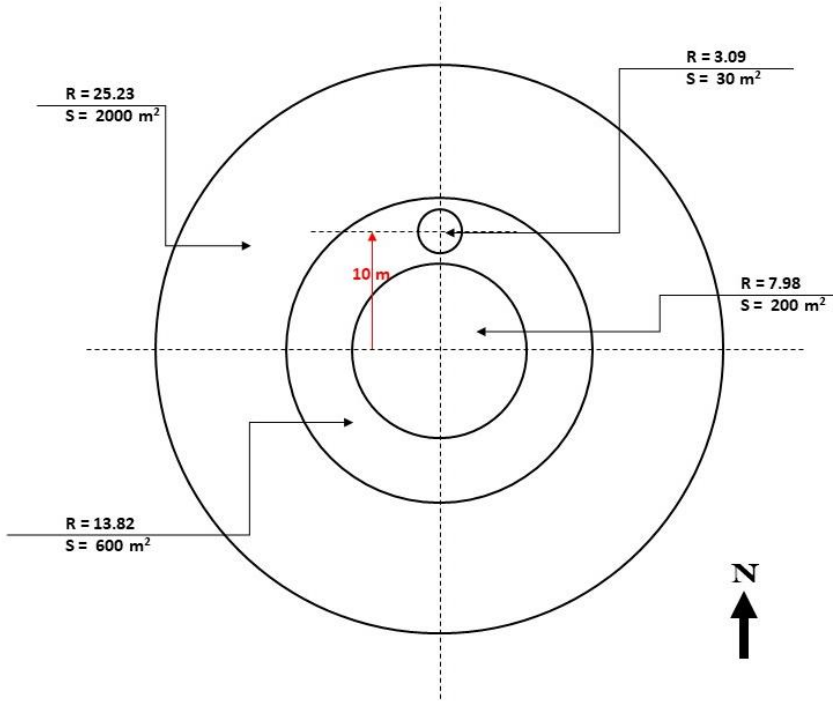
Calculations -> MySQL functions

Graphical interface -> C#

The screenshot displays the SQL Server Enterprise Manager interface. At the top, two pop-up windows show the structure of tables: 'tipodmrlebiomase' with columns 'tblID INT(11)' and 'tblIme VARCHAR(45)', and 'prisotnostskorjeodmrlebiomasa' with columns 'psobID INT(11)' and 'psobIme VARCHAR(45)'. The main window shows the 'Database Structure' tab for a database named 'drevo'. A table named 'drevo' is selected, and its structure is shown in a grid. The table has 14 columns: UID, drPIID, drZapStNaPloskvi, drDrevVrstSaSifra, drAzimut, drAzimutNov, drDistanca, rDistancaSD, drDistancaHD, drObseg, drObsegNov, drKoda, drSocialni, and drV. The data is displayed in a table with 11 rows. The first row is highlighted. The table structure is as follows:

	UID	drPIID	drZapStNaPloskvi	drDrevVrstSaSifra	drAzimut	drAzimutNov	drDistanca	rDistancaSD	drDistancaHD	drObseg	drObsegNov	drKoda	drSocialni	drV
1	764-11	764	11	610 - GORSKI JAVOR	NULL	342	NULL	65	69	NULL	11.6	3 - VRASLO	4 - POTISNjeno/OBVladANO	
2	764-7	764	7	760 - ČRNI GABER	NULL	221	NULL	62	65	NULL	17.7	3 - VRASLO	3 - SOVLADAJOČE	
3	764-5	764	5	510 - GRADEN	NULL	181	NULL	50	58	NULL	13.6	3 - VRASLO	3 - SOVLADAJOČE	
4	764-3	764	3	510 - GRADEN	NULL	58	NULL	48	45	NULL	44.4	3 - VRASLO	2 - VLADAJOČE	
5	764-8	764	8	760 - ČRNI GABER	NULL	331	NULL	44	37	NULL	15.9	3 - VRASLO	3 - SOVLADAJOČE	
6	764-9	764	9	760 - ČRNI GABER	NULL	336	NULL	44	38	NULL	17.1	3 - VRASLO	3 - SOVLADAJOČE	
7	764-4	764	4	510 - GRADEN	NULL	172	NULL	40	32	NULL	10.5	3 - VRASLO	4 - POTISNjeno/OBVladANO	
8	764-10	764	10	770 - MALI JESEN	NULL	353	NULL	33	32	NULL	12.3	3 - VRASLO	3 - SOVLADAJOČE	
9	764-6	764	6	760 - ČRNI GABER	NULL	200	NULL	15	14	NULL	15.5	3 - VRASLO	3 - SOVLADAJOČE	
10	764-2	764	2	410 - BUKEV	NULL	36	NULL	116	111	NULL	47.1	15 - PRERASLO	2 - VLADAJOČE	
11	764-1	764	1	410 - BUKEV	NULL	22	NULL	101	100	NULL	34.9	15 - PRERASLO	2 - VLADAJOČE	208

CALCULATIONS



$$x_i = \sum_{j=1}^d y_j * FP$$

Plot level

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

Average estimation

$$s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$$

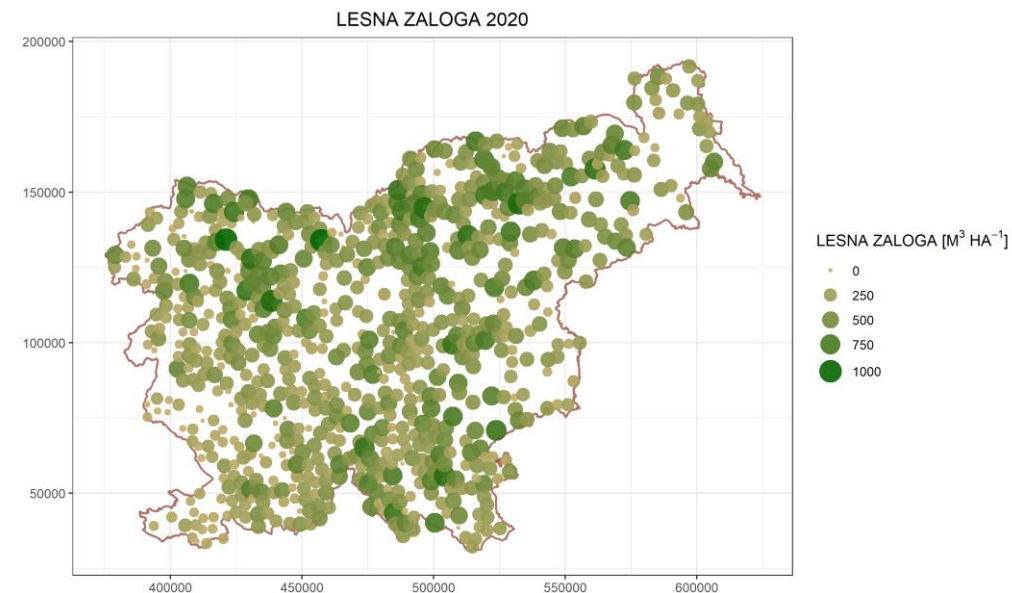
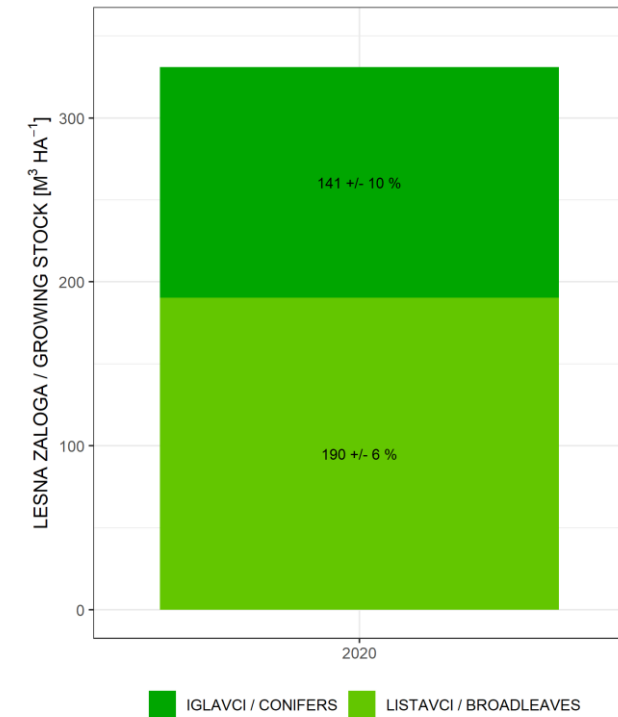
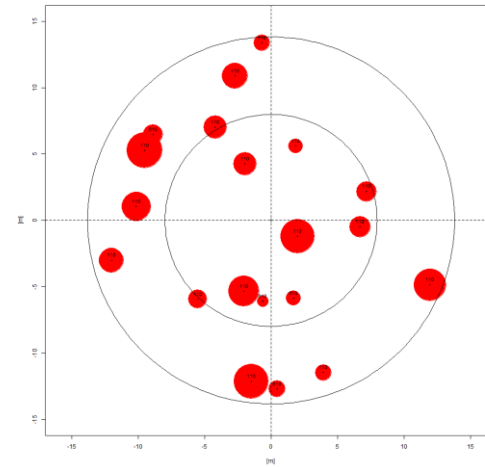
Sampling standard deviation

$$E \% = t * \frac{s}{(\sqrt{n})} / \bar{x} * 100$$

Sampling error

RESULTS

- Transparent calculation methods
- Estimation + known estimation errors (sampling)
- Used for international and national reporting
- **The most important available results:**
 - 1. State of the forest:** growing stock, basal area, number of trees, dominant height, volume of deadwood biomass, diversity indices ...
 - 2. Changes in forest:** increment, harvest, mortality ...
 - 3. Forest characteristics and data stratification:** Information on stand structure, vertical and horizontal forest structure ...



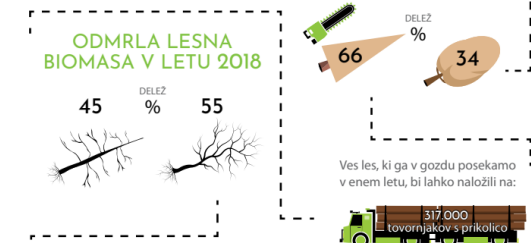
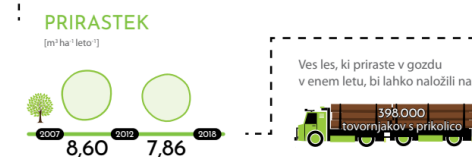
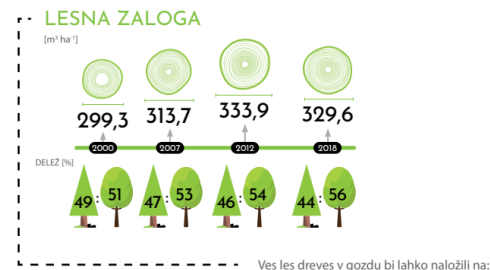
NACIONAL REPORTS

PUBLICATIONS AND REPORTS

- State and changes of Slovenian forests in period (2000-2018) -> <http://dx.doi.org/10.20315/SFS.181>



2. IZVLEČEK O STANJU GOZDOV/ SUMMARY OF THE STATE OF FORESTS



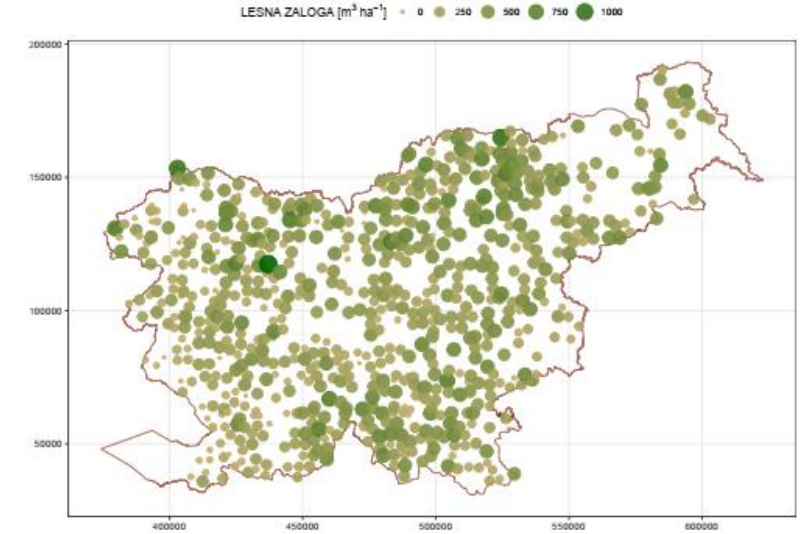
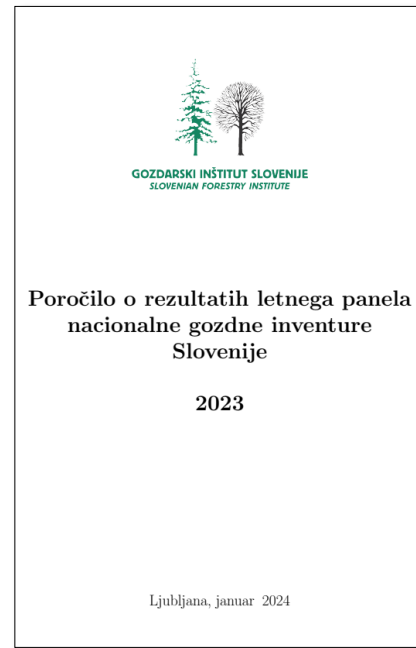
RESULTS NGI 2020

- Publication -> NATIONAL REPORT
- Calculations in R and SQL scripts
- Semi-automated yearly reports -> R knitr

```

poročilo.Rnw
Format Compile PDF
1 <<R knitr-config, echo = FALSE, results = 'hide', message = FALSE, warning = FALSE>>=
2 sys.setlocale('LC_CTYPE', 's1_SI.UTF-8')
3 library(knitr)
4 library(kablextra)
5 ## Load the packages we want
6 library(ggplot2)
7 ## set up knitr options
8 opts_chunk$set(echo = FALSE, # don't output code
9               results = 'hide', # don't output results from code
10              warning = FALSE, # don't put warnings in the document
11              message = FALSE, # don't put messages in the document
12              fig.path="output/figures/")
13 knitr::opts_chunk$set(fig.pos = 'H')
14 ## da lahko kličeš R v figure captionih: https://stackoverflow.com/questions/15708231/knitr-
15 opts_knit$set(eval.after = 'fig.cap')
16
17 hook_inline = knitr_hooks$get('inline')
18 knitr_hooks$set(inline = function(x) {
19   if (is.character(x)) x = knitr::escape_latex(x)
20   hook_inline(x)
21 })
22

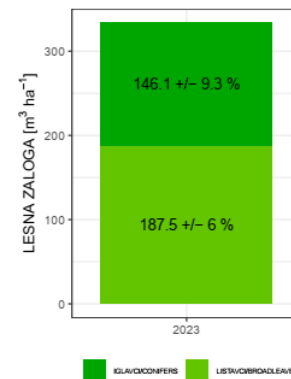
```



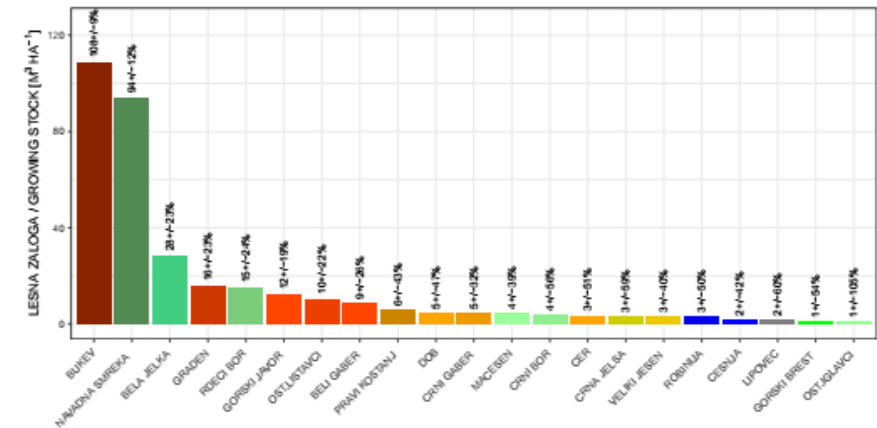
Slika 4: Ploskve po razredih lesne zaloge dreves.

Preglednica 2: Lesna zaloga v letu 2023

	Število ploskev	Povprečje [m ³ /ha]	E [%]	Delež [%]
Listavci	756	187.5	6.0	56.2
Iglavci		146.1	9.3	43.8
Skupaj		333.5	4.2	100.0



Slika 5: Lesna zaloga za iglavce in listavce.



Slika 6: Lesna zaloga po drevesnih in grmovnih vrstah.

INTERNATIONAL REPORTS

- need for data harmonization



Food and Agriculture Organization
of the United Nations

eurostat 

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Home > Forestry > Overview

Forestry – Overview

INTRODUCTION

What data can I find here and how are they collected?

Eurostat publishes **annual data** on forestry which come from two different 'questionnaires'.

- The Joint Forest Sector Questionnaire (JFSQ):
It provides statistics on the **production and trade in wood and wood products**. These data provide information for supply balances of wood products, in order to see for instance whether supply matches demand due to competing uses for material and energy, and are used for comparison with other countries around the world.
- The European Forest Accounts:
These accounts collect annual statistics on the **area and value of wooded land**, the **quantity and value of timber**, the **economic activities** of forestry and logging, and **employment** in the sector. These data are essential to assess the economic viability of forestry.

> Read more



State of Europe's Forests

This report provides comprehensive information on the status and trends in forests and forestry in the pan-European region, based on the criteria for sustainable forest management.

Download here →



<https://www.youtube.com/watch?v=I60ef3ZfEPw&t=146s>

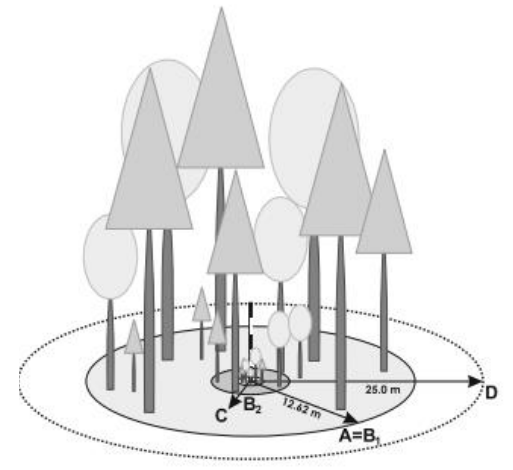
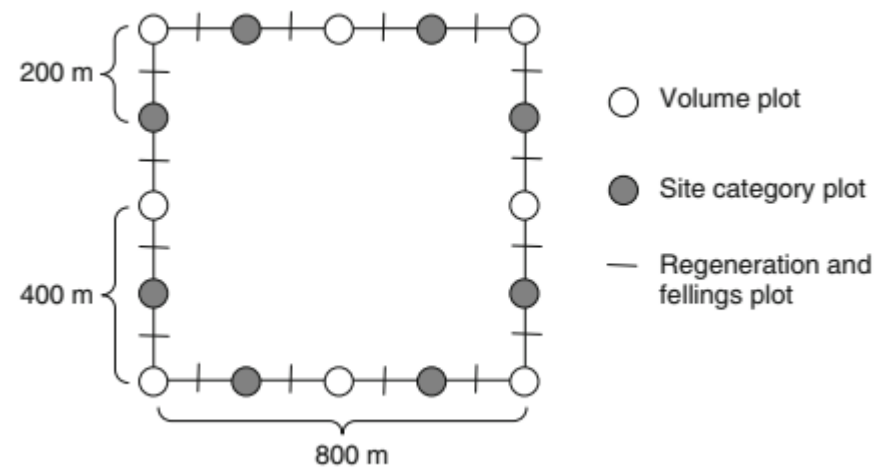
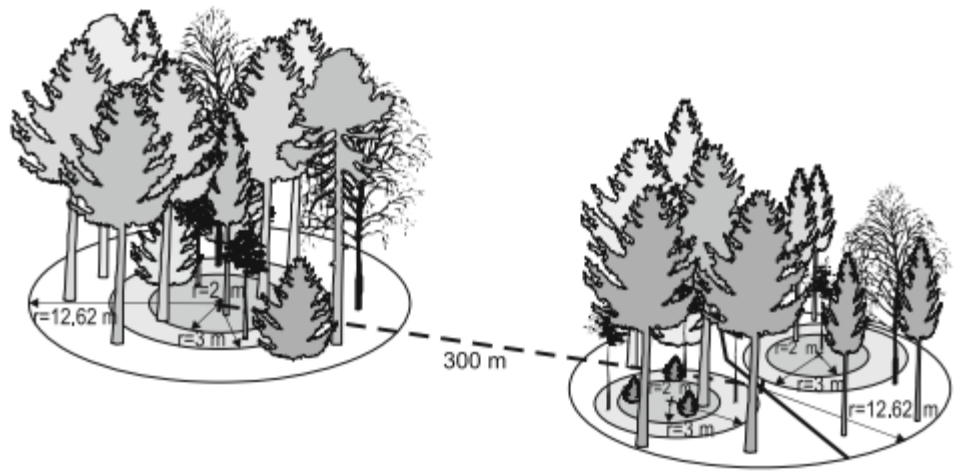
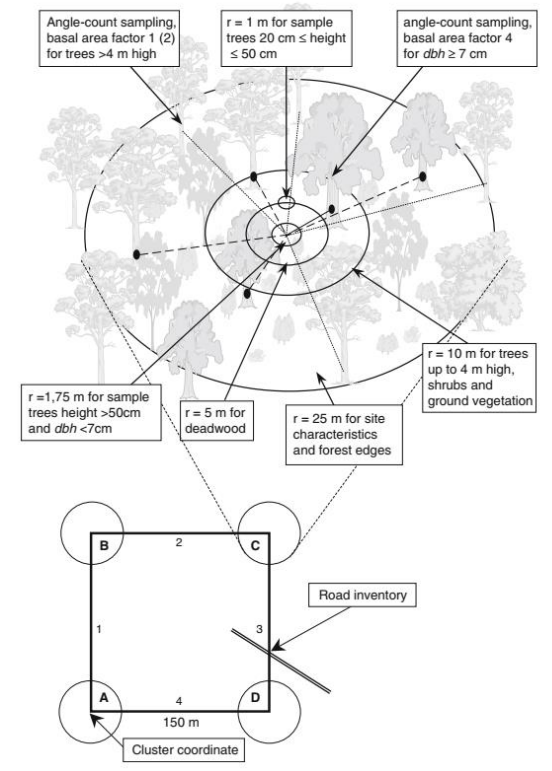
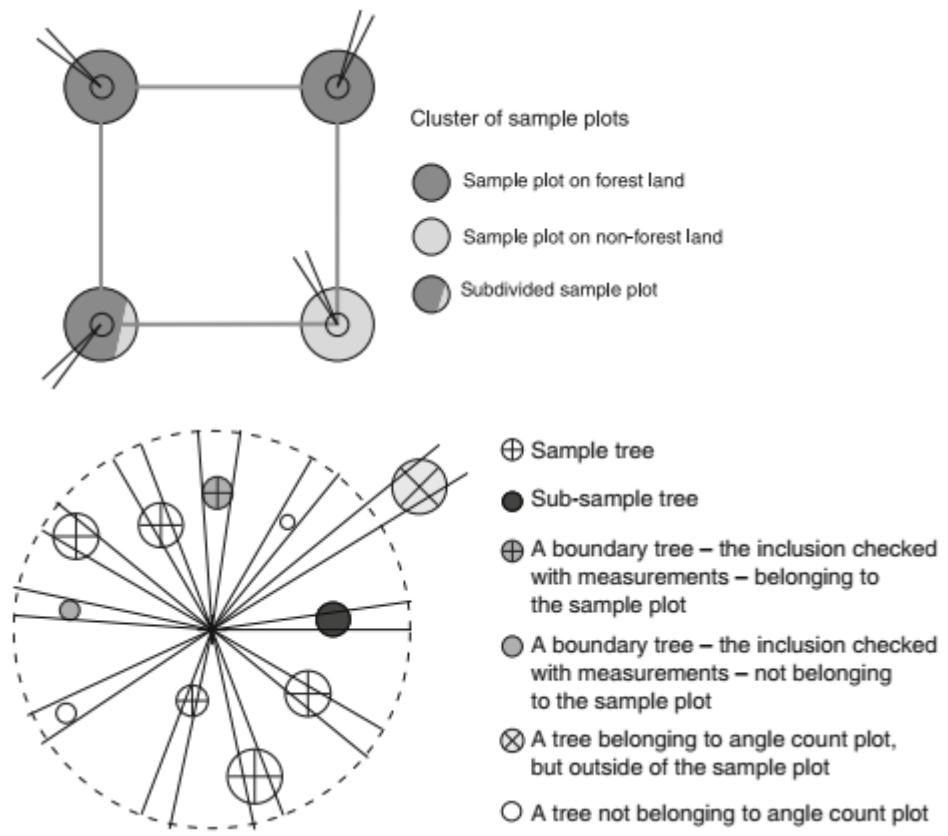


Fig. 8.1 A 300 m transect between plots with a duplex

EU HARMONISATION OF RESULTS

- STATISTICAL FOREST INVENTORIES
 - POINT SAMPLING -> volume estimation (biomass)
 - One, two or three parametric functions ($d_{1.3}$, d_7 , h)
 - Harmonisation of volume estimates on European level

NFI—country	Growing stock (million m ³)		Difference (%)
	Country-level definition	Reference definition 2 Cost Action E43	
Austria	1106.5	1112.9	-0.6
Belgium	118.6	126.8	-6.5
Czech Republic	942.2	1028.0	-8.3
Denmark	133.1	110.7	+20.2
Estonia	476.0	462.4	+3.0
Finland	2343.4	2343.4	0.0
France	2566.5	2757.0	-6.9
Germany	3367.5	3185.8	+5.7
Hungary	390.4	352.7	+10.7
Ireland	97.5	99.4	-2.0
Latvia	660.3	660.9	-0.1
Lithuania	542.7	535.0	+1.4
Norway	1094.4	1126.3	-2.8
Portugal	158.1	179.4	-11.9
Romania	2156.5	1961.1	+10.0
Serbia	375.1	284.5	+31.9
Slovakia	569.5	608.8	-6.4
Slovenia	416.8	403.9	+3.2
Spain	1001.2	1088.5	-8.0
Sweden	3493.5	3493.5	0.0
Switzerland	409.7	408.2	+0.4



CONCLUSIONS

- NFI is important and internationally recognized source of data about forests on national level -> potentially part of EU forest monitoring
- Permanent long-term activity (need to be part of the funding system)
- Data dissemination -> web application (digitalization of information)
- Reporting – proper use of the data, citation, verification
- Additional information collecting on the NFI plots (forest soil and litter, forest functions, wood quality, biodiversity, age structure, AC/QC system ...)
- NFI data – yearly (5 years) available information about the state of forest on country level, data time series ...