Forestry Working Group

16 – 17 July 2019

Slovenian Forestry Institute

SLOVENIAN LARGE-SCALE FOREST MONITORING SYSTEM – METHODES AND DATABASE

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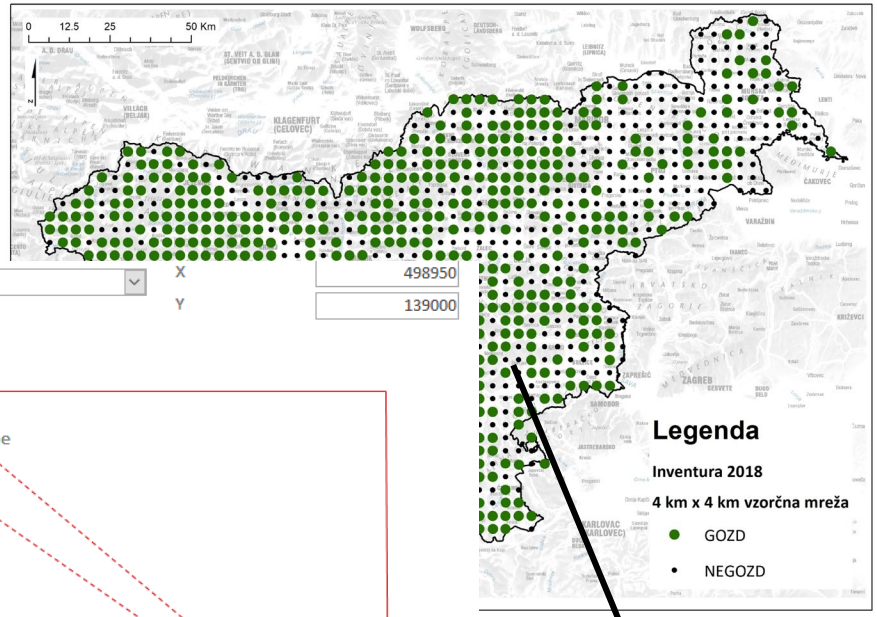
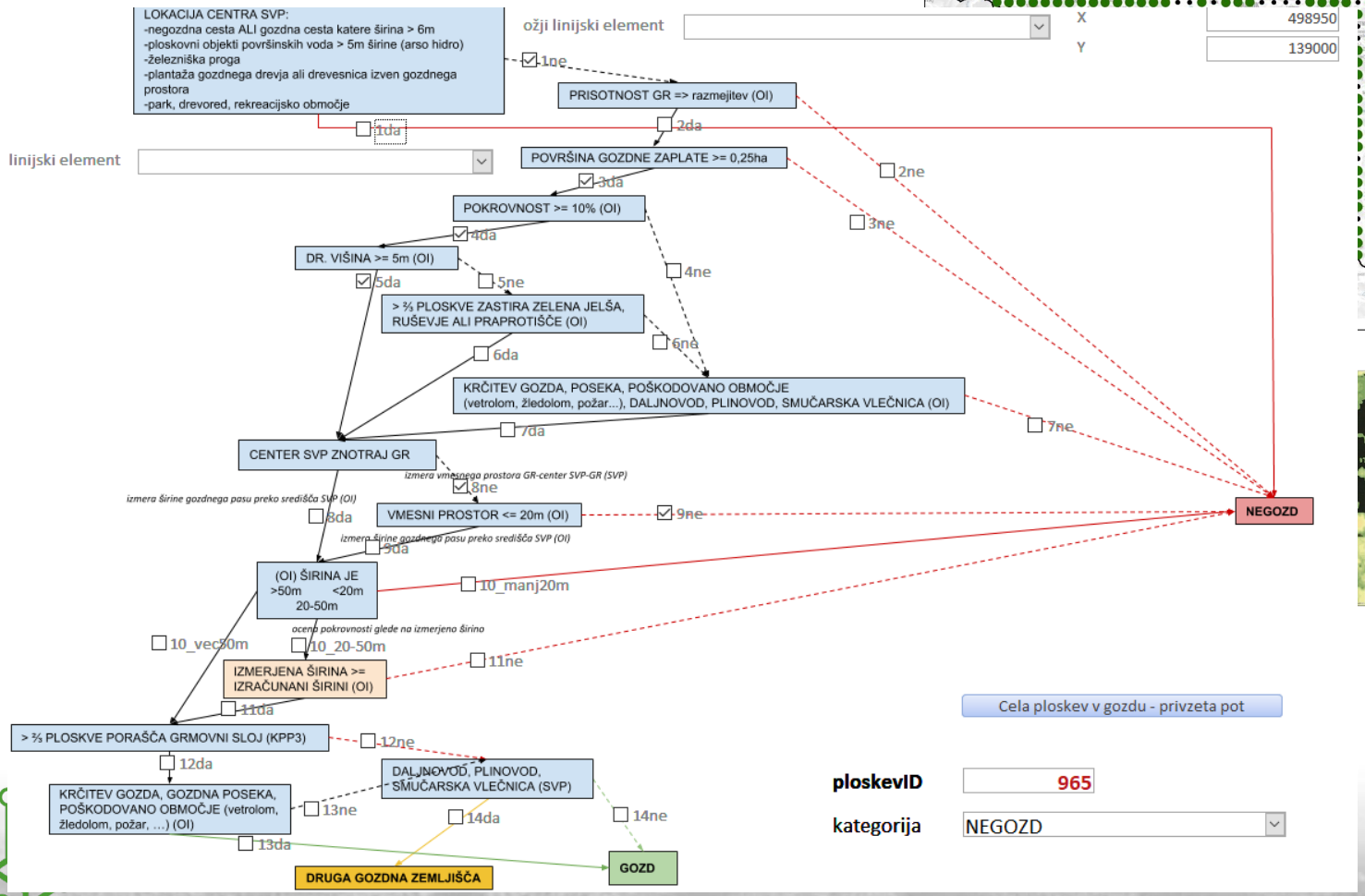
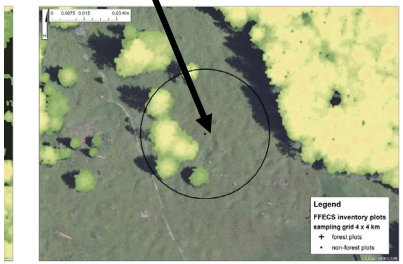
NATIONAL FOREST INVENTORY

- Sampling grid 4 km x 4 km
- Timeline: 2000, 2007, 2012, 2018
- Indicators measured: live trees, dead biomass, site characteristics, other forest functions
- Manual 2012: http://eprints.gozdis.si/566/1/prirocnik_24.11.14varovan1.pdfKova%C4%8D.pdf
- **International harmonisation of indicators**
- Part of ENFIN and ENFIN Alps group
- Data usage: national and international reports (state of Slovenian forests, FAO report, Forest Europe, etc.),

Systematic sampling grid
4 km x 4 km

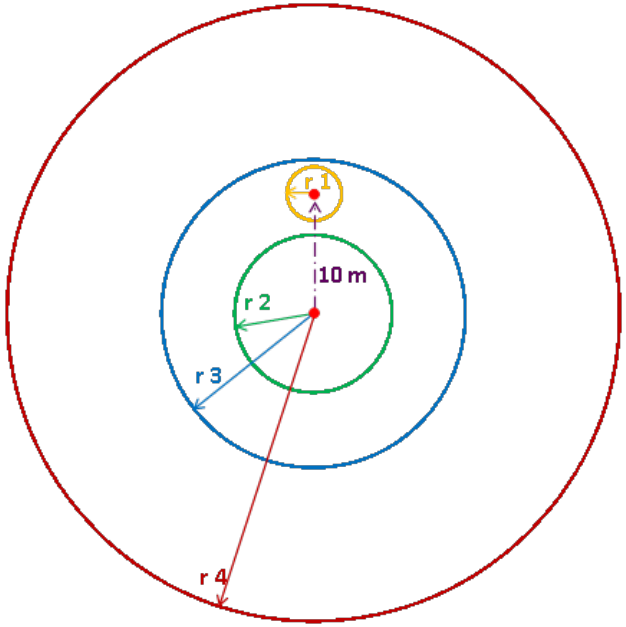


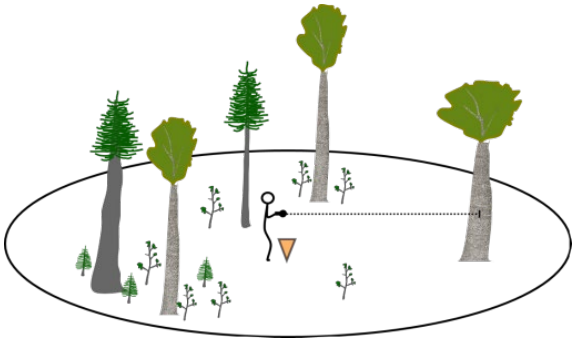




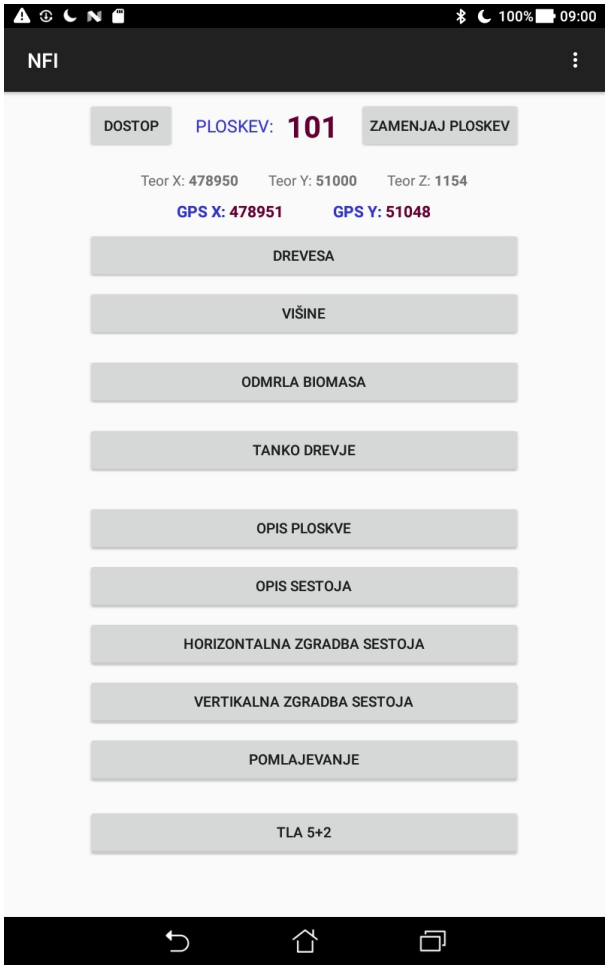
Field work

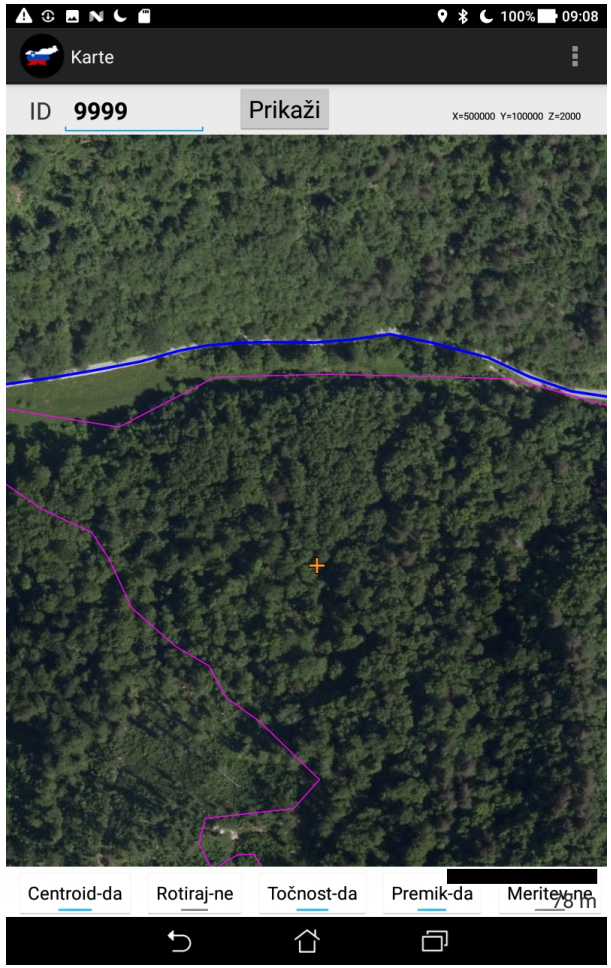
Znak ploskve	KPP1	KPP2	KPP3	KPP4
Radij ploskve [m]	3,09	7,98	13,82	25,23
Površina ploskve [ar]	0,3	2,0	6,0	20,0
POPIS LASTNOSTI RASTIŠČA IN SESTOJA				
Lastnosti rastišča	kamnitost, skalovitost, nagib terena ...			
Lastnosti sestoja	razvojna faza, mešanost, sklep ...			
POPIS ŽIVIH DREVES				
Stoječe živo drevje	0 cm < $D_{1,3}$ < 10 cm H ≥ 1,3 m, po višinskih razredih	$D_{1,3}$ ≥ 10 cm oz. $obseg_{1,3}$ ≥ 31 cm	$D_{1,3}$ ≥ 30 cm oz. $obseg_{1,3}$ ≥ 94 cm	/
POPIS ODMRLE DREVESNE BIOMASE				
Stoječe odmrlo drevje (sušica)	$D_{1,3}$ ≥ 10 cm		$D_{1,3}$ ≥ 30 cm	
Ležeče odmrlo drevje (podrtica)	$D_{1,3}$ ≥ 10 cm		$D_{1,3}$ ≥ 30 cm	
Panj, štor	D ≥10 cm H ≥ 20 cm		/	
Štrcelj	D ≥ 10 cm H ≥ 50 cm		D ≥ 30 cm H ≥ 50 cm	
Kos drevesa (veja, del debla, del koreničnika)	D ≥ 10 cm L ≥ 50 cm		D ≥ 30 cm L ≥ 50 cm	





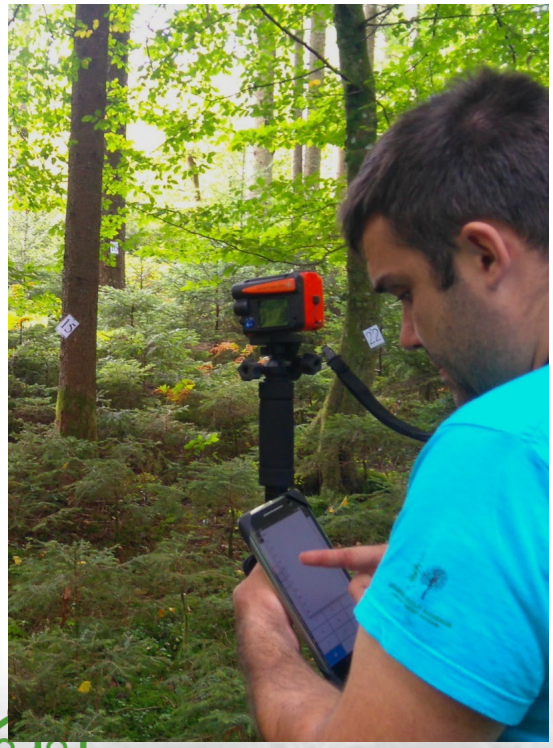
Field work





	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

Field work



Uredi drevo

R2 = 79dm R3 = 138dm

ZSD: 1 DV: 410 - BUKEV ☐ Ne strinjam se z DV

Azimut: 8 ° Distanca SD: 64 dm Premer: 22.2 cm

AZIMUT: ____ ° HD: ____ dm SD: ____ dm

STATUS: 0 - ŽIVO

PREMER: 22.8 cm

SOCIALNI: 3 - SOVLADAJOČE

MORFOLOGIJA: 1 - NORMALNO RASLO DREVO

POTRDI

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

Odmrla biomasa

R2 = 79dm R3 = 138dm R4 = 252dm

TIP: izberi...

DV: izberi...

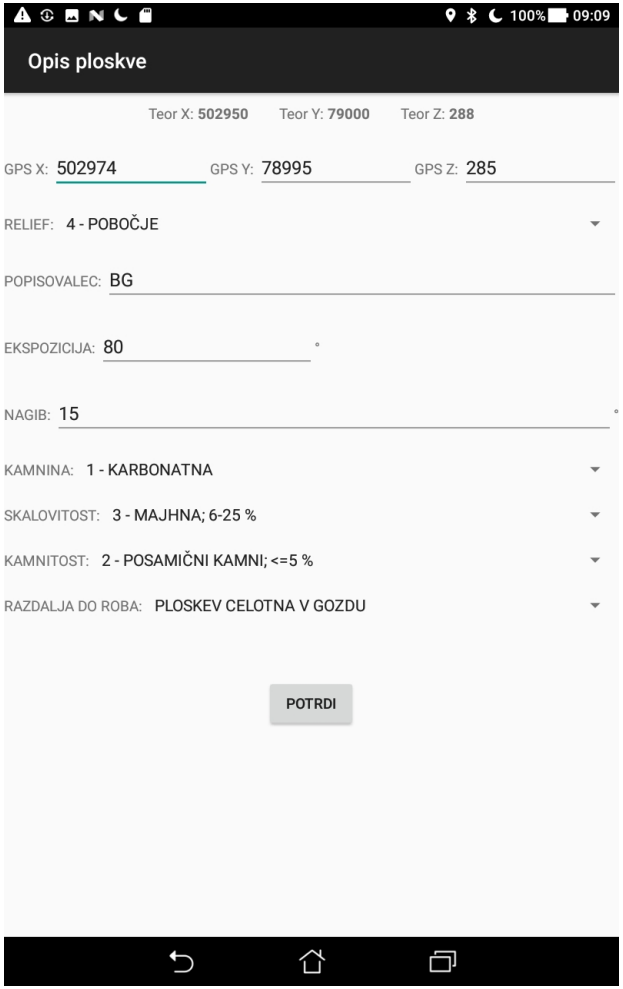
PRISOTNOST SKORJE: izberi...

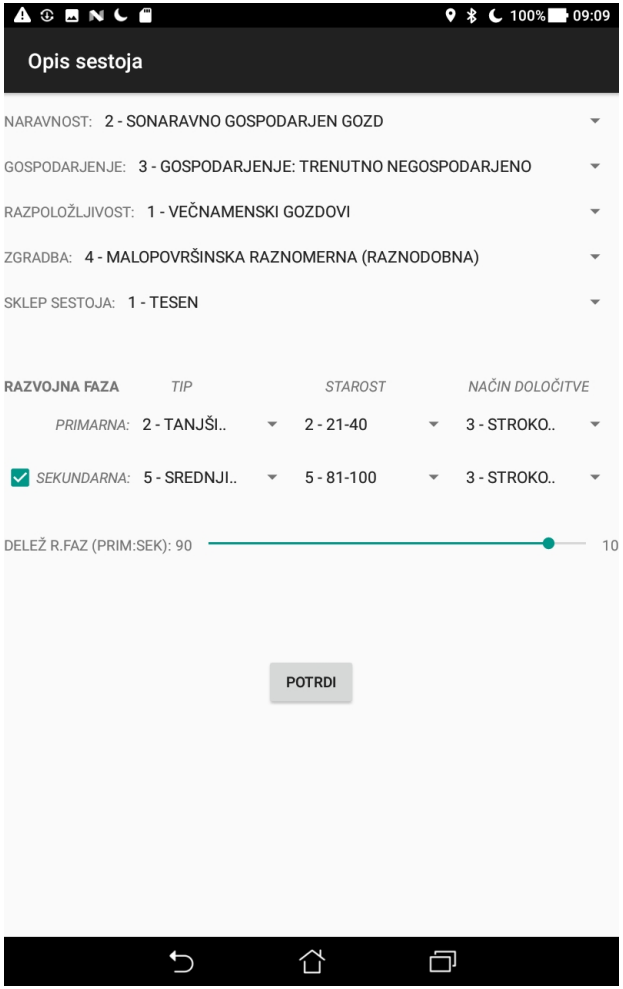
TEKSTURA LESA: izberi...

DODAJ

IZBRIŠI	TIP	DV	PP	H	SP	L	P	T
X	KOS	410 - BUKEV			18	1.2	<= 30	60 - 31
X	KOS	410 - BUKEV			15	1.5	<= 30	90 - 61
X	KOS	410 - BUKEV			16	1.2	<= 30	90 - 61
X	KOS	410 - BUKEV			15	8.0	60 - 31	> 90 -
X	ŠTR	720 - ČEŠNJA		240	15		> 90	> 90 -
X	KOS	410 - BUKEV			17	3.5	<= 30	> 90 -
X	KOS	410 - BUKEV			12	1.7	<= 30	90 - 61
X	KOS	410 - BUKEV			11	1.0	90 - 61	> 90 -
X	KOS	720 - ČEŠNJA			14	3.3	90 - 61	> 90 -

Field work


100% 09:09
Opis ploskve
Teor X: 502950 Teor Y: 79000 Teor Z: 288
GPS X: 502974 GPS Y: 78995 GPS Z: 285
RELIEF: 4 - POBOČJE
POPISOVALEC: BG
EKSPOZICIJA: 80 °
NAGIB: 15 °
KAMNINA: 1 - KARBONATNA
SKALOVITOST: 3 - MAJHNA; 6-25 %
KAMNITOST: 2 - POSAMIČNI KAMNI; <=5 %
RAZDALJA DO ROBA: PLOSKEV CELOTNA V GOZDU
POTRDI

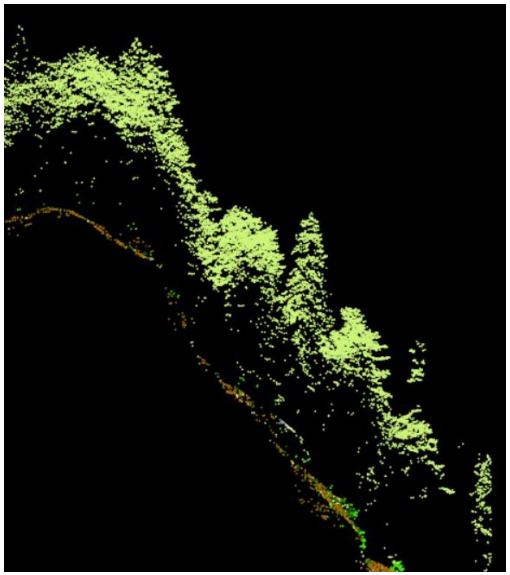

100% 09:09
Opis sestoja
NARAVNOST: 2 - SONARAVNO GOSPODARJEN GOZD
GOSPODARJENJE: 3 - GOSPODARJENJE: TRENUTNO NEGOSPODARJENO
RAZPOLOŽLJIVOST: 1 - VEČNAMENSKI GOZDOVI
ZGRADBA: 4 - MALOPOVRŠINSKA RAZNOMERNA (RAZNODOBNA)
SKLEP SESTOJA: 1 - TESEN
RAZVOJNA FAZA TIP STAROST NAČIN DOLOČITVE
PRIMARNA: 2 - TANJŠI.. 2 - 21-40 3 - STROKO..
SEKUNDARNA: 5 - SREDNJI.. 5 - 81-100 3 - STROKO..
DELEŽ R.FAZ (PRIM:SEK): 90 10
POTRDI

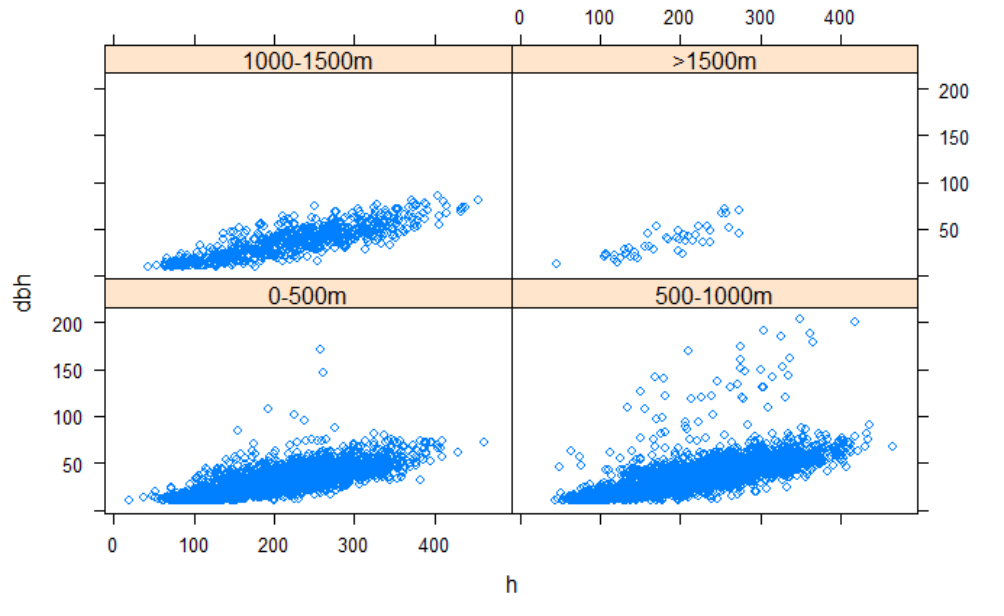
100% 09:09
Horizontalna struktura sestoja
STATISTIKA DV IZ MODULA DREVESA:
20 kos 410 - BUKEV
+ DODAJ PREOSTALE DV NA KPP4 D>= 10CM
100% 09:09
Vertikalna zgradba sestoja
STRUKTURA SESTOJA: 1 - ENOSLOJEN SESTOJ
POKROVNOST: 90
SLOJEVITOST DELEŽ POKROVNOSTI OBLIKA SKLEPA
ZGORNJI SLOJ: 90 2 - RAZPRŠEN/RAZNO..
SREDNJI SLOJ: izberi... izberi...
SPODNJI SLOJ: izberi... izberi...
POTRDI

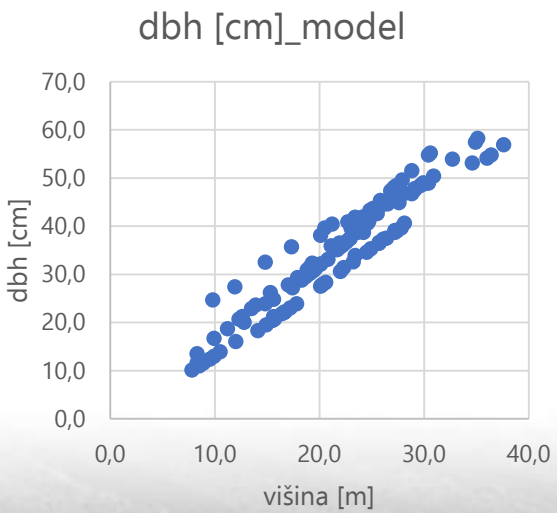
Assessment+ models

Inaccessible plots -> 13

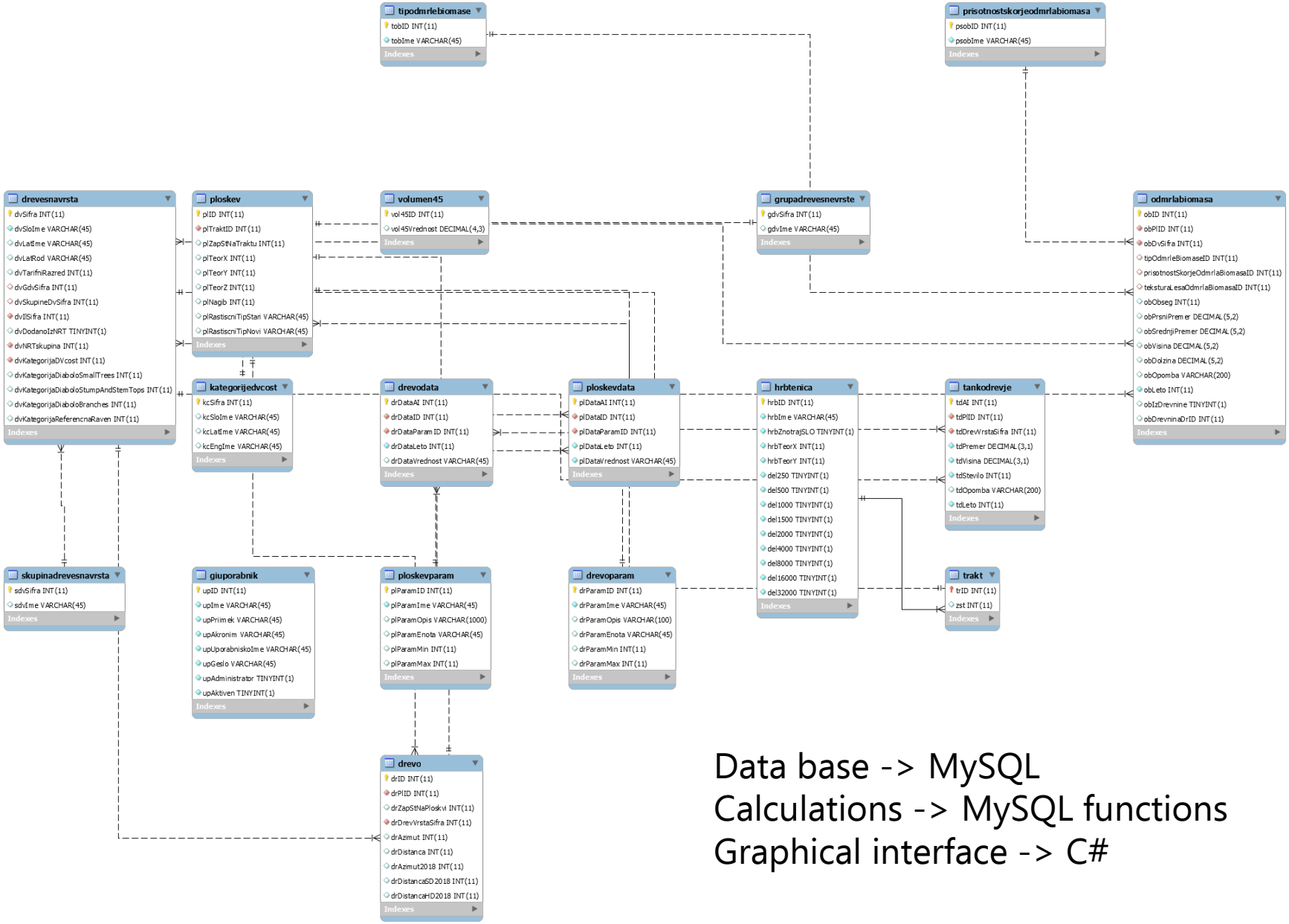
- Remote sensing (dof, lidar)
- height-diameter relationships (5908 trees)
- Mod DBH -> tree volume







DataBase



Data base -> MySQL
Calculations -> MySQL functions
Graphical interface -> C#

DataBase

Basic infrastructure

Field data
(tree, plot, stand)

Other GIS info (auxiliary)
(geology, pedology, precipitation, ...)

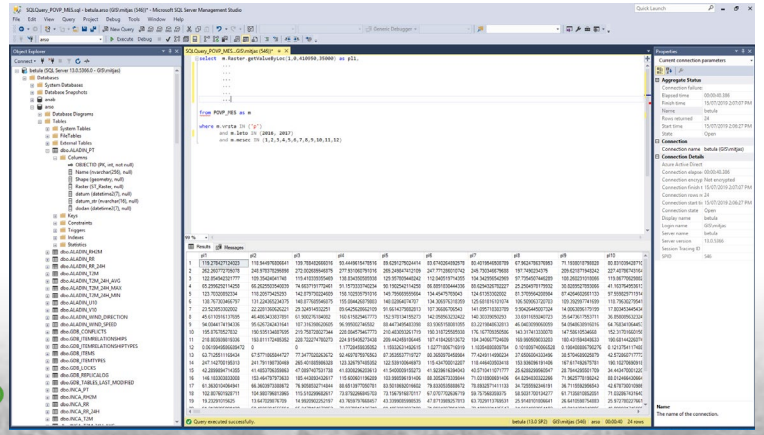
Tree data:
- species
- dbh
- increment
- tree volume
- height
- ...

Plot fixed:
- slope
- exposition
- elevation
- geology
- pedology
...

Plot changing:

Field data:
- development phase
- tree species mixture
- canopy closure
- vertical structure
- ...

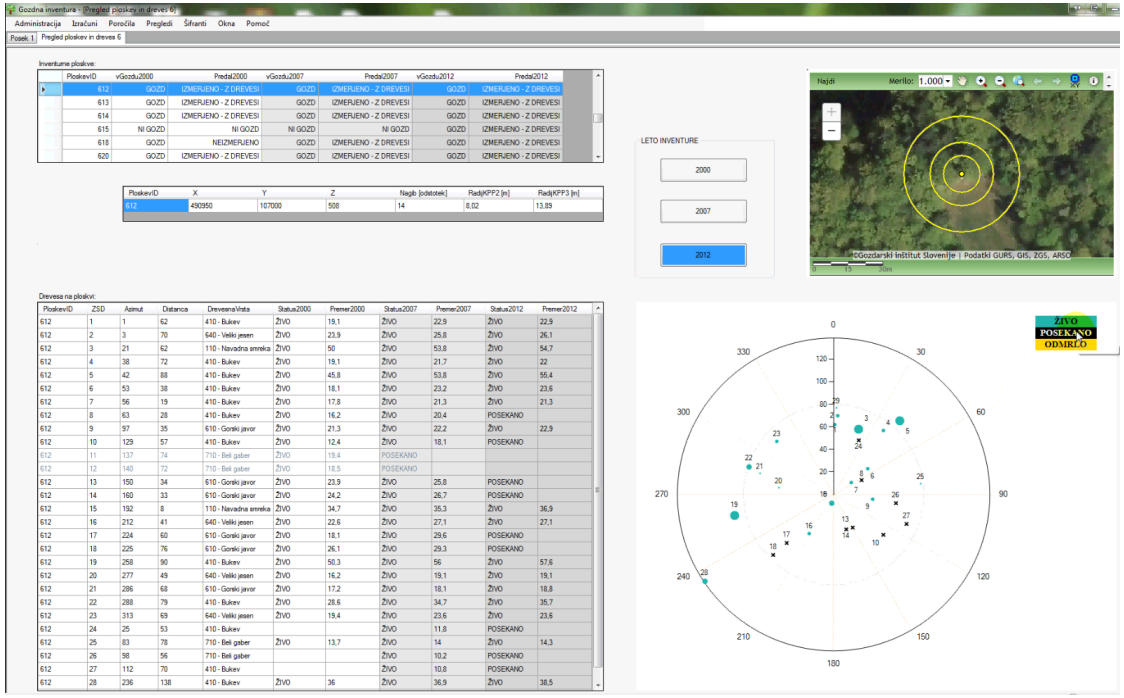
Calculated:
- growing stock
- SDI
- BAL
- number of trees
- ...



Auxiliary variable:
- Precipitation
- temperature
- snow cover
- N deposition
- ...

Processing

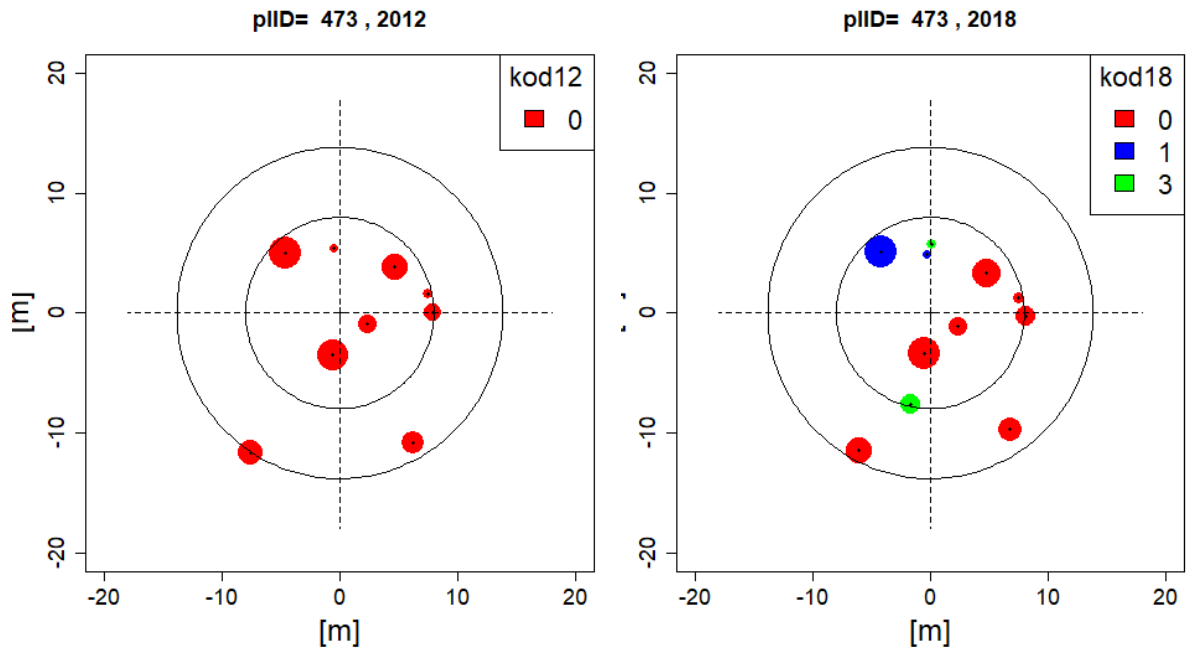
Basic calculations and statistics on plot level -> tree data



TEMELJNICA	temeljnicapredal
	temeljnicadreves
ŠT.DREVES	številodrevespredal
	številodreves
LESNA ZALOGA	LZ_volumenpredal
	LZ_volumendreves
BRUTO PRIRASTEK	LVP
	prirastekLetniVolumenskiPrirastekPosameznegaDrevesa
	prirastekVolumenskiPrirastekPosameznegaDrevesa
	prirastekVolumenDrevesaZacetni
	prirastekVolumenDrevesaKoncni
	getObsegZaPrirastekZacetni
	getObsegZaPrirastekKoncni
	debelinskiPrirastekObseg
	debelinskiPrirastekPremer
	tempGha
NETO PRIRASTEK	LVK
	prirastekVolumenDrevesaZacetni
	prirastekVolumenDrevesaKoncni
	getObsegZaPrirastekZacetni
	getObsegZaPrirastekKoncni
	debelinskiPrirastekObseg
	debelinskiPrirastekPremer
	tempGha
	LVZ
	prirastekVolumenDrevesaZacetni
	getObsegZaPrirastekZacetni
	getObsegZaPrirastekKoncni
	debelinskiPrirastekObseg
	debelinskiPrirastekPremer
	tempGha
POSEK	POSEK_brezPrirastka
	POSEK_sPrirastkom
TANKO DREVJE	LZ_volumenTankegaDrevjaPredal
	LZ_volumenTankegaDrevja
ODMRLA BIOMASA	OB_volumenpredal
	OB_volumen
	OB_volumenDreves_1_2

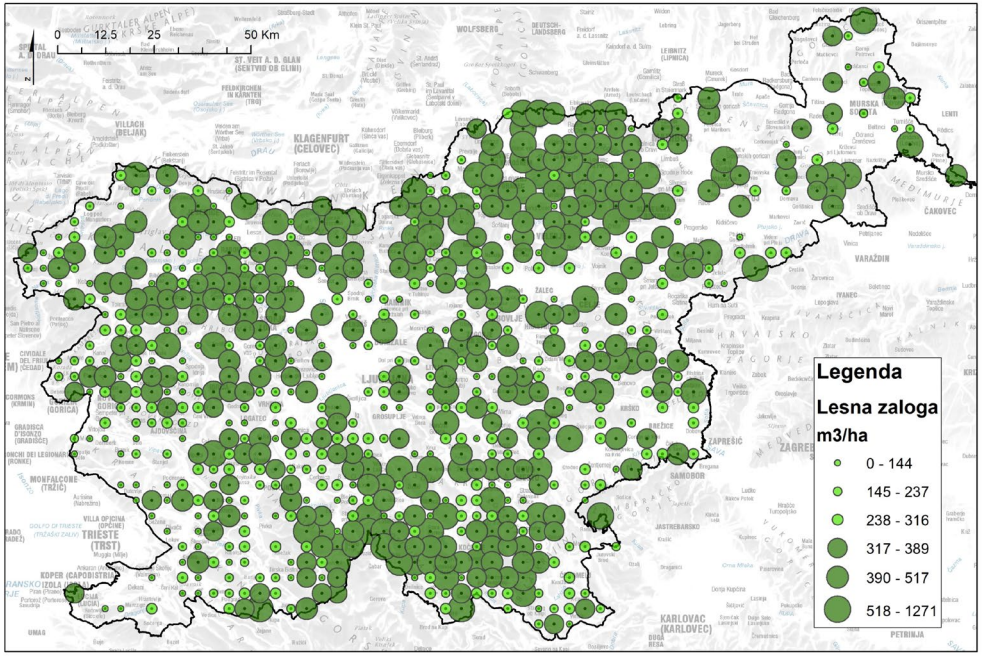
Results – tree level

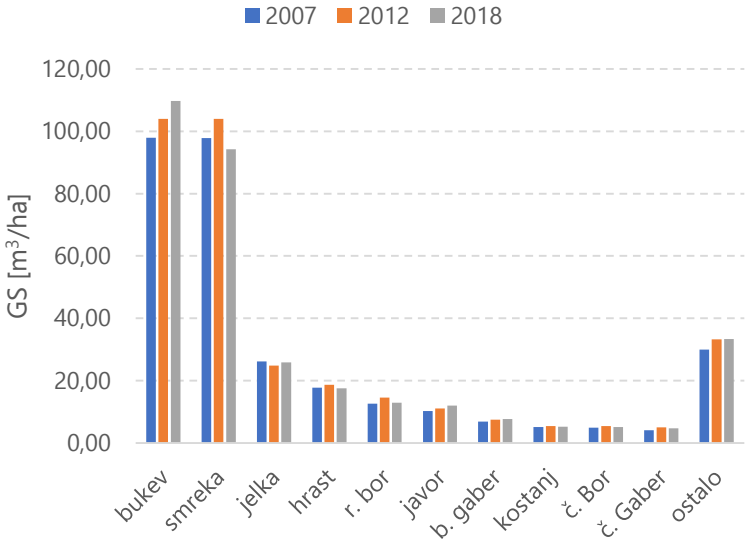
- BA
- **GS**
- Nr. Of trees
- Deadwood
- BAI (bruto, neto)
- **Cutting**
- **Mortality**

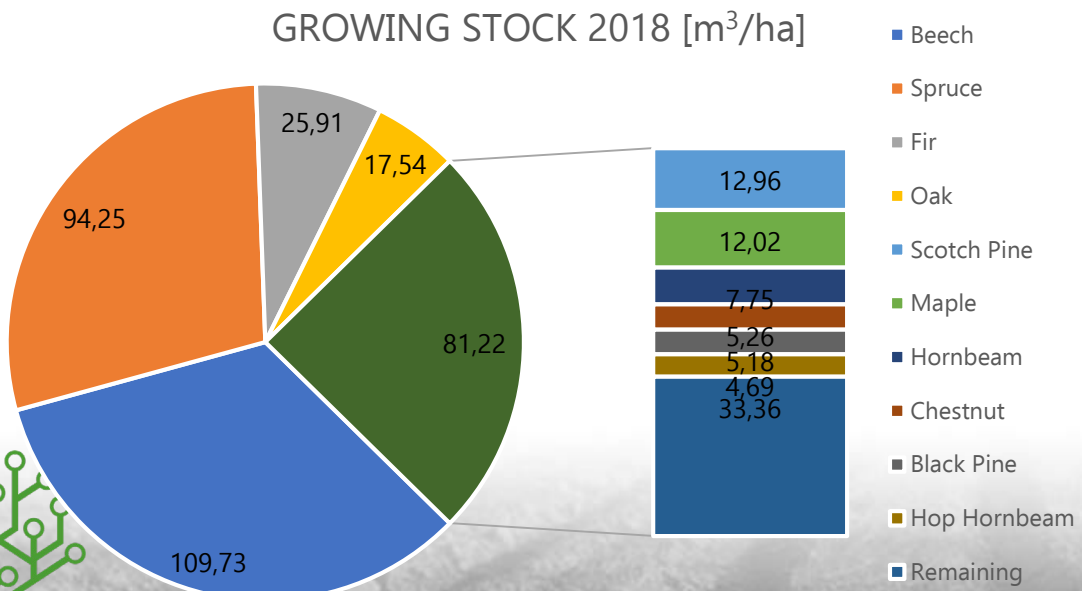


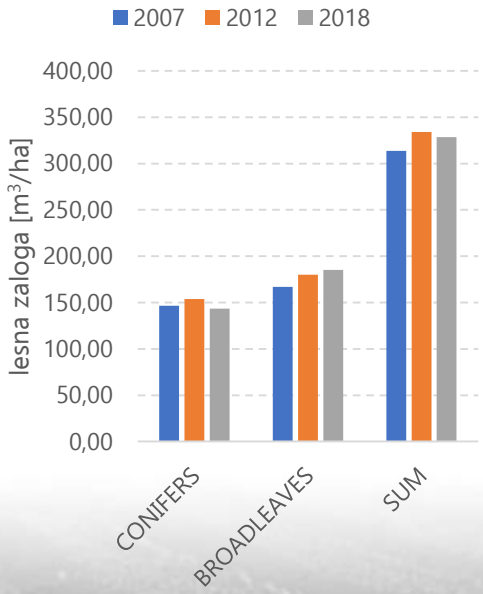
	2007	2012	2018
Nr. Pl	751	760	759
GS [m^3/ha]	313.7	333.9	328.7
Deadwood [m^3/ha]	20.2	19.8	23.9
Increment [m^3/ha y]		8.1	
Cutting [m^3/ha y]		4.3	6.0

Results – tree level

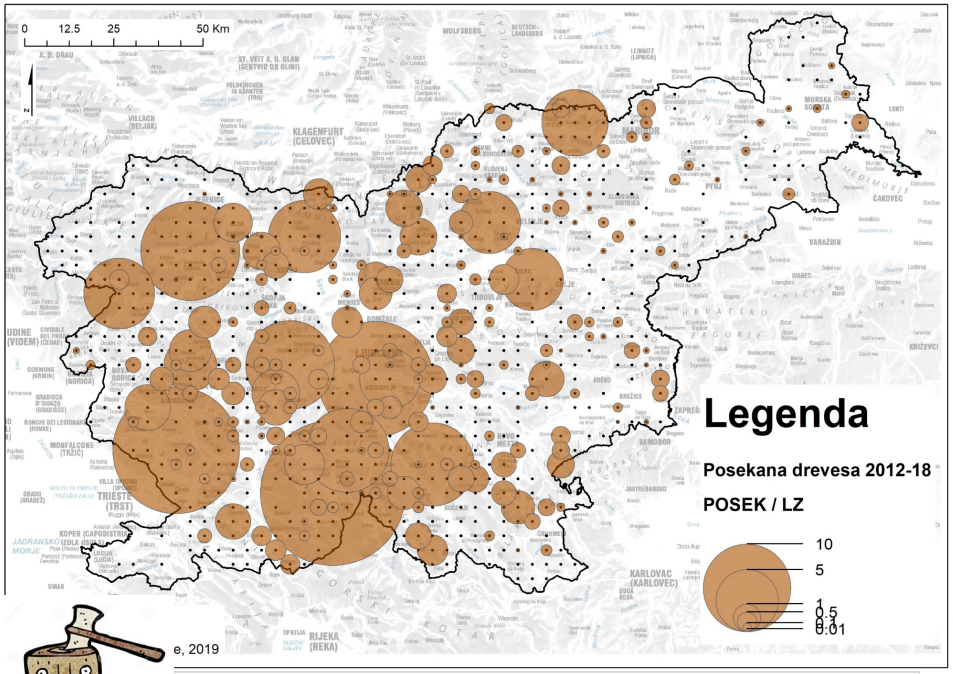


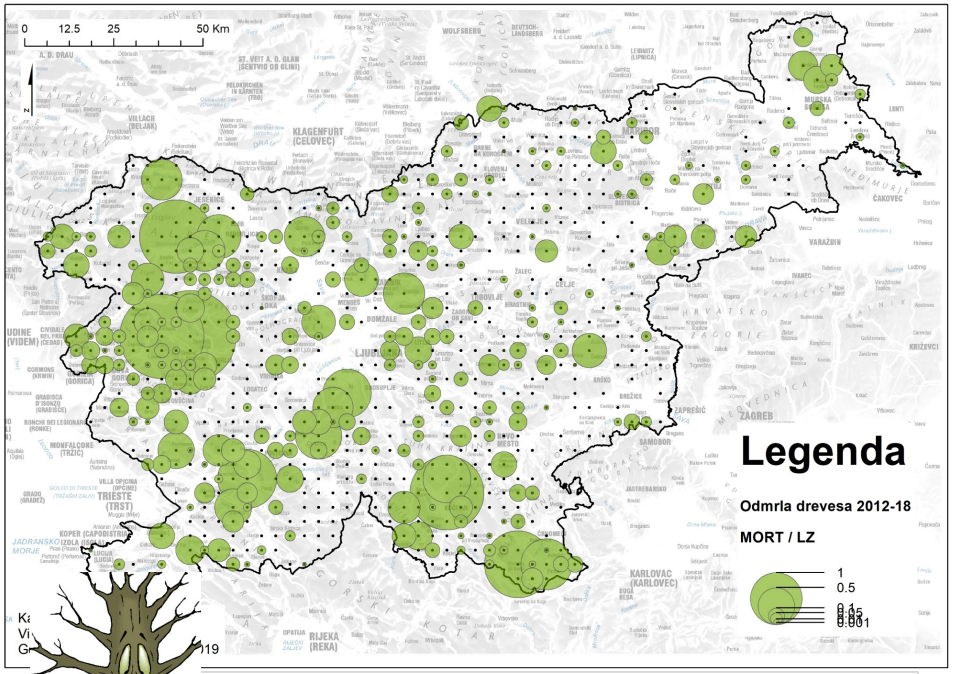


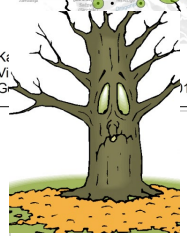


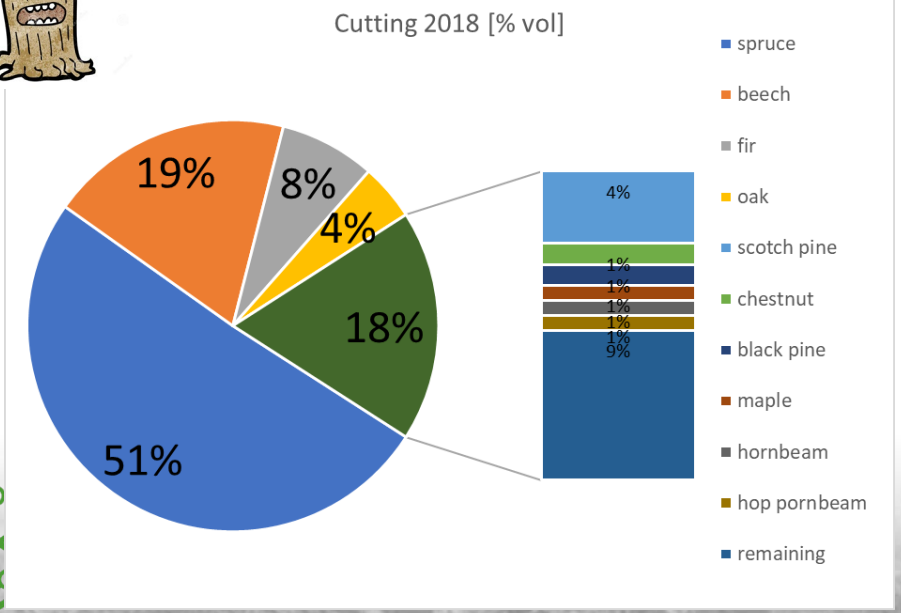


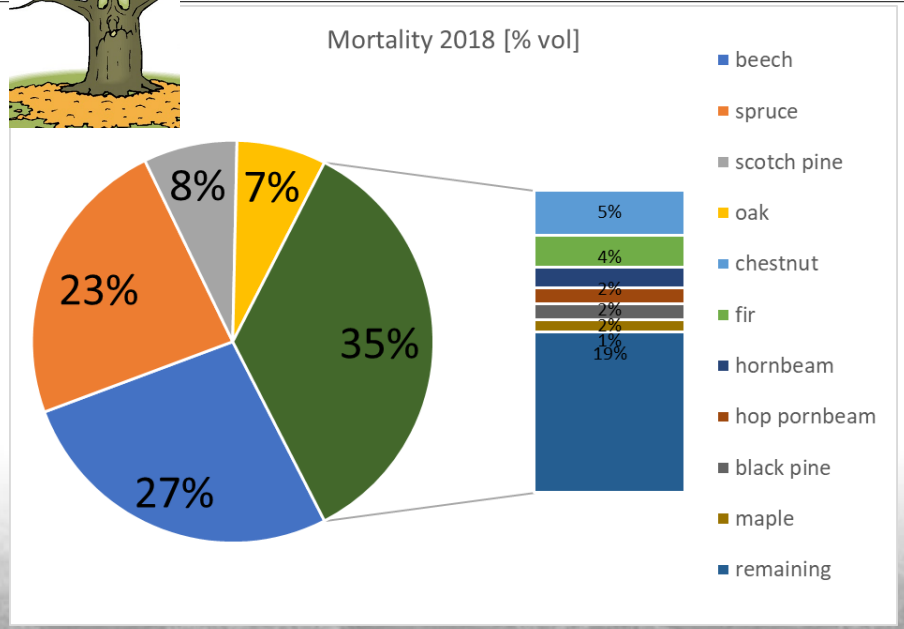
Results – tree level











Current work

- Preparation of new BAI model

  BAI = a * DBH + b * COMP + c * CLIMATE + d * SITE

- New national dbh~height model

- Growth model -> possible test of CALDIS model (BFW)

  ValoFor project -> management scenarios for small forest owners

- Additional auxiliary variables (RS -> satellite images)

  Cooperation with ZRC-SAZU

- Transition into the panel (continuous) NFI system from grid 4 x 4 km into 2 x 2 km (756 -> 3000 plots)?

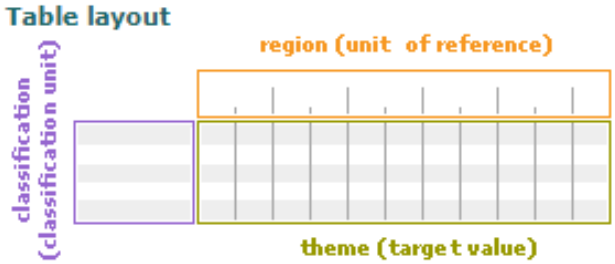
- Stereo photointerpretation – system establishment

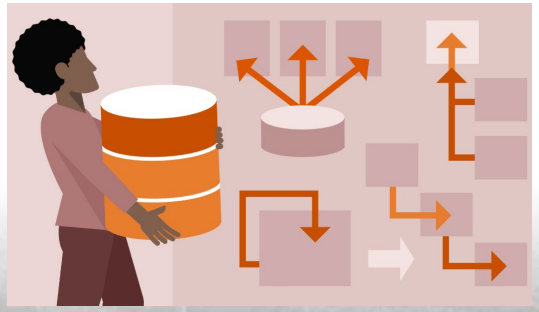
Future work - wishlist

- Data availability and data use policy
- Stereo photointerpretation –> land use classification + two phase sampling
- Improve tree volume estimations (from tariff functions -> volume functions)
- Continue with the development of NFI methods and system
- Growth models -> implementation
- New auxiliary variables
- Testing of new monitoring technologies (UAV, terrestrial scanners)

Problems:

- irregular financing
- small group





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THANK YOU

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