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Future scenarios of management impacts on landscape fragmentation structures in the context of biodiversity

ANDRIS ZIEMELIS

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- An Introduction to myself
- Forest sector and computer science
- Biodiversity and succession
- Methods
- Data and data types (remote sensing)
- My scientific work

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An Introduction to myself

ph.D. student at the University of Latvia

- Faculty of Geography and Earth Sciences
  - Environmental science (Doctoral programme)

- Master's degree:
  - In Biology from University of Latvia (2013)
  - In Environmental science from University of Latvia (2020)

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Andris Ziemelis

1.18 · Mg. biol. Mg. envir. sc. · Edit

Article (6)

Conference Paper (9)

Languages

English · Latvian · Russian

Disciplines

Geoinformatics (GIS) · Environmental Science · Zoology · Remote Sensing · Biostatistics · Ecology · Forestry

Skills and expertise (9)

SPSS · R · QGIS · ArcMap · Sqlite · FRAGSTATS · PCORD · LANDIS-II · GeoSOS

Portrait characteristics and the activity of cyber paedophiles in the P2P system DC ++ at national and regional level

Preprint · Published version available · August 2020

Andris Ziemelis · Sabīne Krilova

Source

44 Reads · 1 Recommendation

Download · Share

Vizuālā tēla neaizskaramības sociāli bioloģiskie apsvērumi

Article · Full-text available · August 2020 · SOCRATES Rīgas Stradiņa universit...

Sabīne Krilova · Andris Ziemelis

Source

49 Reads

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Forest management impact on Black stork Ciconia nigra L. habitat landscape changes in the future scenario

Conference Paper · Full-text available · May 2020 · The 62nd International Scie...

Gatis Patmalnieks · Andris Ziemelis

Source

36 Reads

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Impact of forest management regimes on the development of forest succesions in the territory of Gauja national park in the period from 2020 to 2520

Conference Paper · Full-text available · May 2020 · The 62nd International Scie...

Andris Ziemelis

Source

Experience

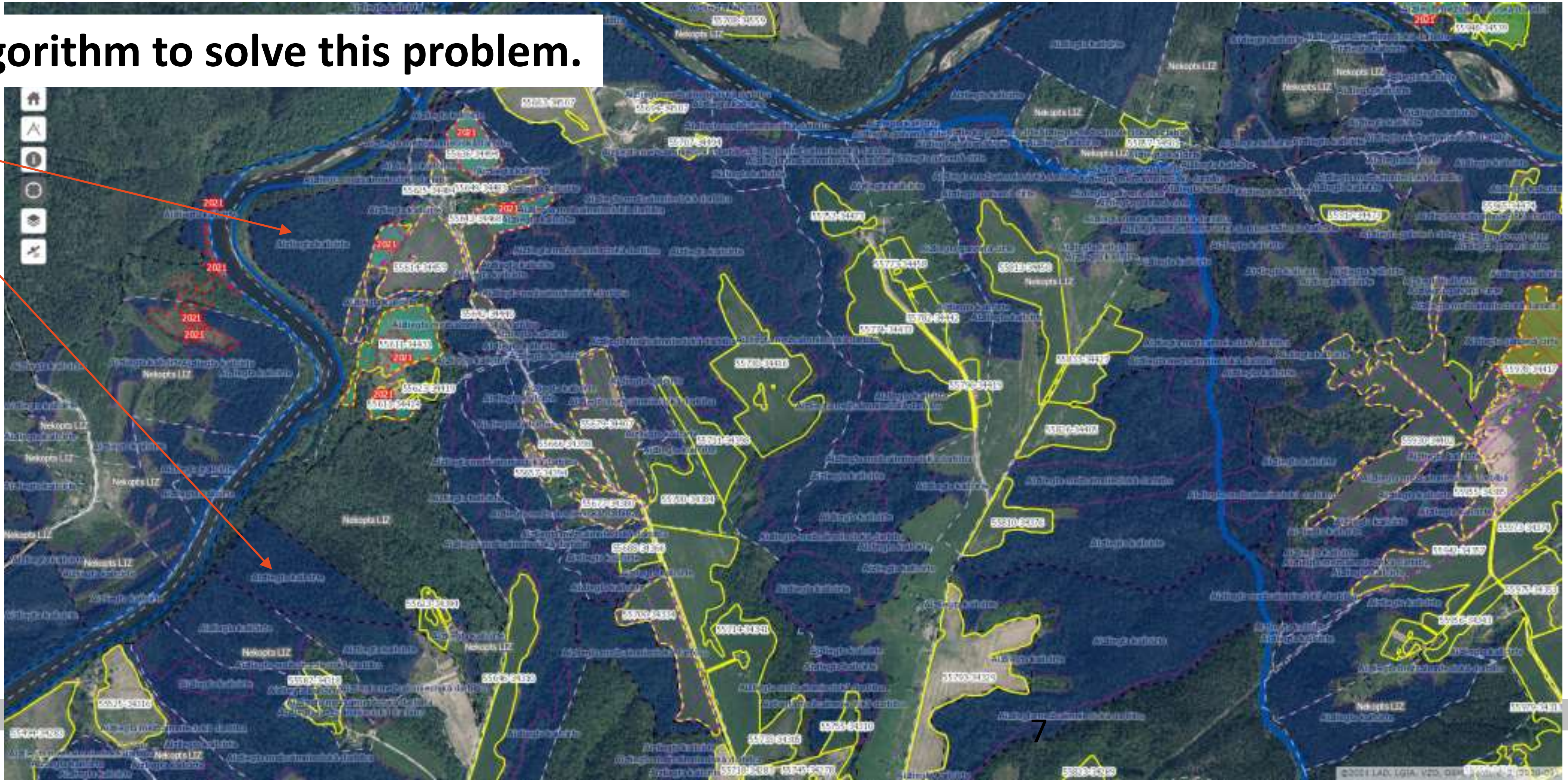
- Secondary School Teacher
  - Sep 2011 – Aug 2014

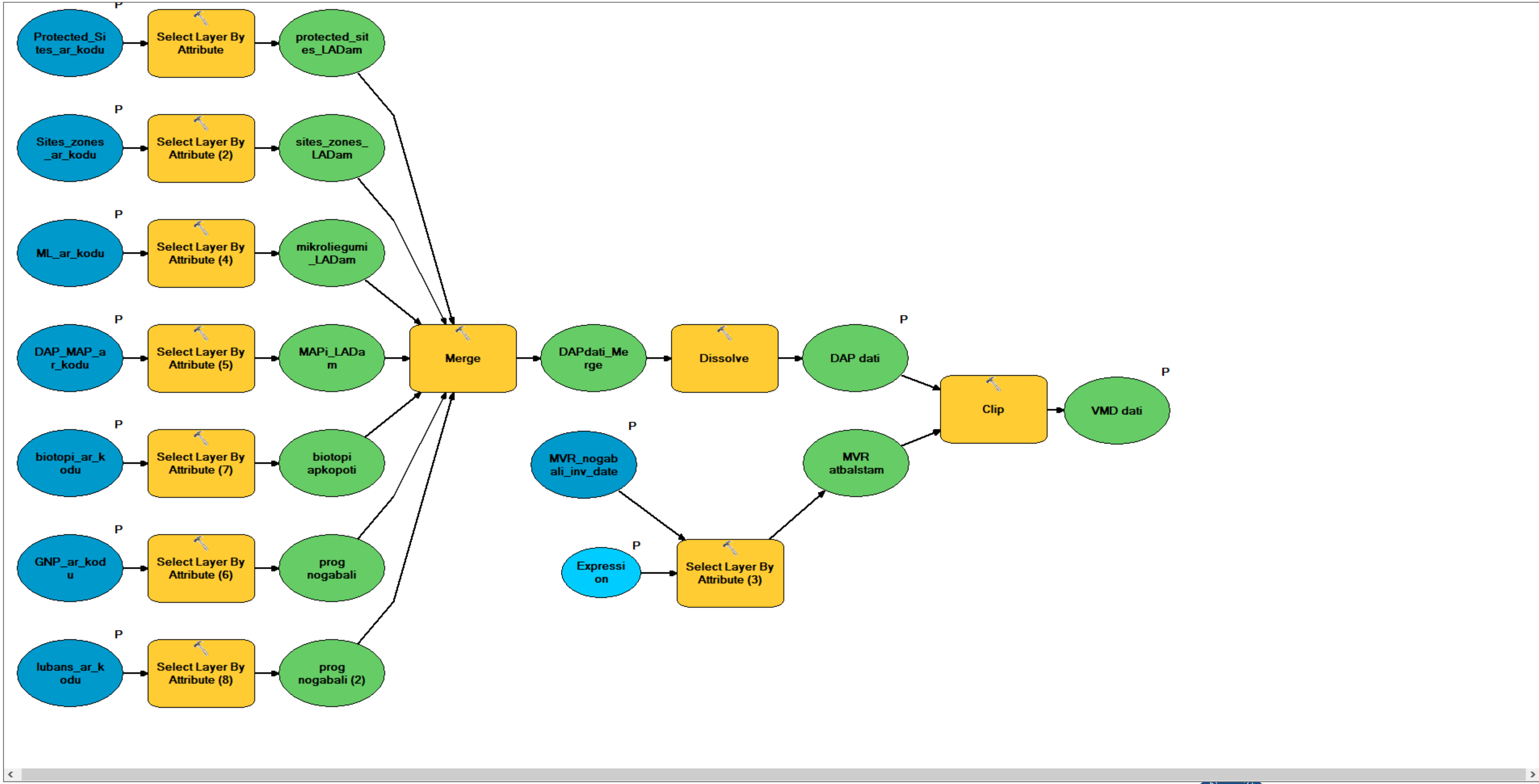
- Senior Desk Officer at State Forest Service (Republic of Latvia)
  - Apr 2014 – Present

Valsts meža dienests

Compensation for Restrictions on Economic Activities in the forest lands (Natura 2000 and microreserves)

I made this algorithm to solve this problem.





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l.py

nr1.py - solis nr1.py

Add Configuration...

l.py × | pycharm64.exe.vmoptions ×

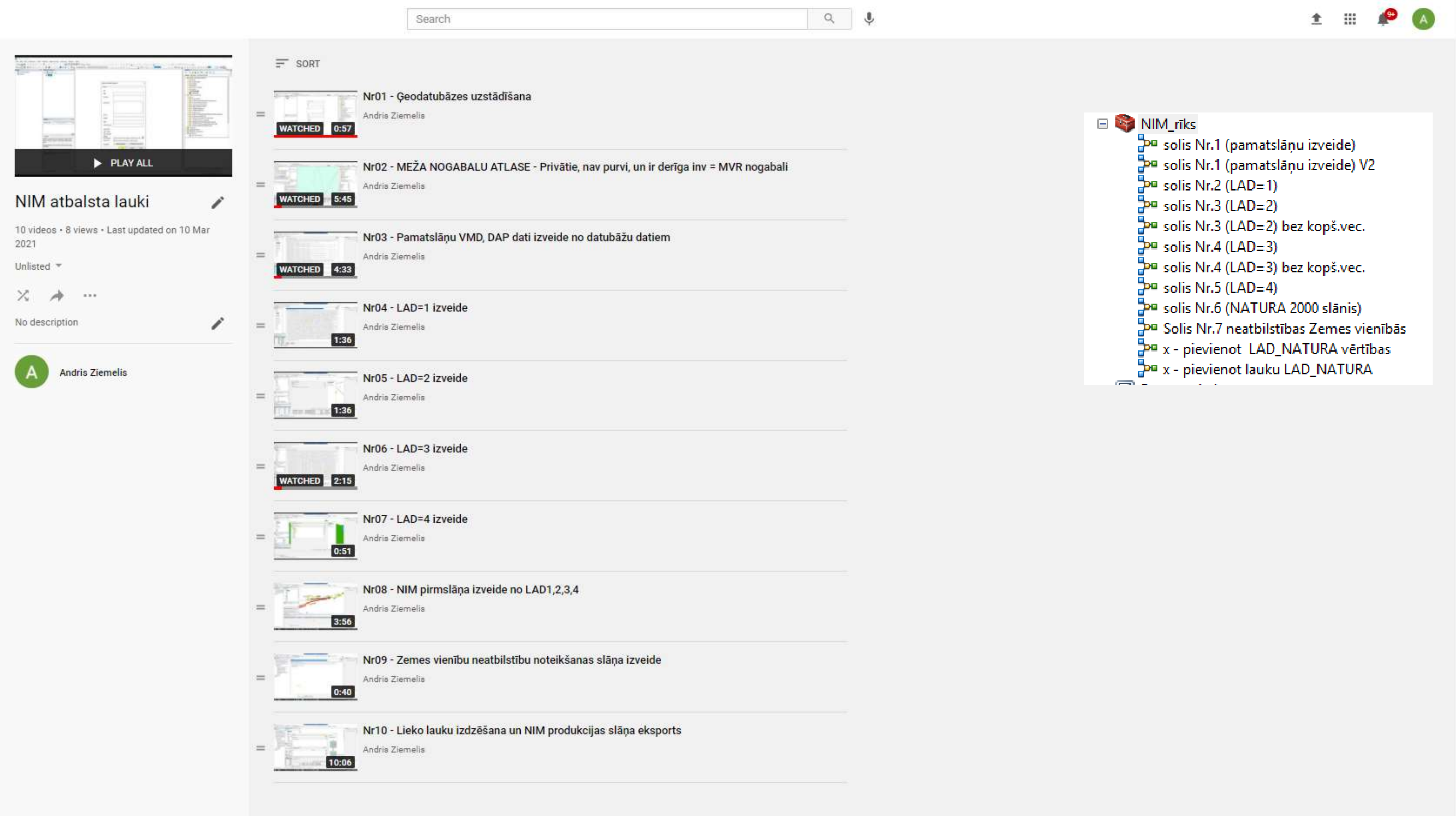
```python
# -*- coding: utf-8 -*-
# ---------------------------------------------------------------------------
# solis nr1.py
# Created on: 2021-04-27 14:47:24.00000
#   (generated by ArcGIS/ModelBuilder)
# Usage: solis nr1 <DAP_dati> <VMD_dati> <Protected_Sites_ar_kodu> <Sit
# Description:
# ---------------------------------------------------------------------------

# Import arcpy module
import arcpy

# Script arguments
DAP_dati = arcpy.GetParameterAsText(0)
if DAP_dati == '#' or not DAP_dati:
    DAP_dati = "K:\\VMD 2021\\Natura 2000\\Natura_rīks_V4.0\\Natura_V1.

VMD_dati = arcpy.GetParameterAsText(1)
if VMD_dati == '#' or not VMD_dati:
    VMD_dati = "K:\\VMD 2021\\Natura 2000\\Natura_rīks_V4.0\\Natura_V1.

Protected_Sites_ar_kodu = arcpy.GetParameterAsText(2)
if Protected_Sites_ar_kodu == '#' or not Protected_Sites_ar_kodu:
    Protected_Sites_ar_kodu = "Protected_Sites_ar_kodu" # provide a def

Sites_zones_ar_kodu = arcpy.GetParameterAsText(3)
if Sites_zones_ar_kodu == '#' or not Sites_zones_ar_kodu:
    Sites_zones_ar_kodu = "Sites_zones_ar_kodu" # provide a default val

ML_ar_kodu = arcpy.GetParameterAsText(4)
if ML_ar_kodu == '#' or not ML_ar_kodu:
    ML_ar_kodu = "ML_ar_kodu" # provide a default value if unspecified

DAP_MAP_ar_kodu = arcpy.GetParameterAsText(5)
if DAP_MAP_ar_kodu == '#' or not DAP_MAP_ar_kodu:
    DAP_MAP_ar_kodu = "DAP_MAP_ar_kodu" # provide a default value if un

biotopi_ar_kodu = arcpy.GetParameterAsText(6)
if biotopi_ar_kodu == '#' or not biotopi_ar_kodu:
    biotopi_ar_kodu = "biotopi_ar_kodu" # provide a default value if un
```

if Protected_Sites_ar_kodu == '...

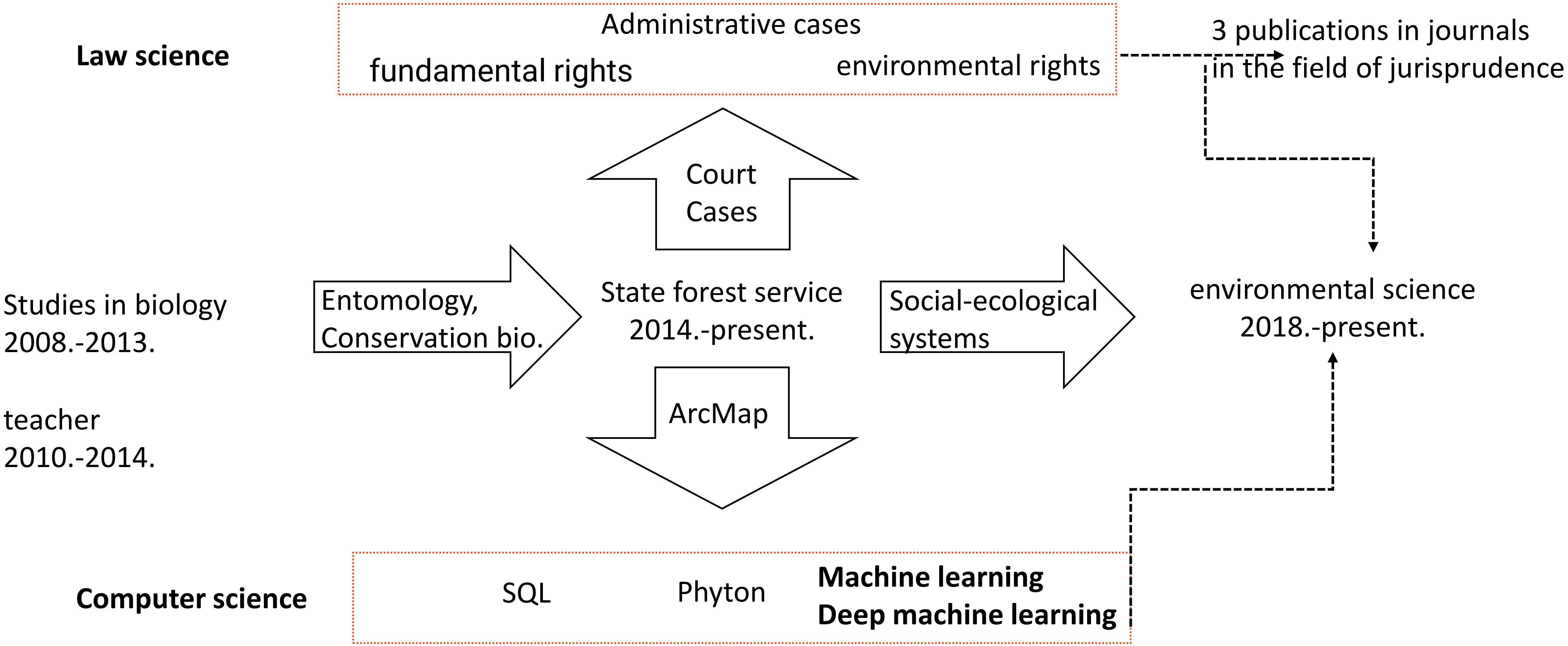
solis nr1.py × | pycharm64.exe.vmoptions ×

```python
if Expression == '#' or not Expression:
    Expression = "STATUS = 'CSS_ACTUAL_MFO' AND IP_STATUS = 'Privātie'  AND FOREST_LAND_TYPE NOT IN ( 'FLT_SUNU_PURVS', 'FLT_ZALU_PURVS', 'FLT_PAREJAS

# Local variables:
MVR_atbalstam = MVR_nogabali_inv_date
protected_sites_LADam = Protected_Sites_ar_kodu
sites_zones_LADam = Sites_zones_ar_kodu
mikroliegumi_LADam = ML_ar_kodu
MAPi_LADam = DAP_MAP_ar_kodu
prog_nogabali = GNP_ar_kodu
biotopi_apkopoti = biotopi_ar_kodu
prog_nogabali__2_ = lubans_ar_kodu
DAPdati_Merge = "K:\\VMD 2021\\Natura 2000\\Natura_rīks_V4.0\\Natura_V1.0.gdb\\DAPdati_Merge"

# Process: Select Layer By Attribute (3)
arcpy.SelectLayerByAttribute_management(MVR_nogabali_inv_date, "NEW_SELECTION", Expression)

# Process: Select Layer By Attribute
arcpy.SelectLayerByAttribute_management(Protected_Sites_ar_kodu, "NEW_SELECTION", "LAD_NATURA NOT IN ( ' ', 'nav natura', 'zonas') ")

# Process: Select Layer By Attribute (2)
arcpy.SelectLayerByAttribute_management(Sites_zones_ar_kodu, "NEW_SELECTION", "LAD_NATURA NOT IN ( ' ', 'nav natura', 'zonas', 'LAD0' , 'navNatura' )

# Process: Select Layer By Attribute (4)
arcpy.SelectLayerByAttribute_management(ML_ar_kodu, "NEW_SELECTION", "LAD_NATURA NOT IN ( ' ', 'nav natura', 'zonas') ")

# Process: Select Layer By Attribute (5)
arcpy.SelectLayerByAttribute_management(DAP_MAP_ar_kodu, "NEW_SELECTION", "LAD_NATURA NOT IN ( ' ', 'nav natura', 'zonas') ")

# Process: Select Layer By Attribute (6)
arcpy.SelectLayerByAttribute_management(GNP_ar_kodu, "NEW_SELECTION", "LAD_NATURA NOT IN ( ' ', 'nav natura', 'zonas') ")

# Process: Select Layer By Attribute (7)
arcpy.SelectLayerByAttribute_management(biotopi_ar_kodu, "NEW_SELECTION", "LAD_NATURA NOT IN ( ' ', 'nav natura', 'zonas') ")

# Process: Select Layer By Attribute (8)
arcpy.SelectLayerByAttribute_management(lubans_ar_kodu, "NEW_SELECTION", "LAD_NATURA NOT IN ( ' ', 'nav natura', 'zonas') ")

# Process: Merge
arcpy.Merge_management("Protected_Sites_ar_kodu;Sites_zones_ar_kodu;ML_ar_kodu;DAP_MAP_ar_kodu;GNP_ar_kodu;biotopi_ar_kodu;lubans_ar_kodu", DAPdati_Me
```

o) ... (10 minutes ago) 68:1 CRLF UTF-8 4 spa


Search
SORT
PLAY ALL
NIM atbalsta lauki
10 videos • 8 views • Last updated on 10 Mar 2021
Unlisted
No description
Andris Ziemelis
Nr01 - Ģeodatubāzes uzstādīšana
Andris Ziemelis
WATCHED 0:57
Nr02 - MEŽA NOGABALU ATLASE - Privātie, nav purvi, un ir derīga inv = MVR nogabali
Andris Ziemelis
WATCHED 5:45
Nr03 - Pamatslāņu VMD, DAP dati izveide no datubāžu datiem
Andris Ziemelis
WATCHED 4:33
Nr04 - LAD=1 izveide
Andris Ziemelis
1:36
Nr05 - LAD=2 izveide
Andris Ziemelis
1:36
Nr06 - LAD=3 izveide
Andris Ziemelis
WATCHED 2:15
Nr07 - LAD=4 izveide
Andris Ziemelis
0:51
Nr08 - NIM pirmslāņa izveide no LAD1,2,3,4
Andris Ziemelis
3:56
Nr09 - Zemes vienību neatbilstību noteikšanas slāņa izveide
Andris Ziemelis
0:40
Nr10 - Lieko lauku izdzēšana un NIM produkcijas slāņa eksports
Andris Ziemelis
10:06
NIM_rīks
solis Nr.1 (pamatslāņu izveide)
solis Nr.1 (pamatslāņu izveide) V2
solis Nr.2 (LAD=1)
solis Nr.3 (LAD=2)
solis Nr.3 (LAD=2) bez kopš.vec.
solis Nr.4 (LAD=3)
solis Nr.4 (LAD=3) bez kopš.vec.
solis Nr.5 (LAD=4)
solis Nr.6 (NATURA 2000 slānis)
Solis Nr.7 neatbilstības Zemes vienībās
x - pievienot LAD_NATURA vērtības
x - pievienot lauku LAD_NATURA

Experience & Skills



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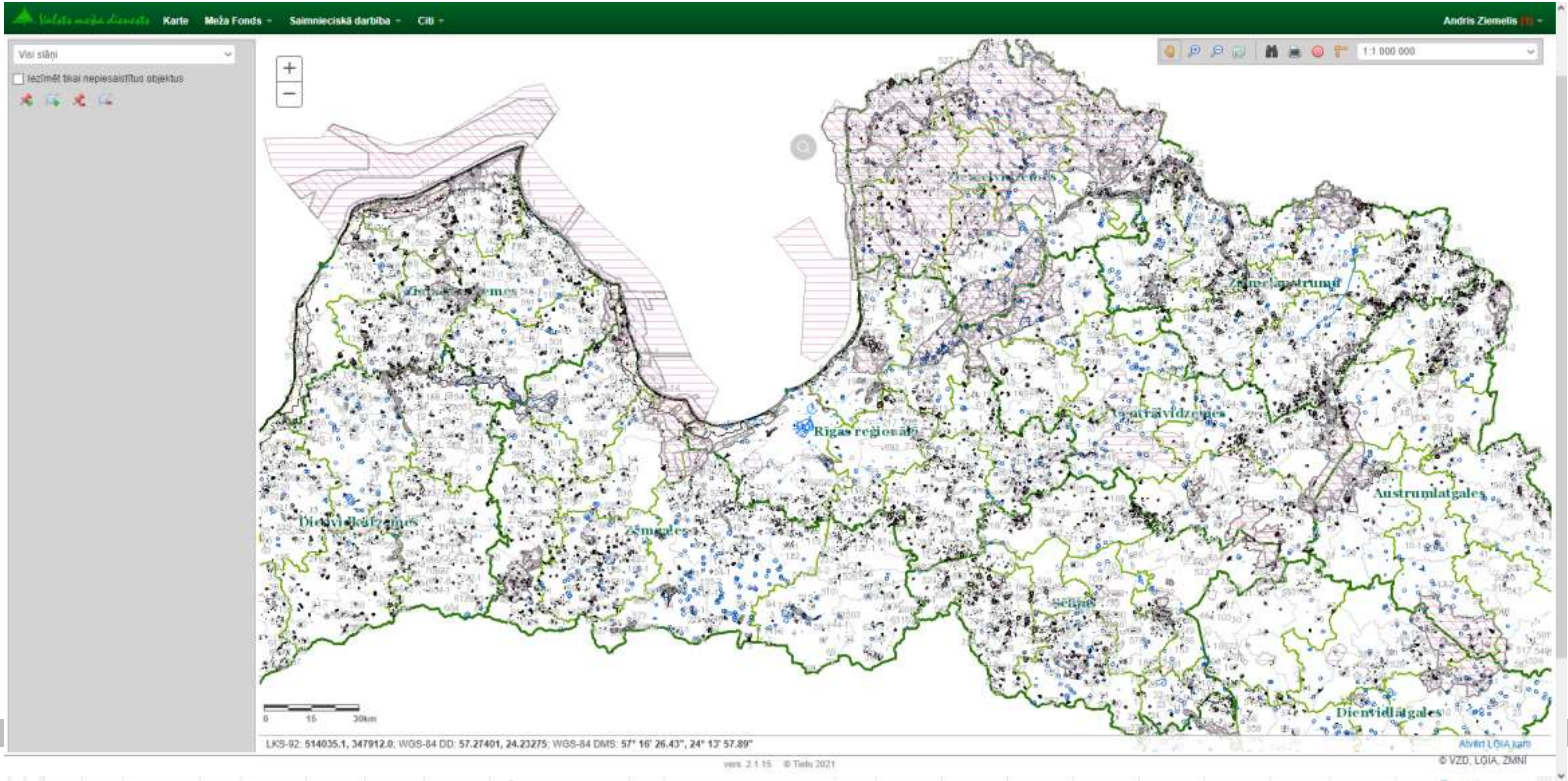
Forest sector and computer science

State Forest Service (Republic of Latvia)



Vacancies in State Forest

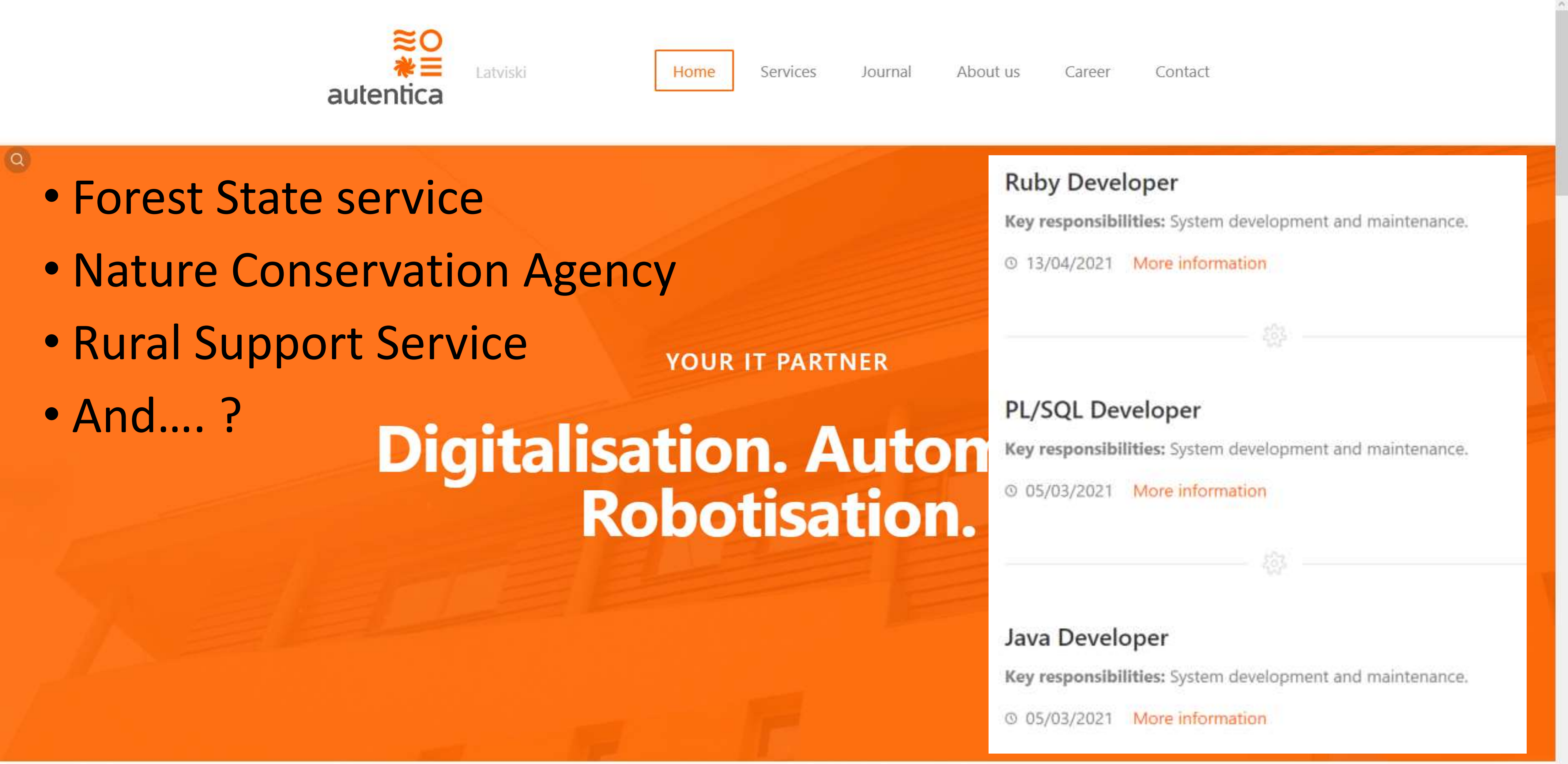
- 2 x Database programmer (Oracle SQL)
- 12 x GIS officers

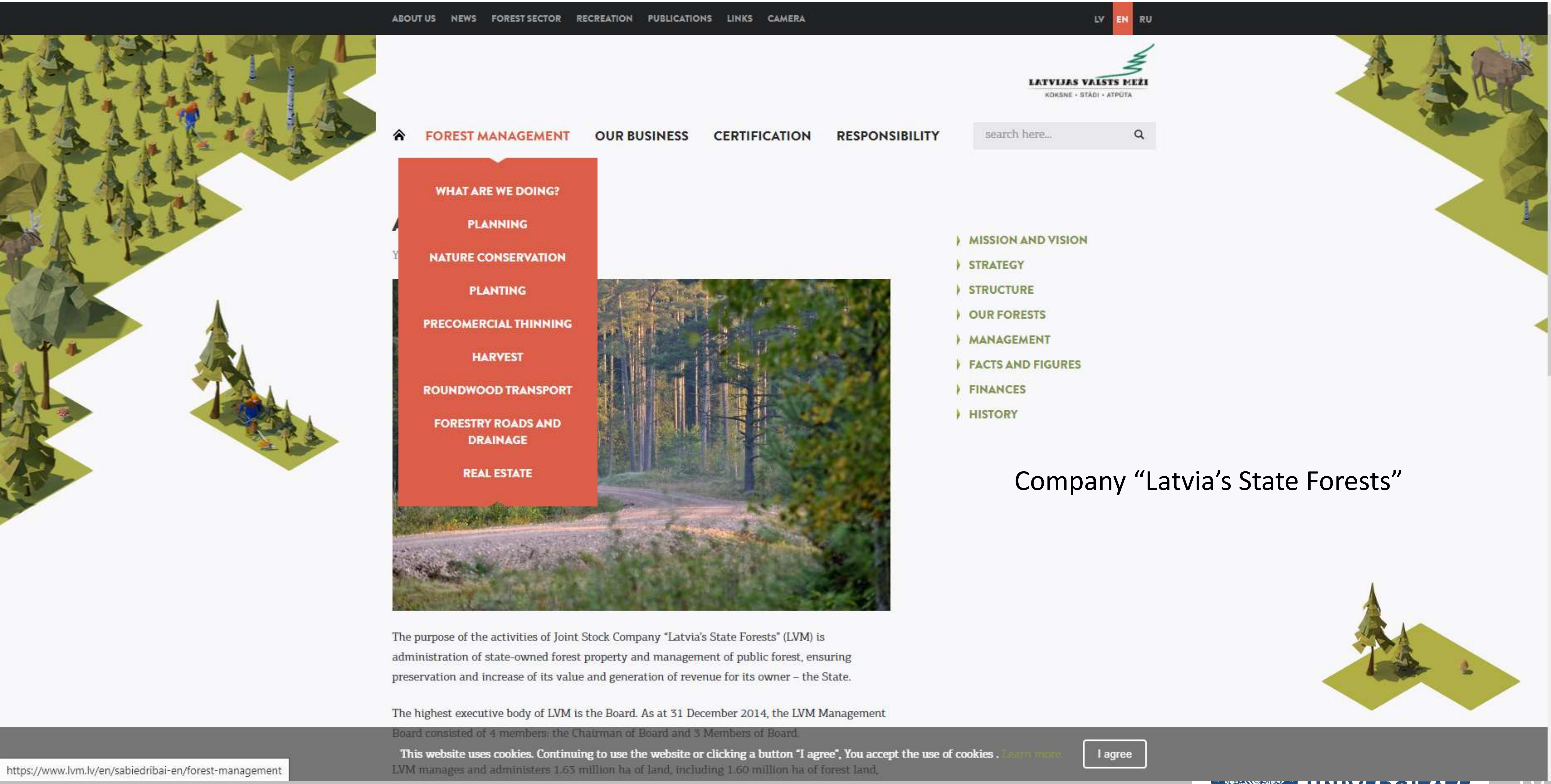
- At this moment we have contract with Authentica

Monta Poļakova. Foto: Ginta Zīverte

Haralds Saltons. Foto: Ginta Zīverte

- Forest State service
- Nature Conservation Agency
- Rural Support Service
- And…. ?





Company "Latvia's State Forests"

Clients

ZMNĪ | SUSAB SKOGSUTVECKLING SYD AB | VMF LATVIA | mežsaimnieks | MEŽA PĒTĪŠANAS STACIJA

SÖDRA | LVM GEO | Latvijas Finieris Mežs | KM

Associations

Latvijas ĢIS biedrība

The main objective of the organization is to unite Latvia's GIS users and developers that develop, provide software, produce and use geospatial information. Most active policy makers from the industry are members of the association. The Latvia's GIS Association was established in 2005. The association is a member of European

LATA

Latvian Open Technology Association (LATA) unites organisations and individuals, including information technology providers and users who consider that they, their organisations and the whole society will economically benefit from broader use of open source solutions in Latvia.

LIKTA
Latvijas Informācijas un komunikācijas tehnoloģijas asociācija

Latvian information and communications technology association was founded in 1998, bringing together industry-leading companies and organizations as well as information and communication technology professionals - currently more than 150 members. The aim of LIKTA is to promote the growth of the ICT sector in Latvia by

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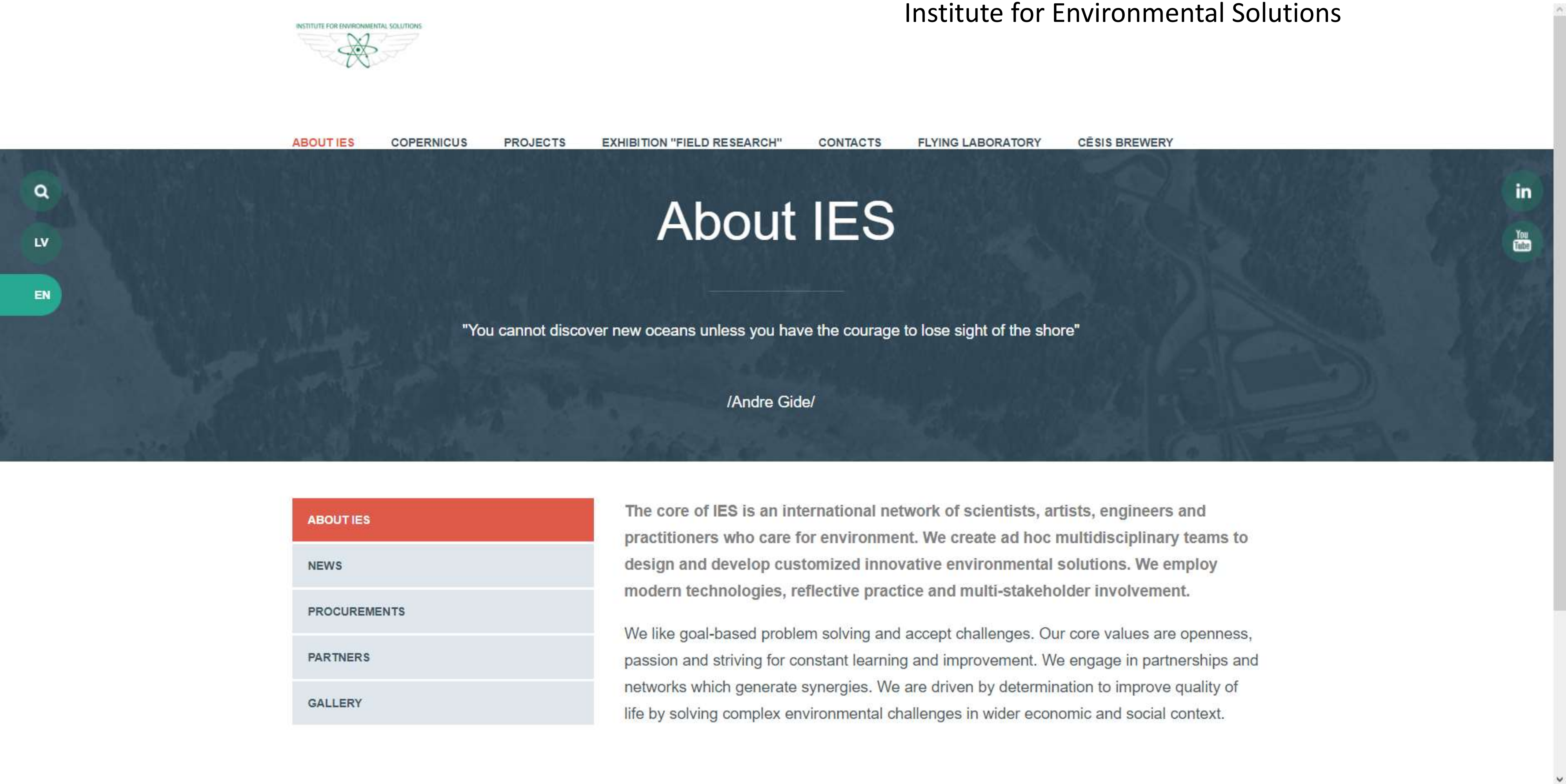
Institute for Environmental Solutions



METRUM

Worldwide Survey, Planning, Consulting
& GIS data and Geospatial systems company

LV EN RU

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Where we work | **Services** | **Projects** | **News & Publications**

Airport Obstacle Mapping

Forest inventory by forest type

Amount Calculations for Mineral Mapping

Forest inventory by forest type

We have developed technology which allows quickly and easy determine amount of different species in forest and calculate amounts of them. Or , in case of cut-outs , we determine amounts which are released.

Technology based on LIDAR data combined with our software.

Related Projects

- Railway topographical survey in Latvia
- Aerial laser scanning of the territory, forests and road network of Finland
- Aerial photographing works in Romania

Related Services

- Wind maps
- Mapping of airport flight obstacles
- Geospatial Solutions

Related Spheres

- Planning
- Topographical survey
- Property management service

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Klientu sadaļa

mans.metrum.lv

Typical questions in the forest sector for decision making

- How much of the Latvia surface today is covered:
  - - by forest?
  - - by conifer forest?
  - - by clearcuts?
  - - by pine?
- How much timber is in the:
  - Latvia`s forest?
  - Latvia territory?

- How healthy is forest?
- Which factors affect forest health?

https://cdn.pixabay.com/photo/2020/08/09/10/53/question-mark-5475172_960_720.jpg

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Biodiversity and succession

Biodiversity??

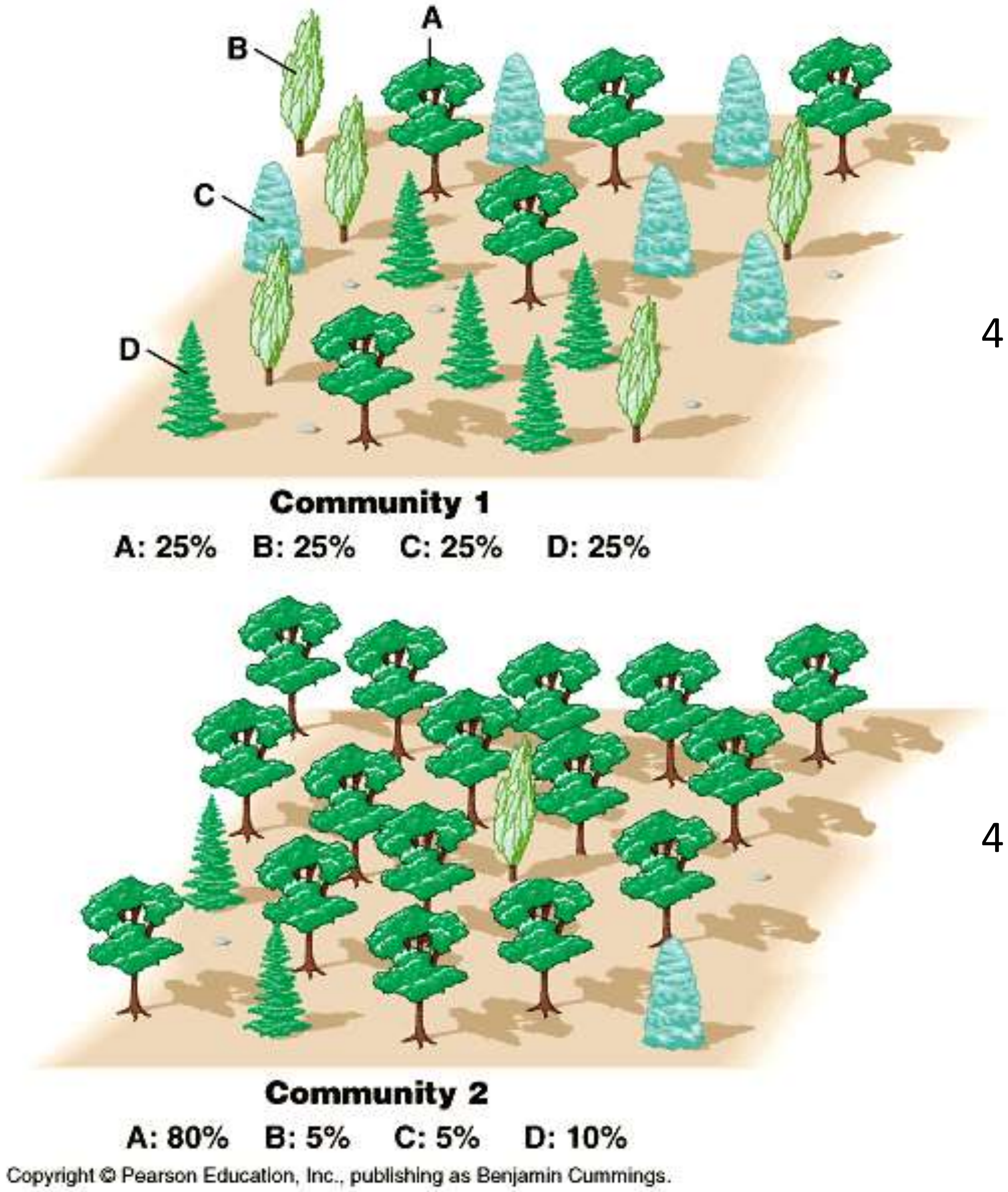
Genes Species Ecosystems

Biodiversity??

Ecosystems

Species

Genes



4 species

4 species

Community Nr1 > Nr2

So, we can measure it ??

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If Latvia will disappear from world map? Biodiversity will grow/fall / or do not change?

Table 1.1 Different types of cybernetics

Type	Authors	Period
Cybernetics	N. Wiener W. Ashby S. Beer	The 1948–1950s
Second-order cybernetics	M. Mead G. Bateson H. Foerster	The 1960–1970s
Autopoiesis	H. Maturana F. Varela	The 1970s
Homeostatics	Yu. Gorsky	The 1980s
Conceptual cybernetics of third and fourth orders	V. Kenny R. Mancilla S. Umpleby	The 1990–2010s
Neo-cybernetics	B. Sokolov R. Yusupov	The 2000s
Neo-cybernetics	S. Krylov	The 2000s
Third-order cybernetics	V. Lepsky	The 2000s
New cybernetics, post-cybernetics	G. Tesler	The 2000s
Control methodology	D. Novikov	The 2000s
Evergetics	V. Vittikh	The 2010s
Subject-oriented control in noosphere (Hi-Hume cybernetics)	V. Kharitonov A. Alekseev	The 2010s

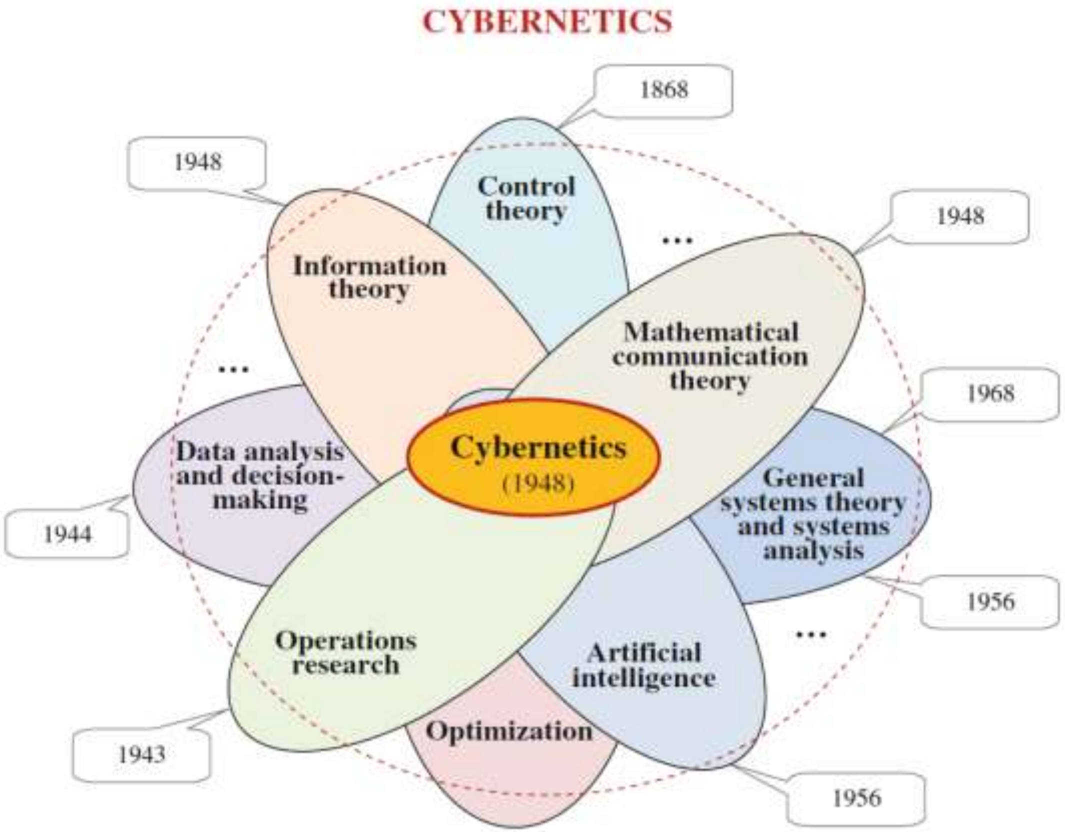

Fig. 1.9 The composition and structure of cybernetics

Novikov, D.A. Cybernetics, From Past to Future. Springer, 115pp

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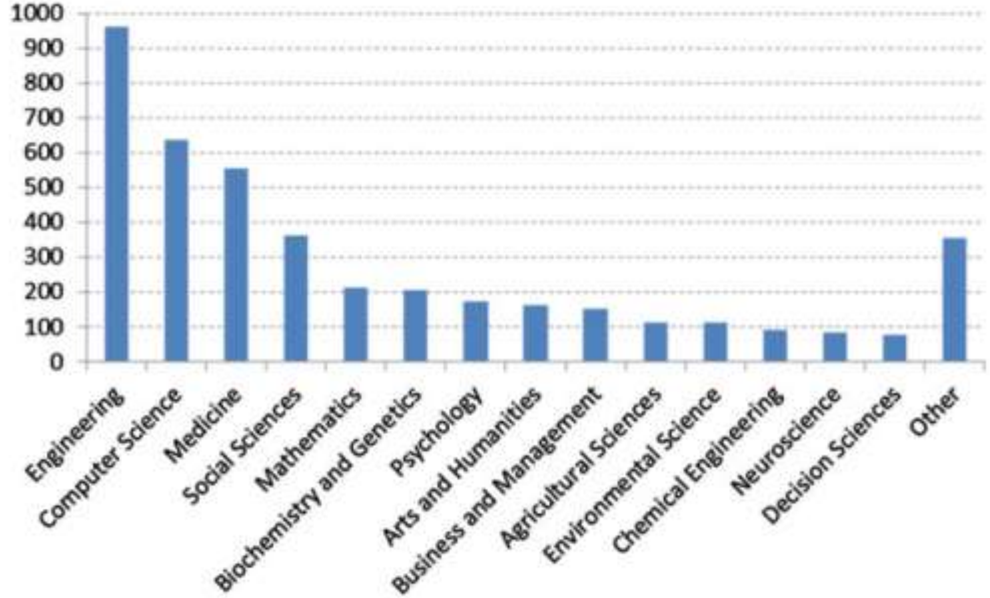

Fig. 1.2 The usage of the term "Cybernetics" by scientific branches in paper titles indexed by Scopus

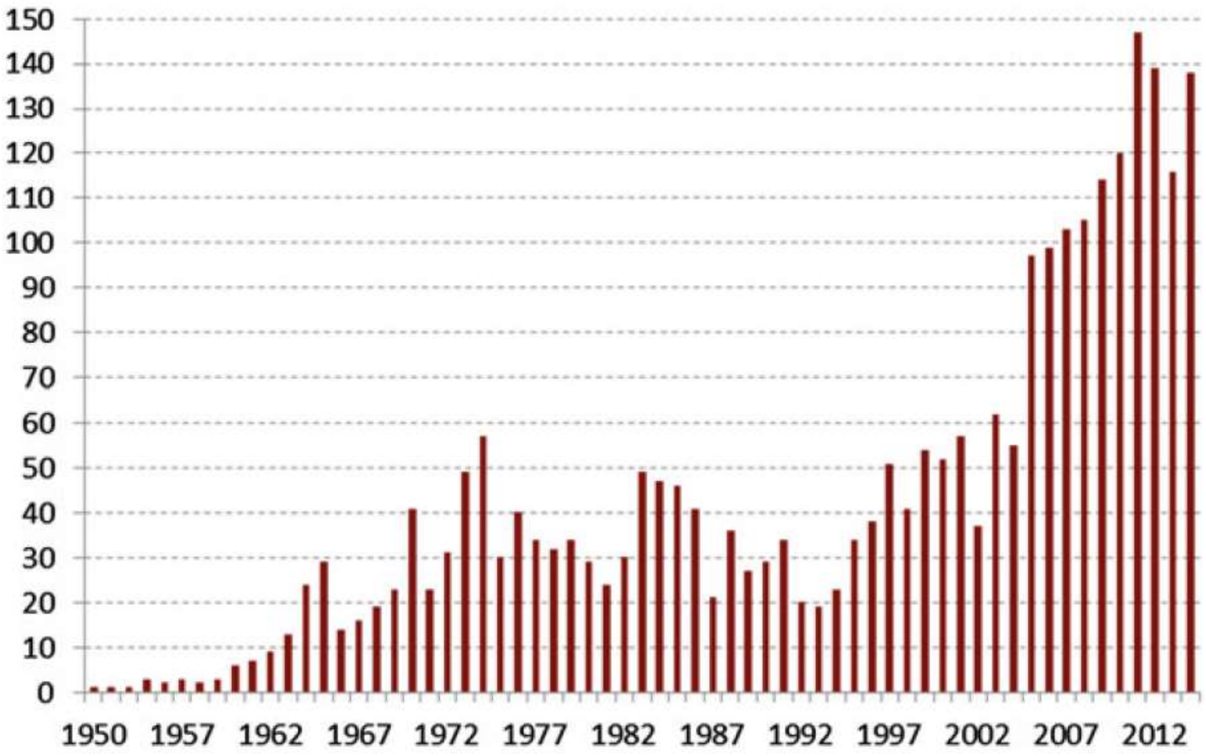

Fig. 1.4 The usage of the term "Cybernetics" by years in publications indexed by Scopus

Novikov, D.A. Cybernetics, From Past to Future. Springer, 115pp

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General system theory

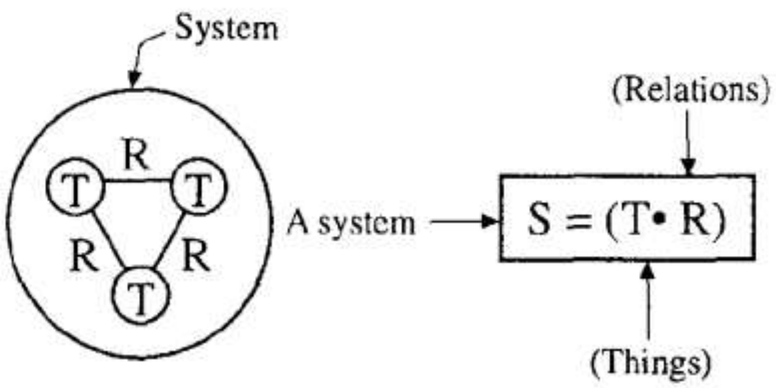


Figure 2.1 A formula defining a system.

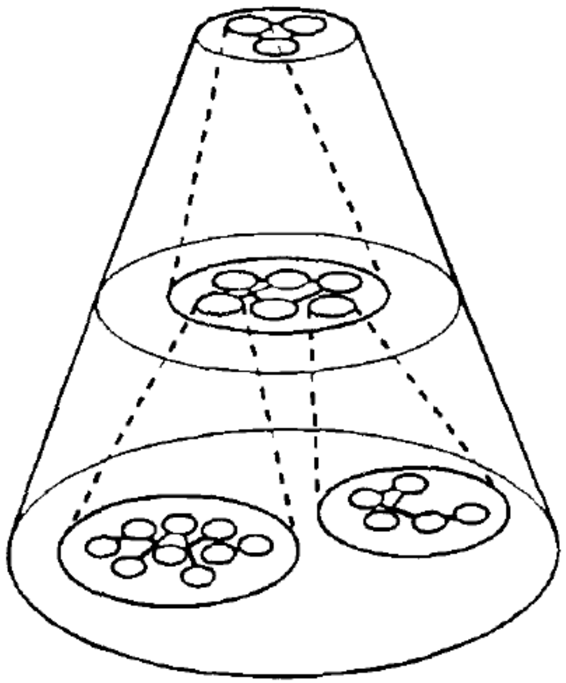


Figure 2.3 A multilevel systems hierarchy.

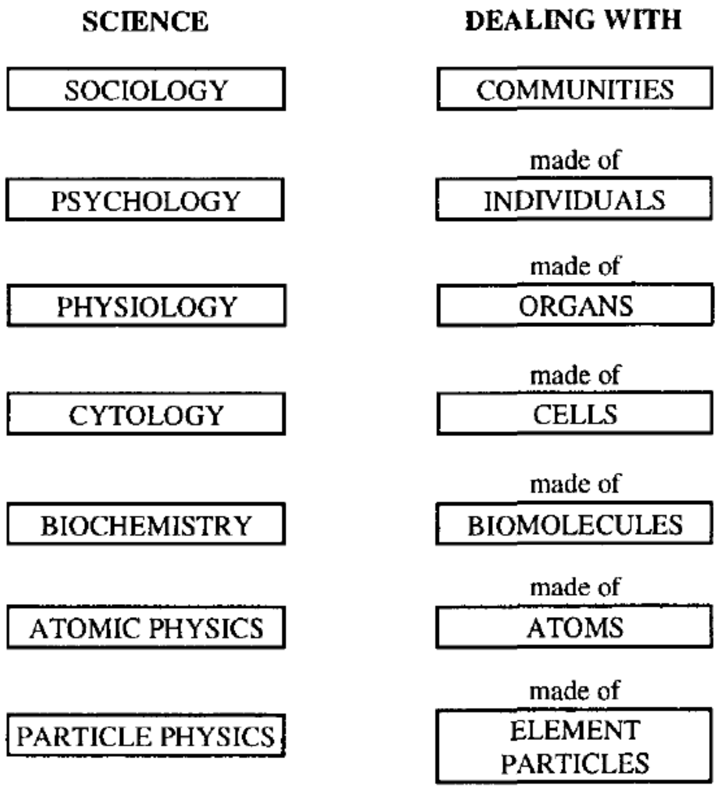


Figure 2.2 A hierarchy of science.

Skyttner, L. General System Theory, Problem, Perspective, Practice. World Scientific, 535pp.

System dynamics

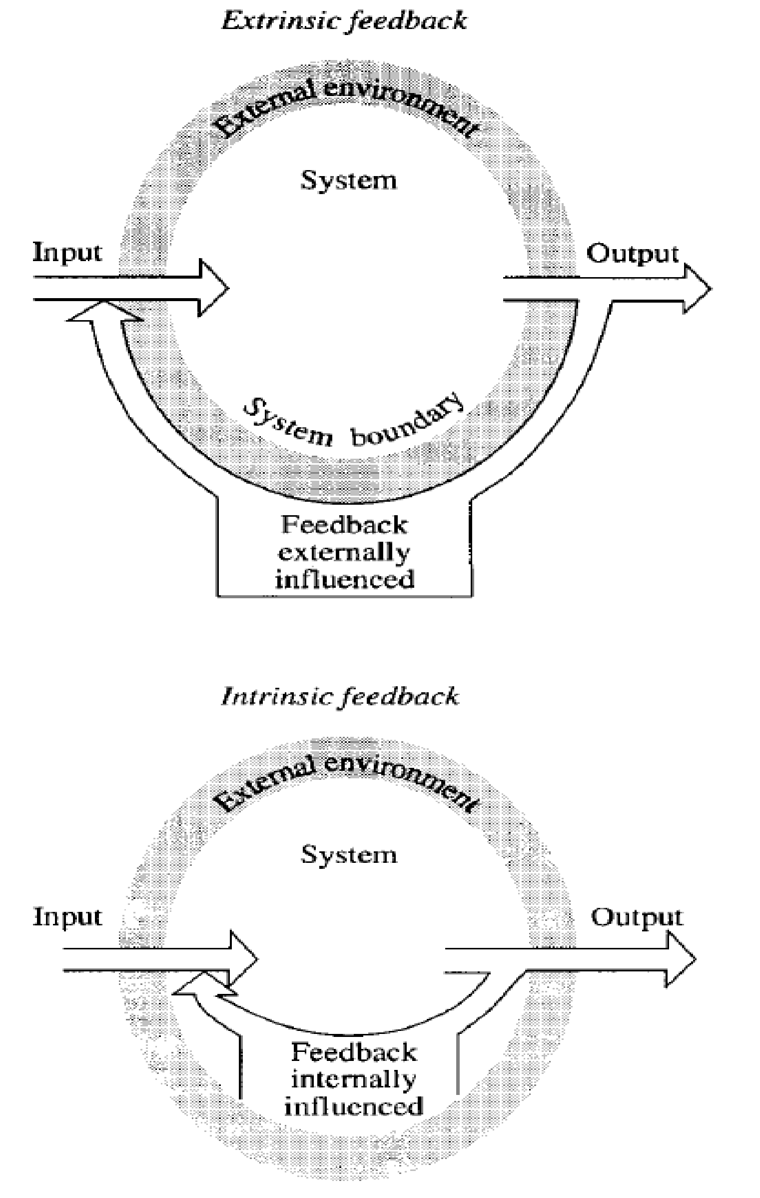


Figure 2.15 Extrinsic and intrinsic feedback.

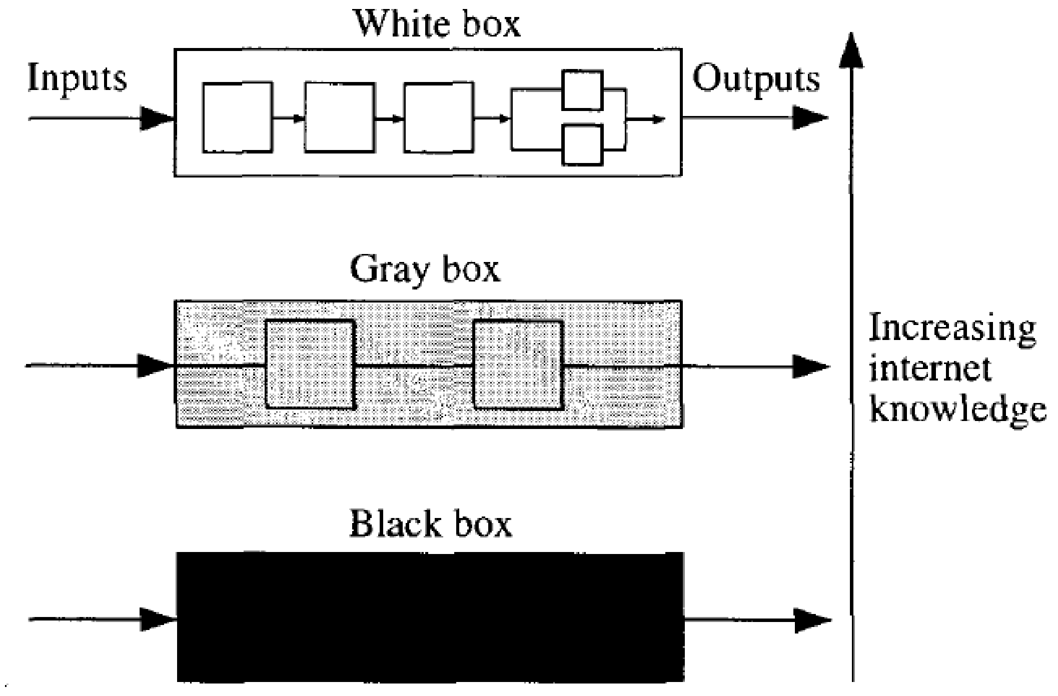
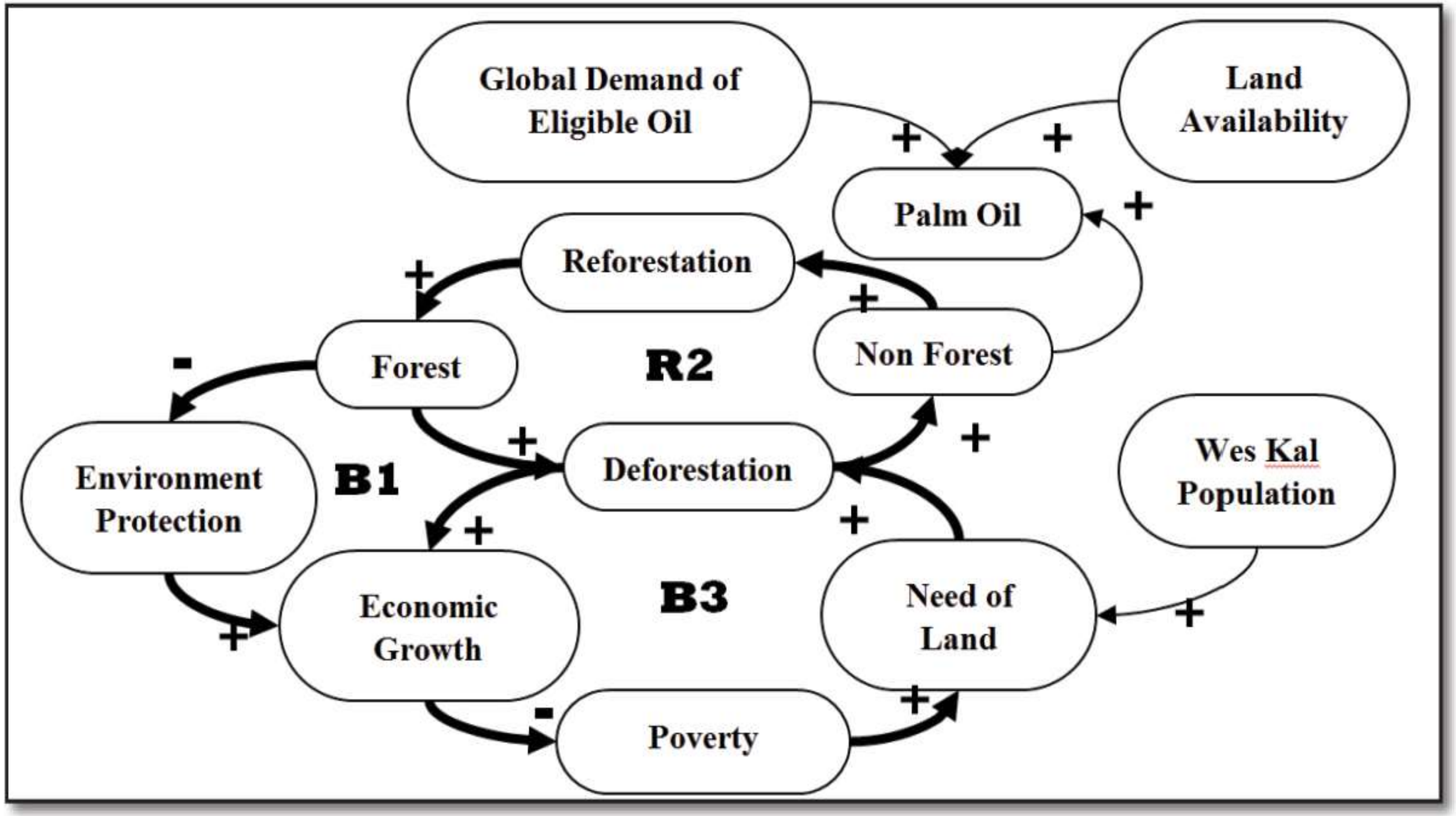
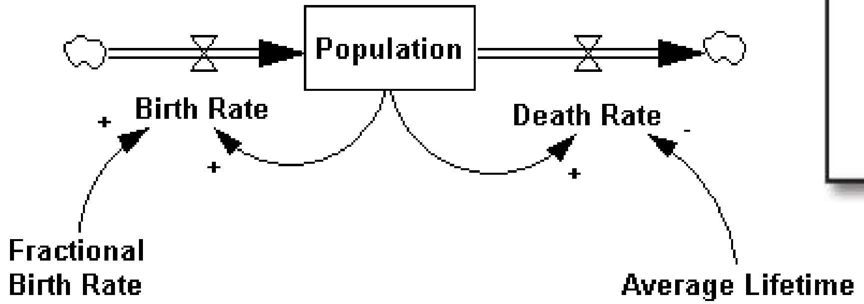


Figure 2.7 Degrees of internal understanding.

Skyttner, L. General System Theory, Problem, Perspective, Practice, World Scientific. 535pp.

https://d3i71xaburhd42.cloudfront.net/153575ee147e332f7295252a10c5c9df79166c0e/5-Figure4-1.png





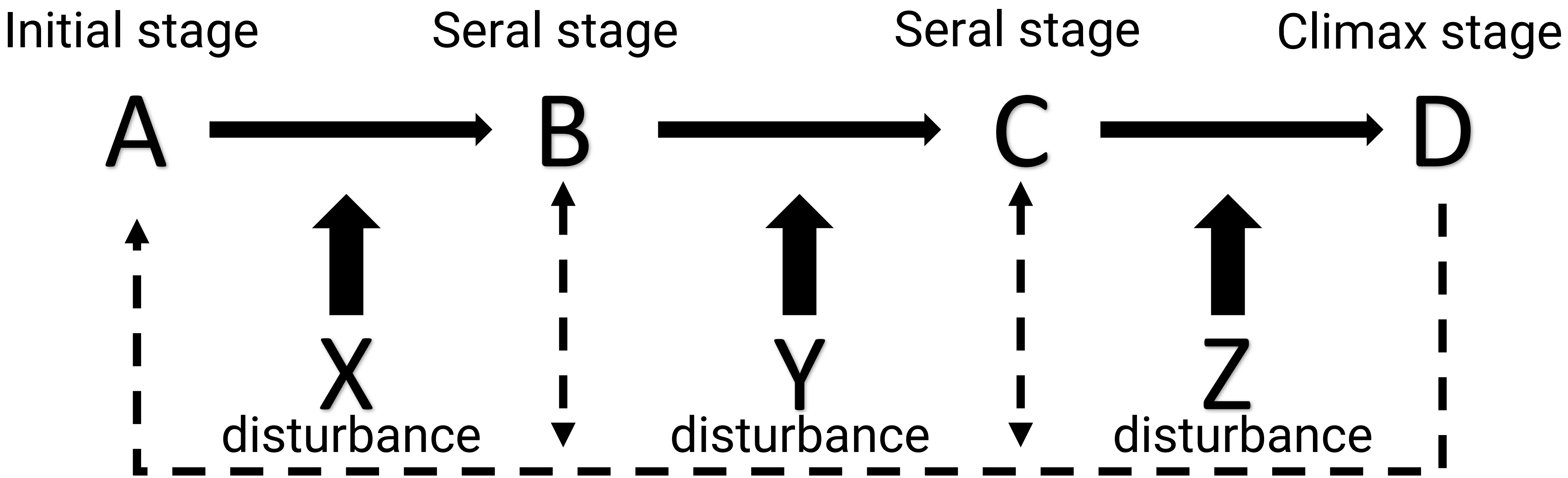
http://2.bp.blogspot.com/_eHW9SUkbuXQ/TBot6l9TEXI/AAAAAAAAAXc/l-nezAzVfdw/s320/simple+population+model.gif

35 years after the world's worst nuclear accident

https://i.redd.it/zmd2beg0q1v21.jpg

http://monumentalism.net/wp-content/uploads/2018/07/UA-Chernobyl-Pripyat-Town-Sign.jpg

Succession


Initial stage
Seral stage
Seral stage
Climax stage
A
B
C
D
X
Y
Z
disturbance
disturbance
disturbance

ECOLOGICAL SUCCESSION

It is the observed changes in an ecological community over time.

How does an ecological community develop? Ecological succession describes this process of development, identifying how the community began as well as how and when it stabilizes.

So, we can make cluster analysis for grouping succession stages? Problem is data availability..


LKS-92
x(N) 344254.55 B 57° 14` 10.586
y(E) 568303.74 L 25° 7` 53.731
1 : 2000
Sakarā ar tehniskiem darbiem infrastruktūras uzlabošanā,
Karšu Pārlūkā īslaicīgi nebūs pieejami Topogrāfiskie plāni 1:2000!
© Latvijas Ģeotelpiskās informācijas aģentūra 2021. gads

http://www.gaizins.lv/files/image/P5220150.JPG

Methods

How to make a good model or/and simulation?

Model

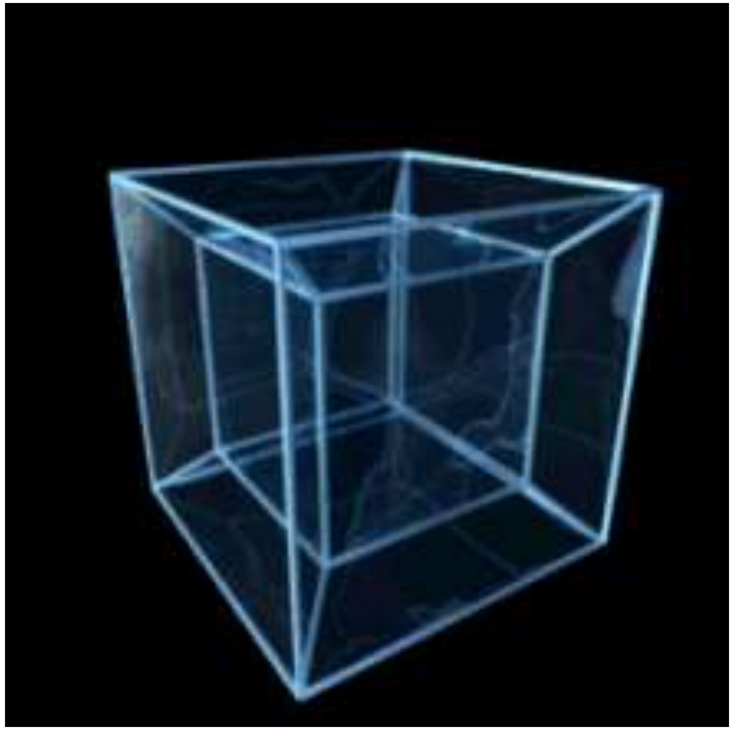
In general, a model is an informative representation of an object, person or system.

A model may help to explain a system and to study the effects of different components, and to make predictions about behavior.

Pablo Picasso, *Buste de femme au chapeau* (Dora), 1939.

https://d7hftxdivxxvm.cloudfront.net/?resize_to=width&src=https%3A%2F%2Fartsy-media-uploads.s3.amazonaws.com%2F5hHS2QIKHR72V3oqRqZU2g%252Ffarmhouse-picasso-lead.jpg&width=1200&quality=80

Tesseract



https://upload.wikimedia.org/wikipedia/commons/thumb/d/d7/8-cell.gif/220px-8-cell.gif

Simulation

A simulation is the imitation of the operation of a real-world process or system over time

Simulations require the use of models;

the model represents the key characteristics or behaviors of the selected system or process, whereas the simulation represents the evolution of the model over time.

Often, computers are used to execute the simulation.

https://myrepublica.nagariknetwork.com/uploads/media/2018/June/Genetic-Literacy-Project.jpg

https://upload.wikimedia.org/wikipedia/commons/thumb/e/ee/Reality_check_ESA384313.jpg/250px-Reality_check_ESA384313.jpg

The Virtual Forest:
Robotics And Simulation Technology As The Basis For New Approaches To The Biological And The Technical Production In The Forest

J. Rossmann*, M. Schluse and Christian Schlette
Institute of Man-Machine-Interaction
RWTH Aachen University
Ahornstr. 55, 52074 Aachen
Tel. +49 (0)241/80-26101
E-Mail: {rossmann, schluse, schlette}@mmi.rwth-aachen.de
http://www.mmi.rwth-aachen.de/

Keywords: forest planning, mobilization of wood resources, aerial photography, robotics, virtual reality

Forest landscape models

Analytical models

Mathematical abstraction that can be extended to address various working conditions, thanks to some assumptions about the way a process is evolving. In some cases, an exact solution can be derived and a result can be obtained in various conditions. The beauty of the analytical model is that it provides a generic way to get performance results in various conditions through a mathematical formulation. The accuracy of the model is to be considered through the validity of the assumption to derive the mathematical formulation. Some uncertainties can be handled through a stochastic model to account for modelling and measurement model.

Simulation models

also make assumption of a model and some assumption about the behaviour of the process. It is used when an analytical formulation cannot be derived (for example when the size of the model is too large, or when no exact solution can be derived). Simulation models provide results for a specific use case and should be run many times to counterbalance the effect of numerical calculations. For a different functioning use case, the simulation should be run over again. A simulation model can be accepted when results are validated in a number of working conditions under various input assumptions.

Forest landscape models

Landscape ecology
Forest ecology
Computer science
Remote sensing
Ecological succession
Forest disturbances
Ecosystem ecology

Landscape simulation models

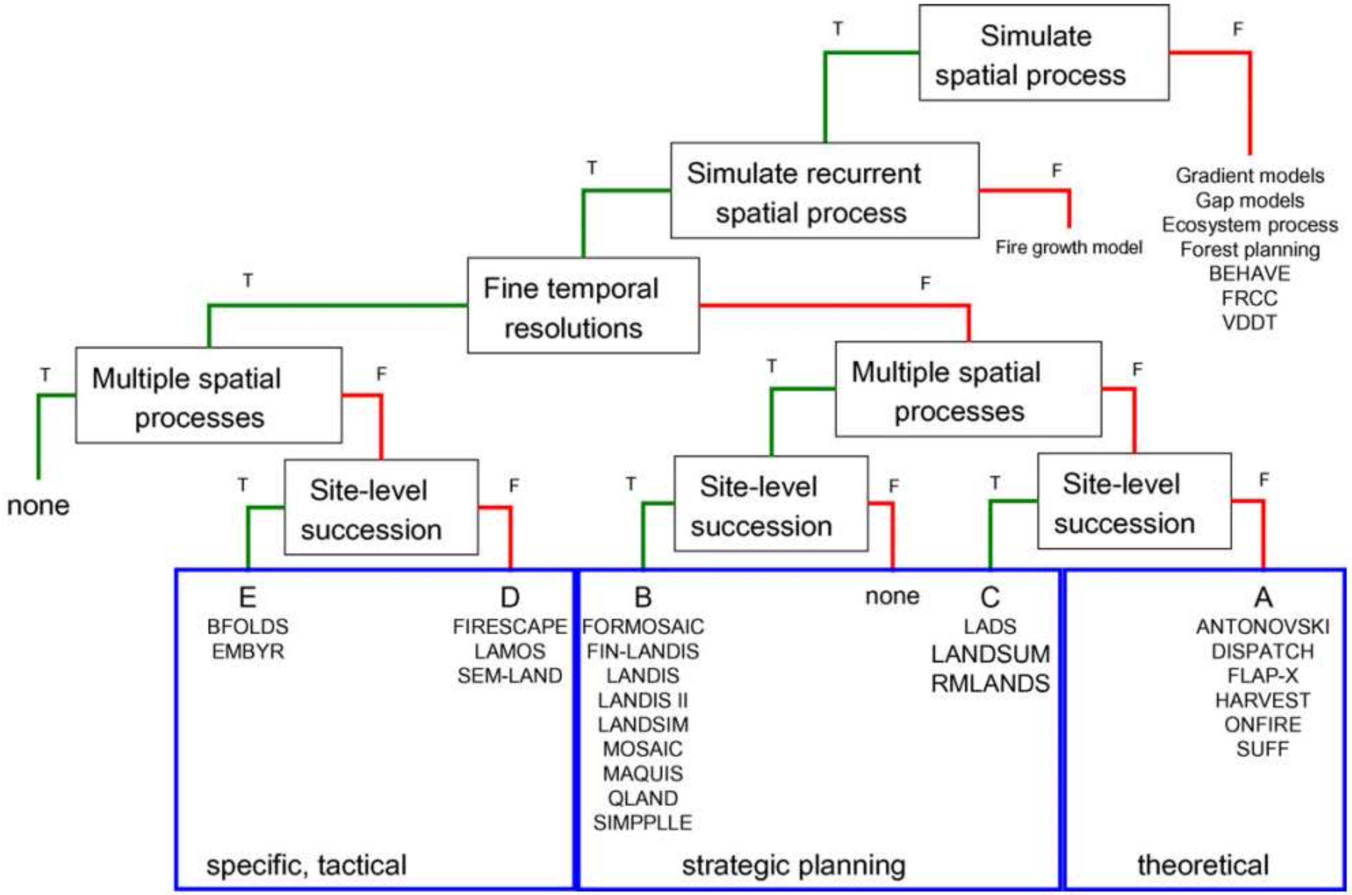


Fig. 2. A classification of forest landscape models using key characteristics. The figure shows that forest landscape models have been developed using diverse approaches. In general, fire temporal resolution models (groups D and E) are more suitable to tactical and specific objectives, coarse temporal resolution models (groups B and C) that simulate site-level succession are more suitable for strategic planning, and coarse temporal resolution models (group A) that do not simulate site-level succession are more suitable for theoretical studies.

He, S.H. 2008. Forest landscape models: Definitions, characterization, and classification. Forest Ecology and Management 254(3):484-498

Markov chain model

[Conversion Matrix]

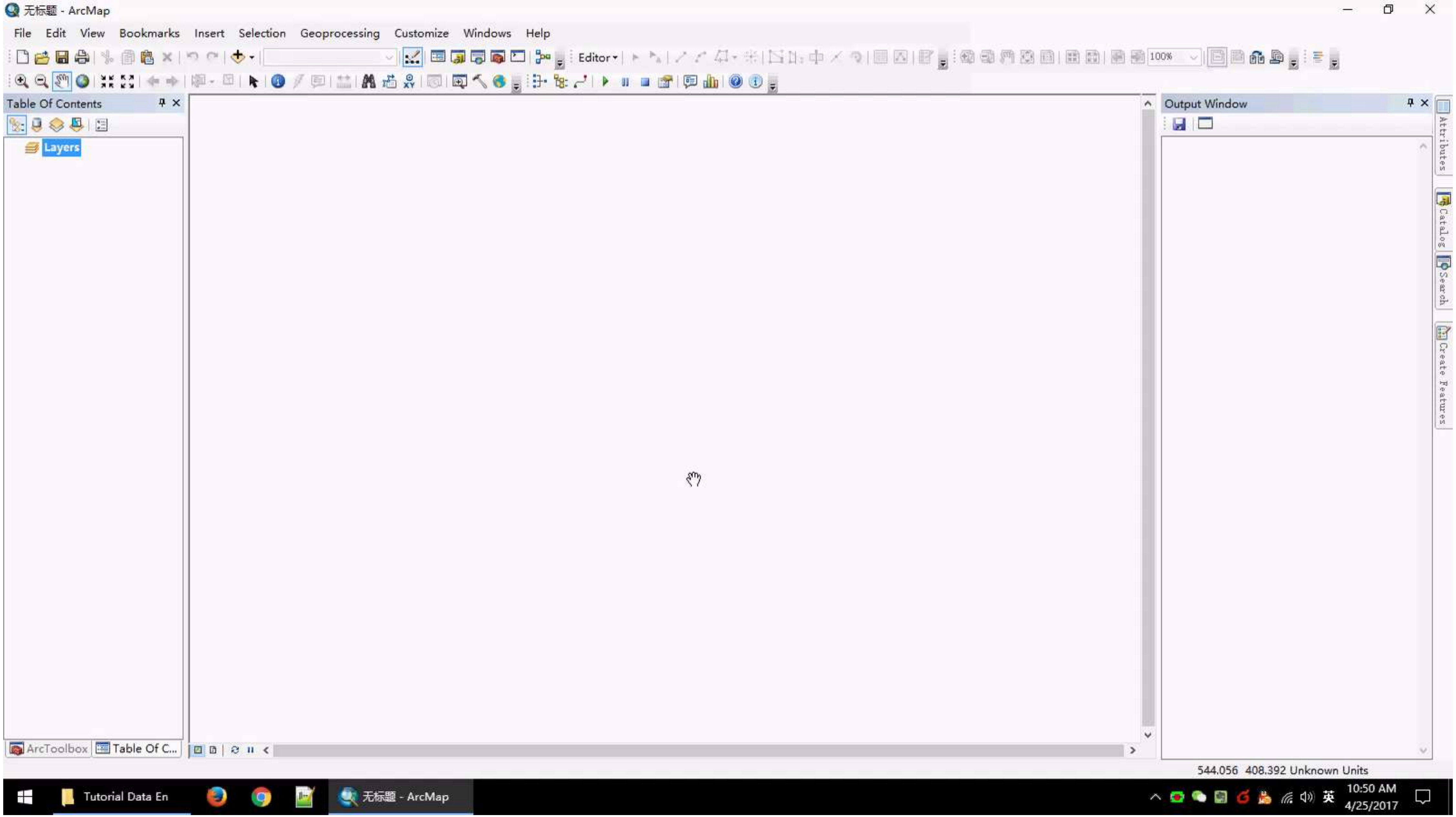
Land use types	type1	type2	type3	type4	type5	total
type1	52571	62812	8	3537	17011	135939
type2	40123	235198	471	16325	23077	315194
type3	13	367	340239	71	1150	341840
type4	8340	48345	620	46017	48891	152213
type5	20747	81357	2003	20966	706630	831703
total	121794	428079	343341	86916	796759	

[Conversion Probability]

type1	0.386725	0.46206	0.000059	0.026019	0.125137
type2	0.127296	0.746201	0.001494	0.051793	0.073215
type3	0.000038	0.001074	0.995317	0.000208	0.003364
type4	0.054792	0.317614	0.004073	0.30232	0.321201
type5	0.024945	0.09782	0.002408	0.025209	0.849618

[Predict amount]

year	type1	type2	type3	type4	type5
2020	121794	428079	343341	86916	796759
2027	126244	481622	344653	71774	752596
2034	132850	514504	345870	68972	714693
2041	138491	537497	347029	69044	684827
2048	142859	554364	348146	69651	661870
2055	146155	566916	349230	70243	644344
2062	148624	576280	350288	70717	630980
2069	150463	583253	351325	71073	620776
2076	151826	588422	352344	71332	612964
2083	152831	592228	353349	71517	606964
2090	153565	595005	354341	71645	602332
2097	154094	597006	355322	71730	598737



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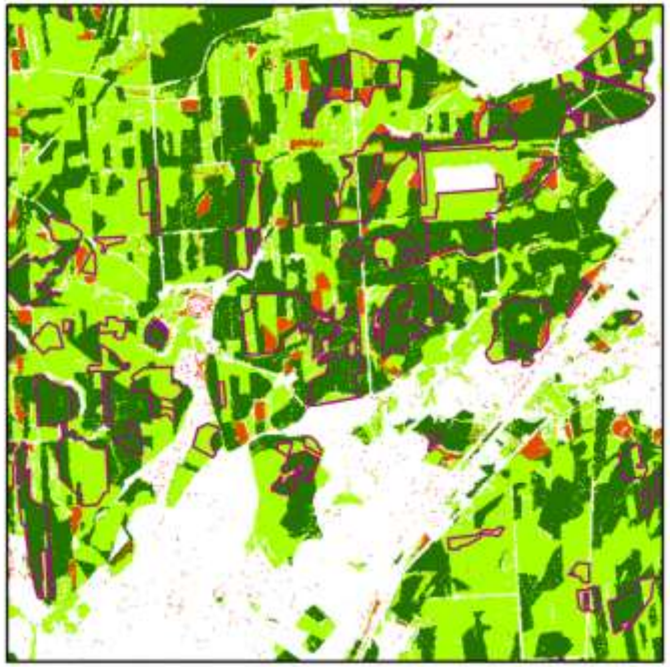
LANDIS II

Table 1 Some spatial landscape models selected to illustrate specific points in how the landscape modelling approach taken has developed and changed over the last 10–15 years

Author/model	Brief description and system of interest	Source of model description
Kessell Fire Gradient Model	Possibly the first 'true' spatial landscape model. It considers vegetation and fire dynamics in a spatially explicit manner in a range of systems (eg, Californian chaparral, Australian fuels) using a grid-based approach.	Kessell (1976); Kessell and Cattelino (1978)
Sklar *et al.* CELSS	Early process-based spatial landscape model of coastal marsh succession and habitat change in a marsh/estuarine complex in south Louisiana (USA).	Sklar *et al.* (1985); Costanza *et al.* (1990)
Green	Early spatial landscape model considering effects of disturbance (fire spread) and seed dispersal on landscape pattern. The model is not site specific.	Green (1989)
Baker DISPATCH	Grid-based model to explore the interactions between climatic change, disturbance regime and landscape pattern. DISPATCH has also been used to explore the effects of fire suppression on landscape pattern and change (Minnesota).	Baker *et al.* (1991); Baker (1999)
Davis and Burrows REFIRES	Spatial landscape model of vegetation dynamics in a chaparral ecosystem in southern California. The model is of interest because it employs a detailed mechanistic approach to simulate disturbance dynamics (the fire spread model of Rothermel, 1972).	Davis and Burrows (1994)
Ratz Fire in Canadian Boreal Forest	Spatial landscape model of fire dynamics in the Canadian boreal forest using a CA-derived approach; explores issues of self-organization in landscape pattern in relation to fire dynamics.	Ratz (1995; 1996)
Gardner *et al.* EMBYR	Spatial landscape model of fire dynamics in Yellowstone NP, developed to consider effects of climate change on the fire regime, similar to Ratz's model except that fires are not assumed stand-replacing. Vegetation change is modelled using a simple (non-spatial) Markov process.	Gardner *et al.* (1996); Hargrove *et al.* (2000)
Maldenoff *et al.* LANDIS	LANDIS is a good example of a contemporary 'state of the art' SELM. The model is designed to explore multispecies dynamics over large spatiotemporal areas. Processes of interest (eg, dispersal, regeneration, fire and windthrow) are modelled mechanistically. Originally designed for northern USA forest landscapes (Wisconsin) and since applied to other systems (see text).	Mladenoff and He (1999); Mladenoff *et al.* (1996); He and Mladenoff (1999); Mladenoff (2004)



2020. gads

Patmalnieks, G. 2020. Mežsaimnieciskās darbības ietekme uz melnā stārķa dzīvotnes ainavas izmaiņām nākotnes scenārijā, maģistra darbs

Enright, N.J. 2006. Spatial modelling of vegetation change in dynamic landscapes: A review of methods and applications, Progress in Physical Geography 30(1):47-72

Succession Extensions: You can install multiple succession extensions although only one operates during a simulation.

Name	Last Updated
Age-only Succession	
Biomass Succession	
Forest Carbon Success	
Net Ecosystem Carbon Succession	
PnET Succession	

Universal Disturbance and Output Extensions: Compatible with ALL succession extensions

Name	Last Updated
Age Reclassification Outp	
Base Biological Disturbar	
Base Epidemiological Dis	
Base Fire	
Base Harvest	
Base Wind	
BFOLDS Fire	
Cohort Statistics Output	
Dynamic Fuels & Fire Sys	
Forest Road Simulator	
Linear Wind	
Local Habitat Suitability	
Maximum Species Age Ou	

Biomass Extensions: Compatible with Biomass, PnET, and NECN Succession

Name	Last Updated
Biomass-by-Age Output	September 2018
Biomass Browse	September 2018
Biomass Fuels	September 2019
Biomass Harvest	October 2019
Biomass Output	September 2018
Biomass Reclassification Output	September 2018
Land Use Change+	February 2021
Landscape Habitat Output	January 2020
Biomass Community Output	December 2019
SCRAPPLE	February 2020

Other Extensions: Compatible with various

Name	Last Updated
PnET Output (Compatible with PnET Succession)	September 2018

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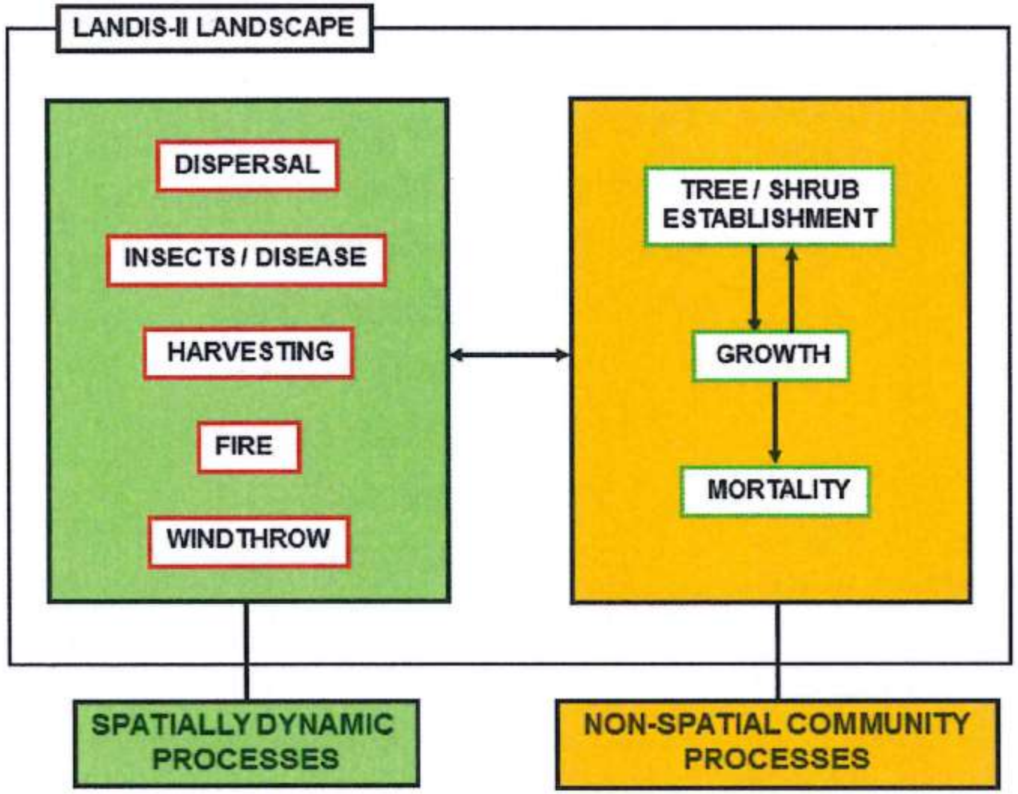


Figure 3.1. General overview of spatial and non-spatial processes in LANDIS-II. Not all processes are represented.

ecoregions.tif	2021-02-13 6:33 PM	FastStone TIF File
initial-communities.tif	2021-02-13 6:31 PM	FastStone TIF File
management_test.tif	2021-02-13 7:07 PM	FastStone TIF File
managementV1.tif	2021-02-20 11:39 ...	FastStone TIF File
managementV2.tif	2021-02-20 1:10 PM	FastStone TIF File
stand.tif	2021-02-13 6:35 PM	FastStone TIF File
age-only-succession.txt	2021-02-13 6:31 PM	TXT File
age-only-succession-dynamic-inputs.txt	2020-04-02 1:06 AM	TXT File
BaseHarvest-Sample-Input.TXT	2021-02-20 4:18 PM	TXT File
ecoregions.txt	2021-02-13 7:17 PM	TXT File
initial-communities.txt	2021-02-13 7:15 PM	TXT File
Landis-log.txt	2021-02-20 5:35 PM	TXT File
max-spp-age.output.txt	2021-02-13 6:23 PM	TXT File
scenario_s1e1.txt	2021-02-13 7:08 PM	TXT File
species.txt	2021-02-13 7:14 PM	TXT File
scenario_s1e1_BatchFile.bat	2018-08-16 11:24 ...	Windows Batch File

Scheller, R. M., Mladenoff, D. J. 2004. A forest growth and biomass module for a landscape simulation model, LANDIS: Design, validation, and application. Ecological Modelling. 180(1), **211–229.**
Scheller, R. M., Mladenoff, D. J. 2007. An ecological classification of forest landscape simulation models: Tools and strategies for understanding broad-scale forested ecosystems. Landscape Ecology. 22(4), 491–505. https://doi.org/10.1007/s10980-006-9048-4

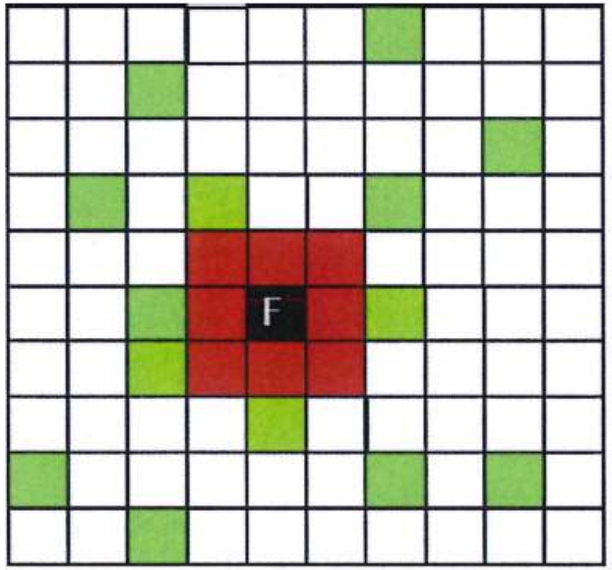


Figure 3.2. Neighborhood interactions from a focal cell (F) can include: adjacent neighbors (red; e.g., fire spread), non-adjacent neighbors (green; e.g., seed dispersal). Neighborhood size and shape vary by process.

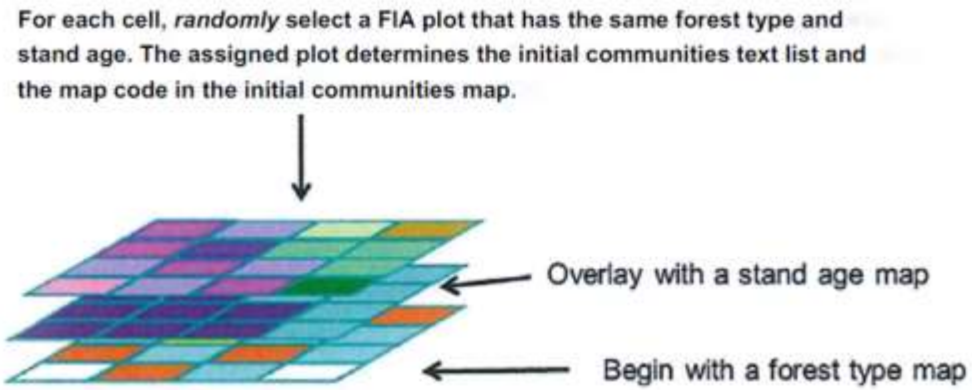


Figure 4.1 A hypothetical example of how a forest type and a stand age map can be used to constrain the spatial imputation of FIA plots across the landscape.

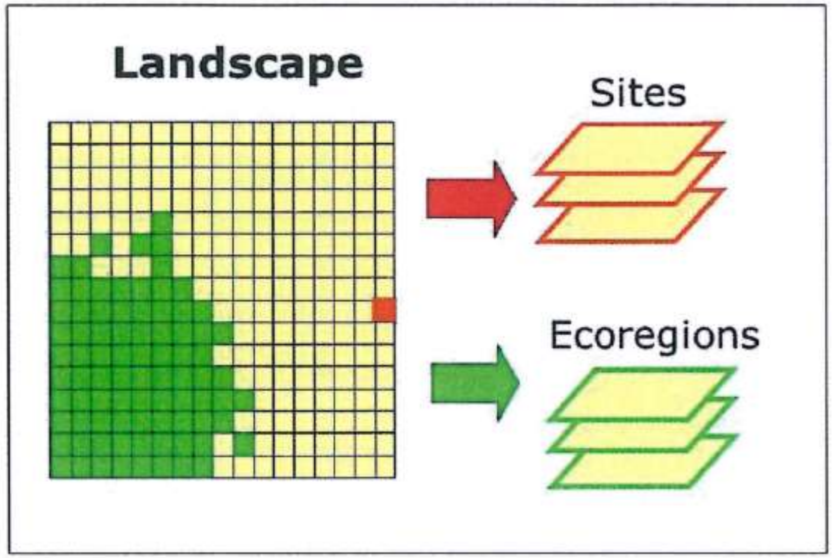
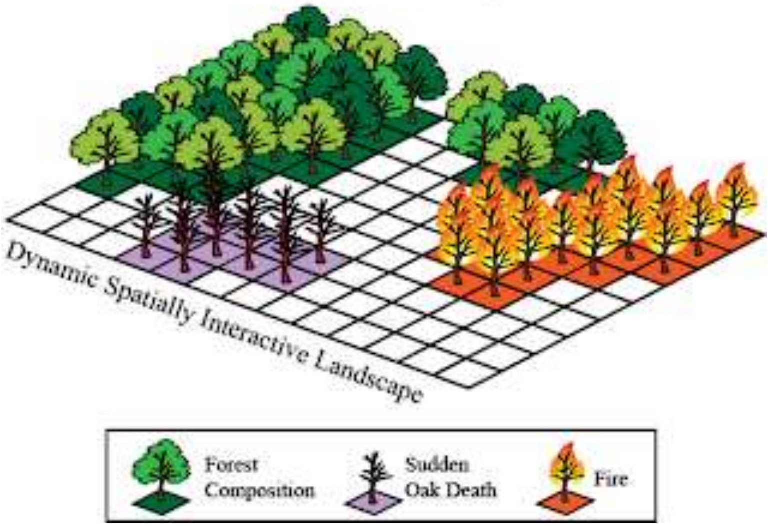


Figure 3.5 LANDIS-II assumes homogeneity at multiple scales. Sites are single cells that are homogeneous in regards to light levels, cohorts, and other attributes. Ecoregions contain one or more cells, typically defined by climate and soils; they need not be contiguous. Ecoregions are homogeneous in regards to species establishment and ecosystem process rates. Disturbance extensions can have their own unique aggregations of sites.



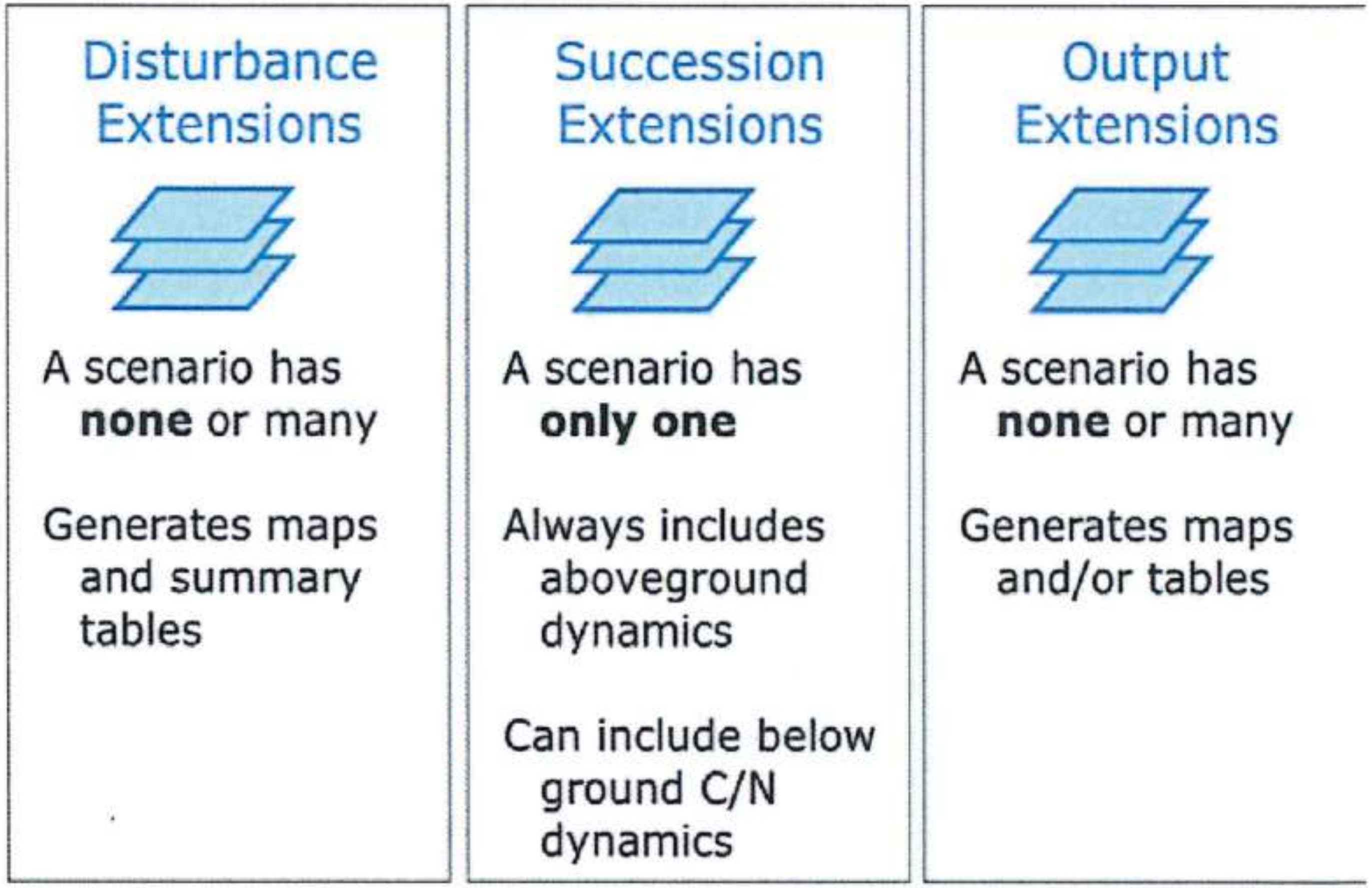


Figure 3.6 In LANDIS-II, users select and download the extensions which best match their question and desired level of complexity. Many processes have more than one possible extension.

Parametrization

```
LandisData      "Scenario"

Duration        60

Spec

Ecor
Ecor

Cell

>>
>> -
   "
>> D
>> -
   "
>> D

>>
>> -
"Output Max

RandomNumberS
```

```
LandisData      "Species"

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      "pic
      "bet
      "al
      "al
      "ti
      "que
      "fra
      "ace
      "ul
      "pop
      "sa
```

```
LandisData  Ecoregions

>>
>>
>>
>>
                  Fire   Seed Disperal Dist   Vegetative     Sprout Age   Post-Fire
              m   Reprod Prob    Min    Max    Regen
              -   -----------    ----   ----   ----------
                  0              0      0      none
                  0.2            0      400    none
                  0.8            0      60     resprout
                  0.7            1      60     resprout
                                                out
                                                out
                                                out
                                                out
                                                out
                                                out
                                                out
                                                out
yes     11
yes     12
yes     13
yes     14
yes     15
yes     16
yes     17
yes     18
yes     19
yes     20
yes     21
yes     22
yes     23
no      24
```

```
LandisData  "Age-only Succession"

>> Compatible

Timestep    1

SeedingAlgori

InitialCommun
InitialCommun

DynamicInputF
```

```
LandisData    "Initial Communities"

>> APSE_10
MapCode
poputrem

>> APSE_
MapCode
poputrem

>> APSE_
MapCode
poputrem

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MapCode
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>> APSE_
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>> APSE_
MapCode
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```

```
LandisData  "Base Harvest"

Timestep    1

ManagementAreas ./managementV2.tif

Stands   ./stand.tif

>>   -----------------------------------------
>>   PRESCRIPTIONS

Prescription    VISPAREJS
    StandRanking    Economic
    >>Species       EconomicRank        MinimumAge
    piceabie        100                 81
    betulasp        100                 71
    pinusylv        100                 101
    querrobu        90                  71
    alnuglut        90                  71
    fraxexce        90                  71
    poputrem        90                  51
    alnuinca        90                  51
    salicapr        90                  51

    MinimumAge  71
     ForestTypeTable
     >> InclusionRule   ageRange    %Cells   species
     >>-------------------------------------------------------
```

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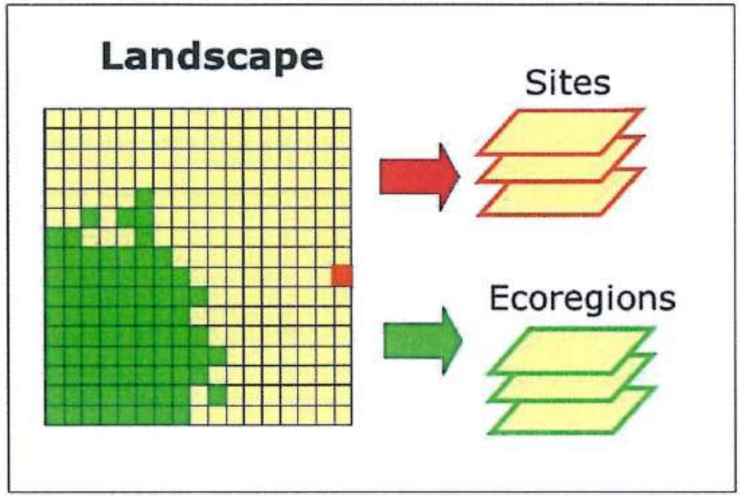
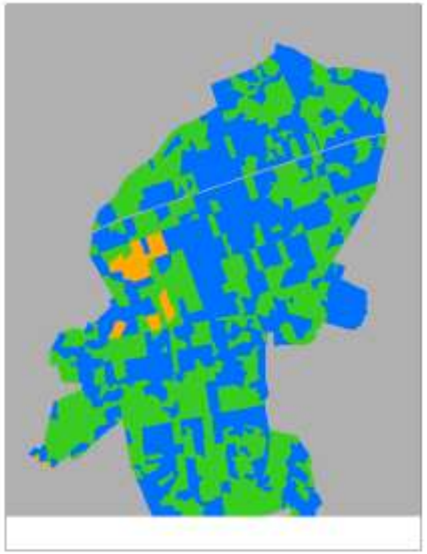


ecoregions.tif

initial-communities.tif

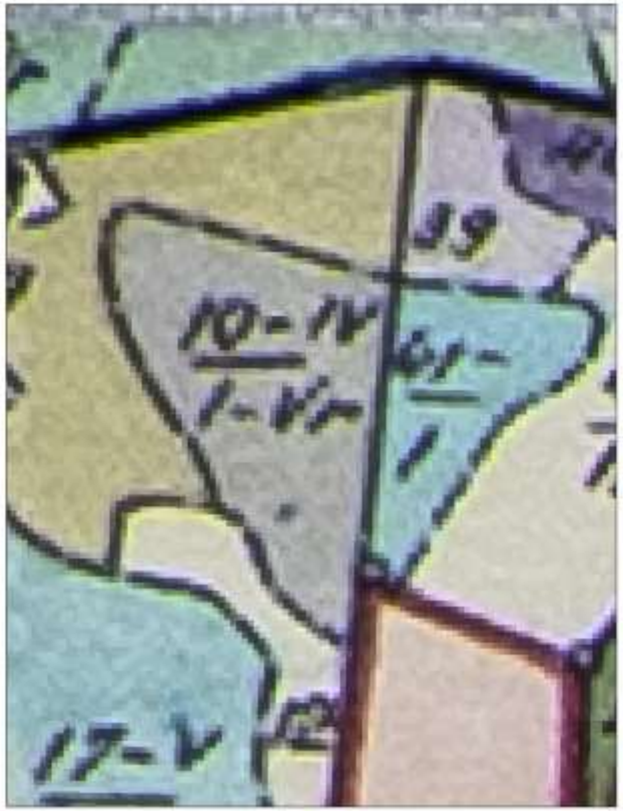
managementV1.tif

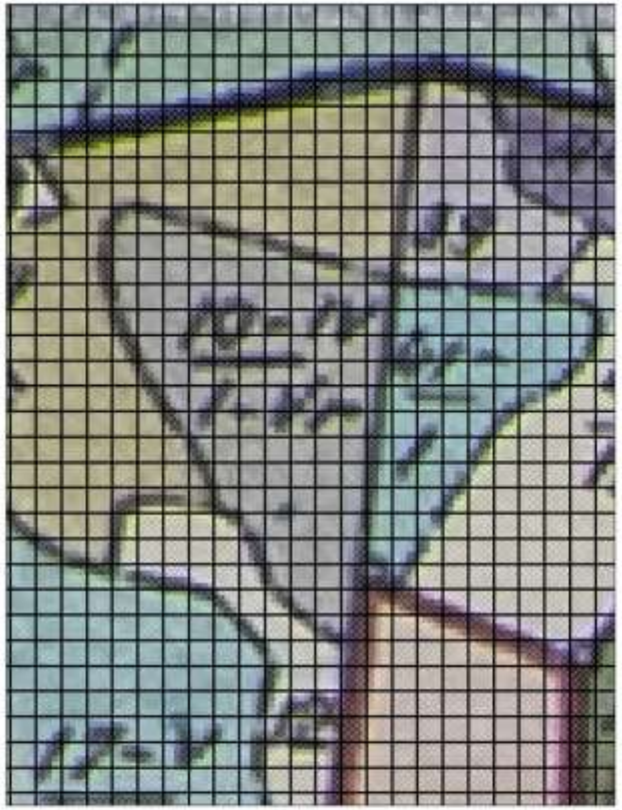


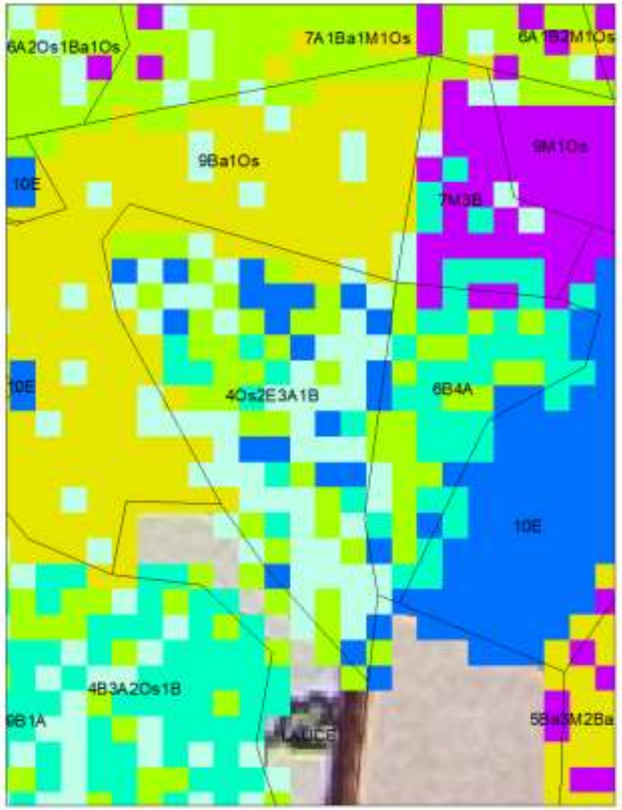
stand.tif

Digitalisation of forest inventory data

Using the theory of probability

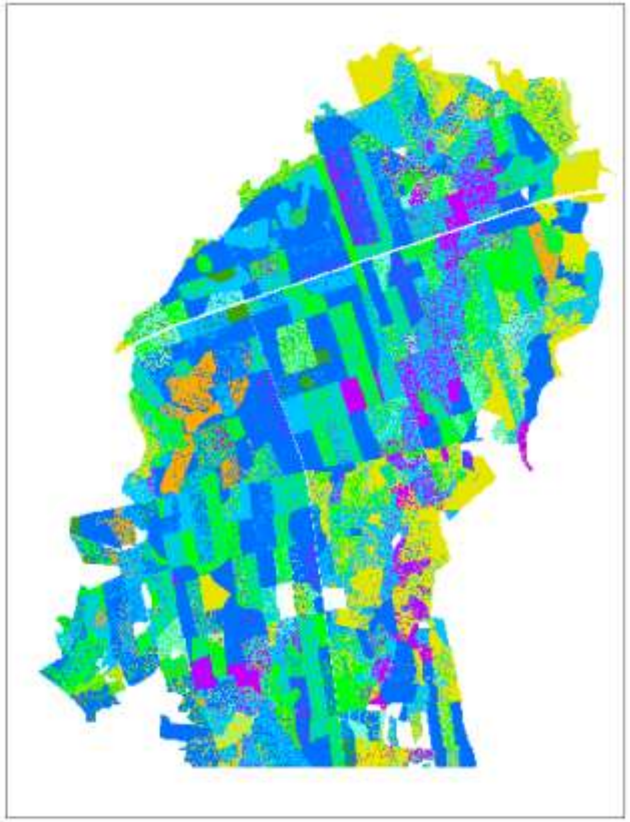




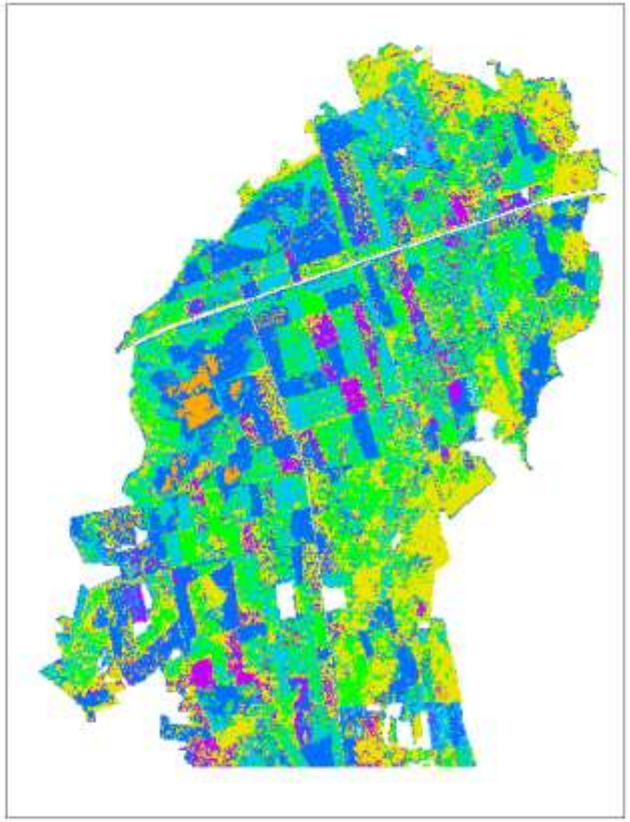


Random forest atgorithm (machine learning)

- Use scikit-learn
- R programming
- QGIS with dzetsaka plugin
- ArcGis Pro



Digitised data



RFA

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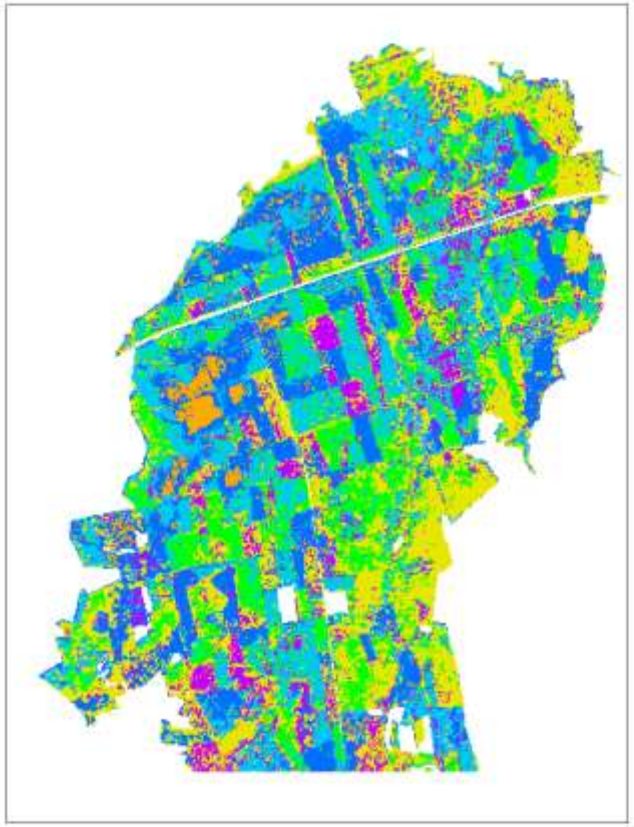
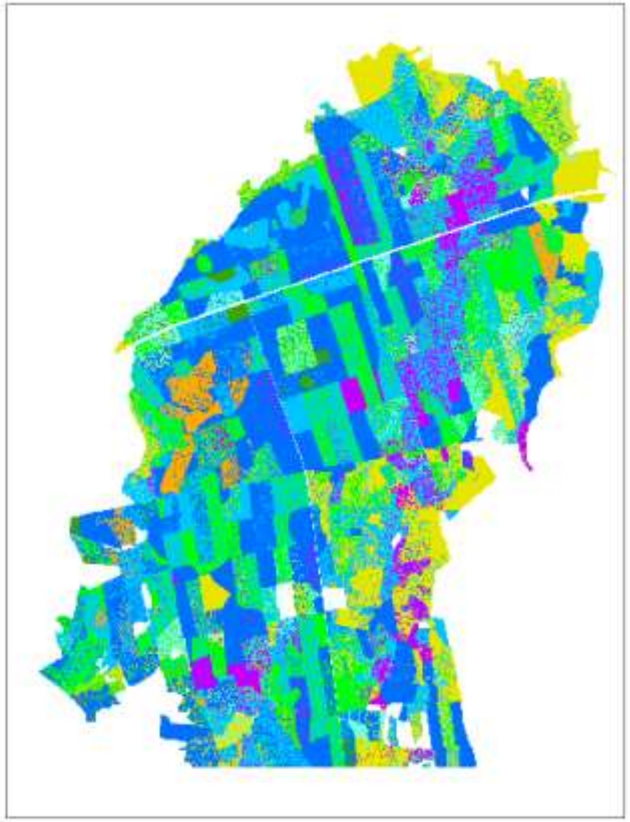
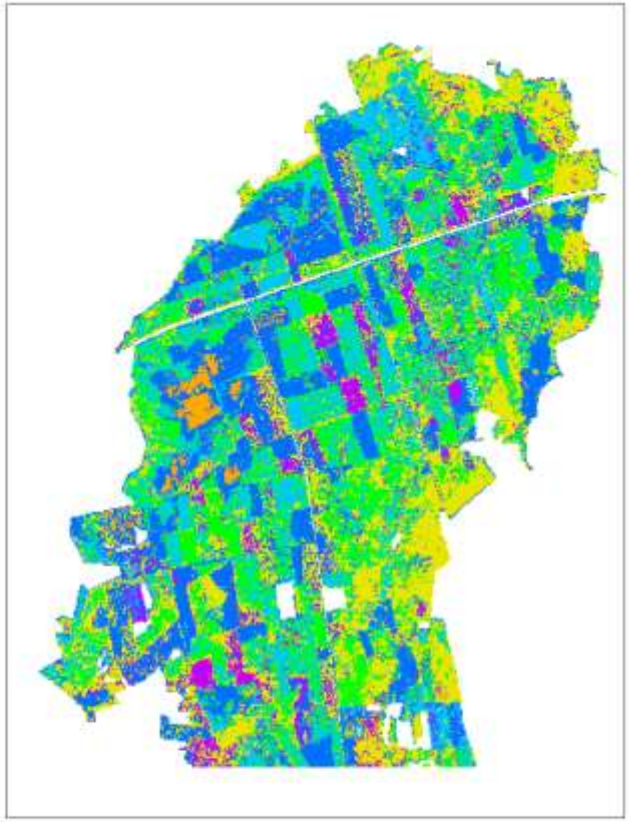


Vector machine



Digitalisation



RFA

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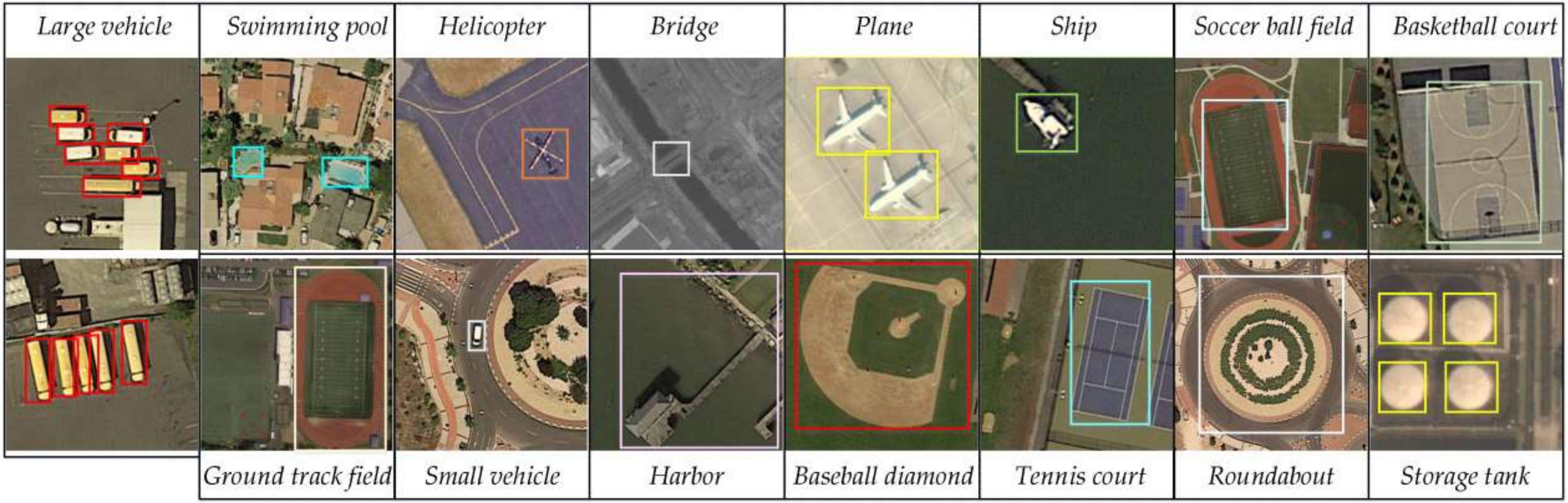
Deep learning – object detection



Chen, C.; Gong, W.; Chen, Y.; Li, W. Object Detection in Remote Sensing Images Based on a Scene-Contextual Feature Pyramid Network. Remote Sens. 2019, 11, 339. https://doi.org/10.3390/rs11030339

https://www.mdpi.com/remotesensing/remotesensing-11-00339/article_deploy/html/images/remotesensing-11-00339-g005.png

Photogrammetry

Mikita, T.; Janata, P.; Surový, P. Forest Stand Inventory Based on Combined Aerial and Terrestrial Close-Range Photogrammetry. Forests 2016, 7, 165. https://doi.org/10.3390/f7080165

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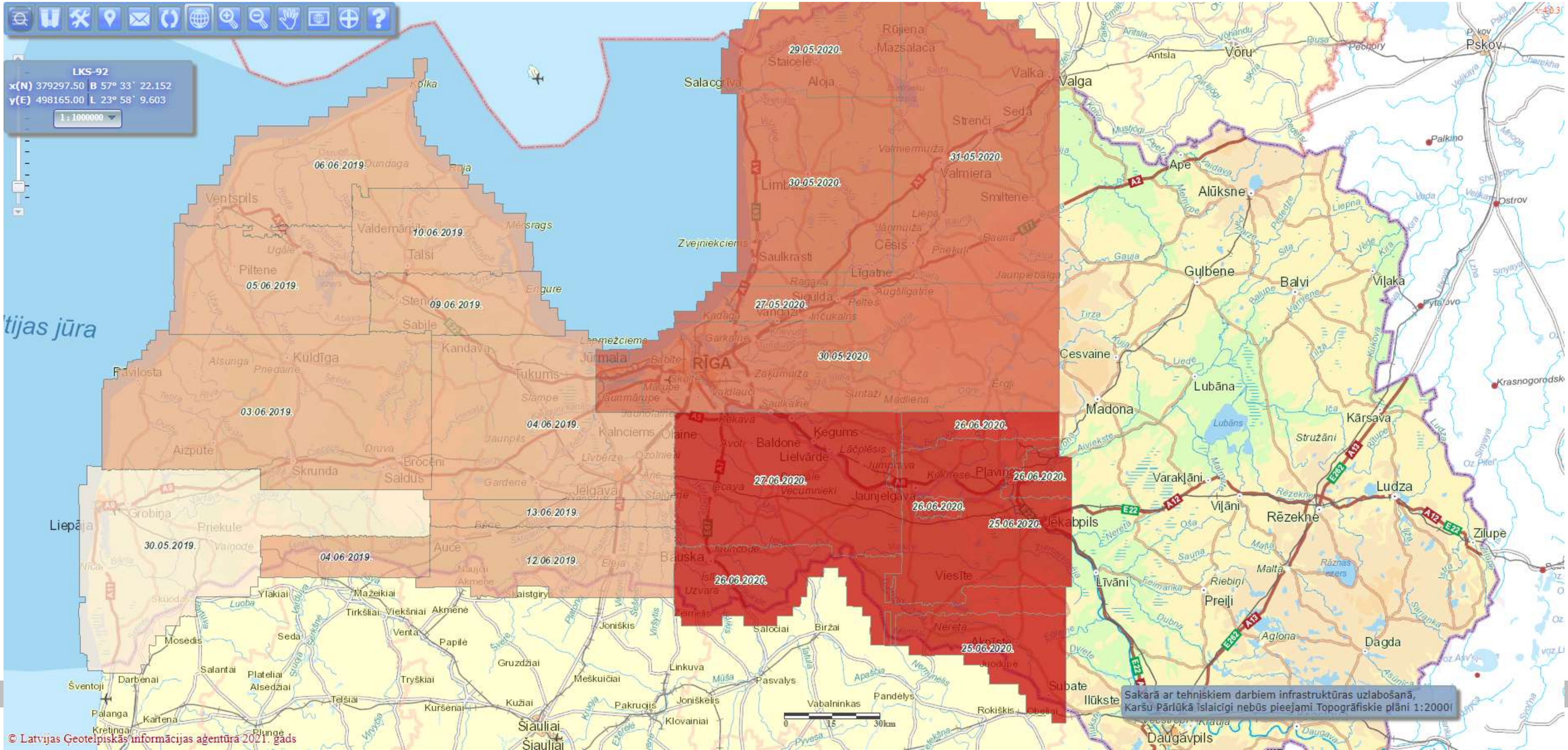
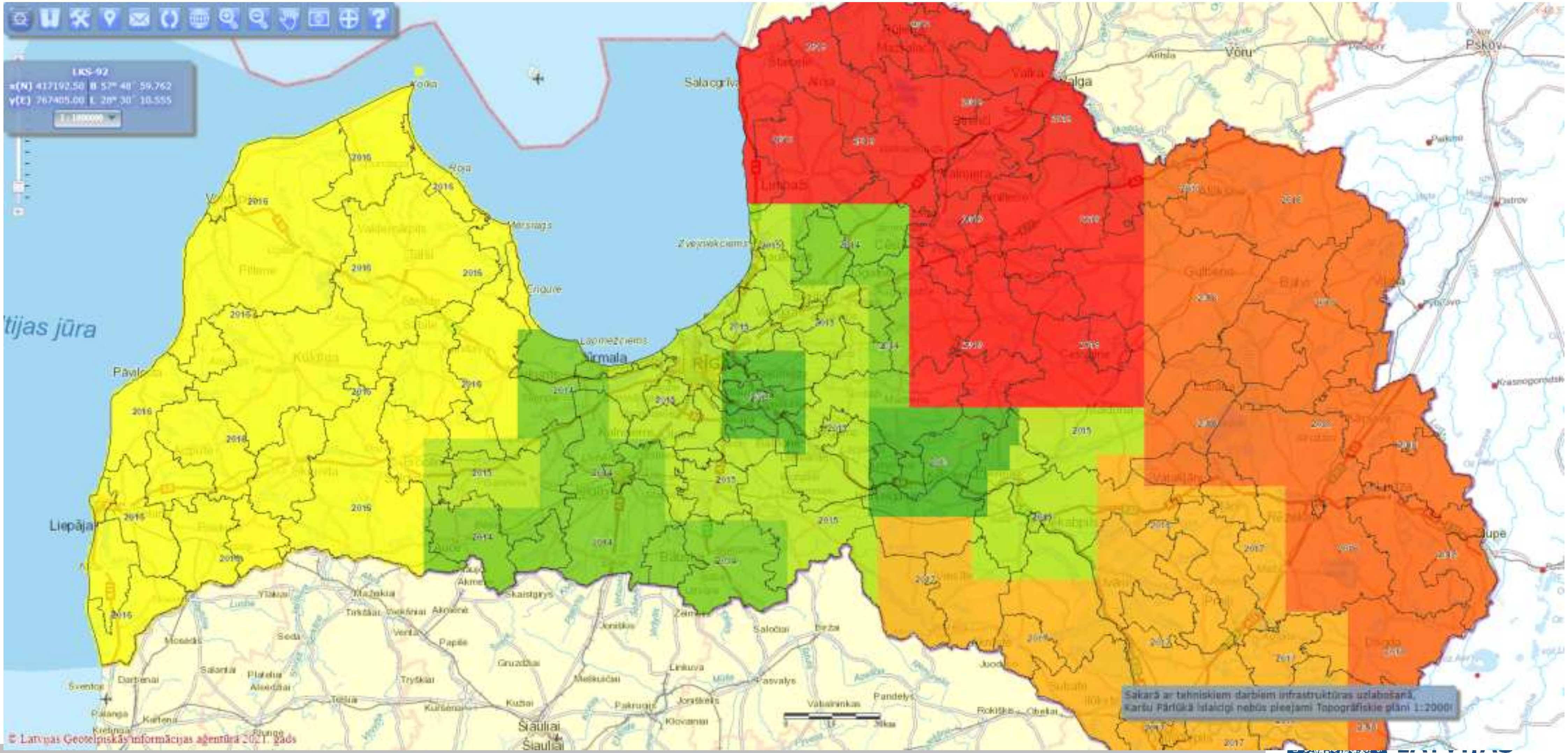
Data and data types

Aerial maps (0,25 cm)



LIDAR point clouds



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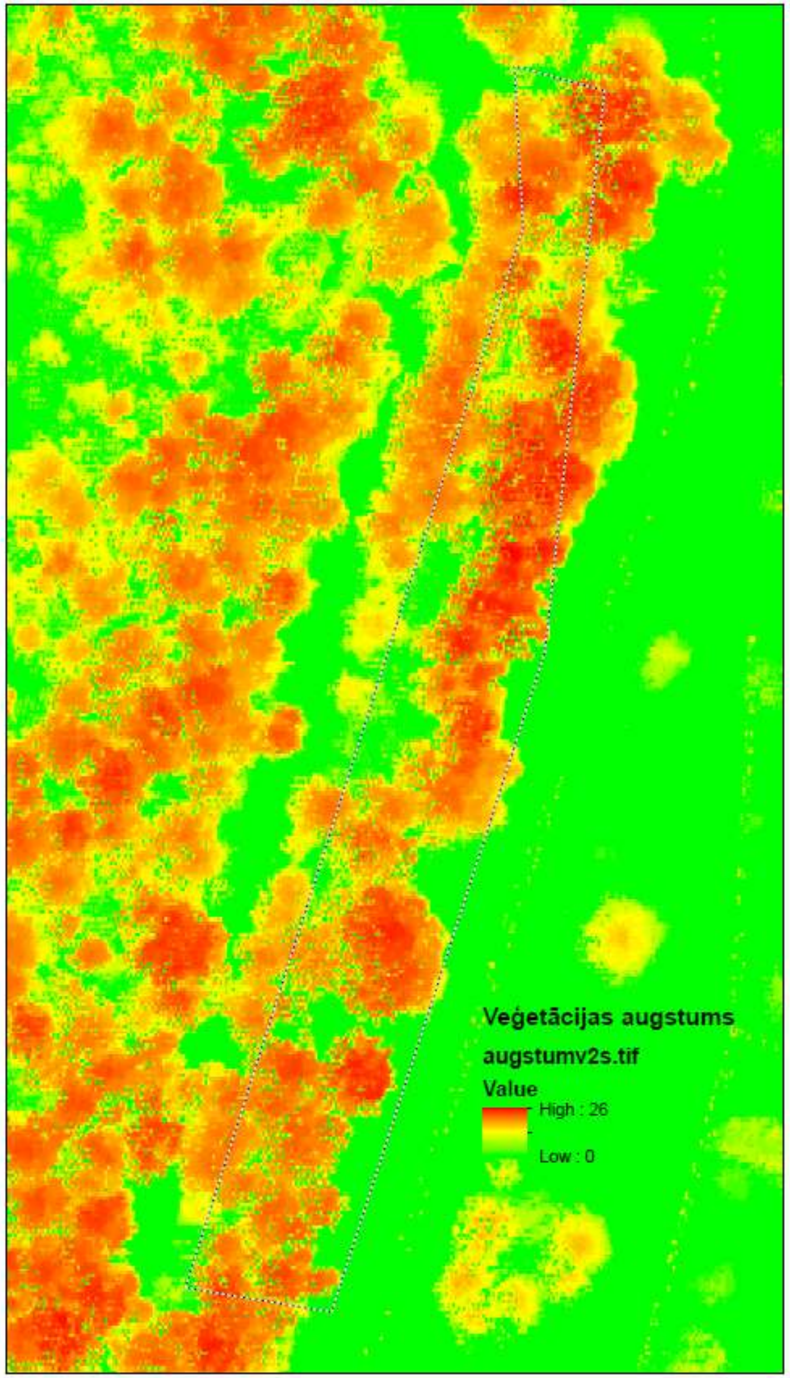
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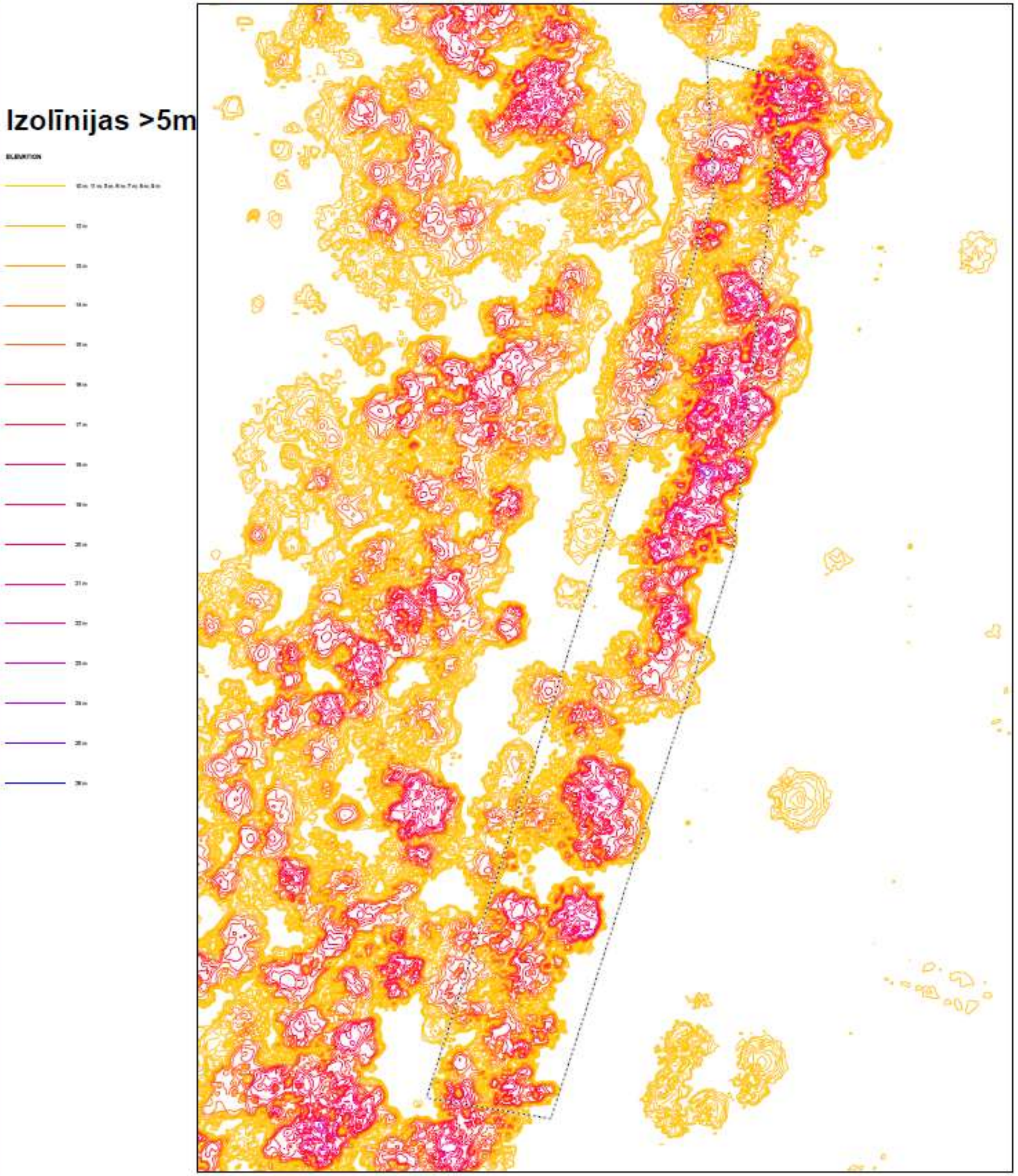
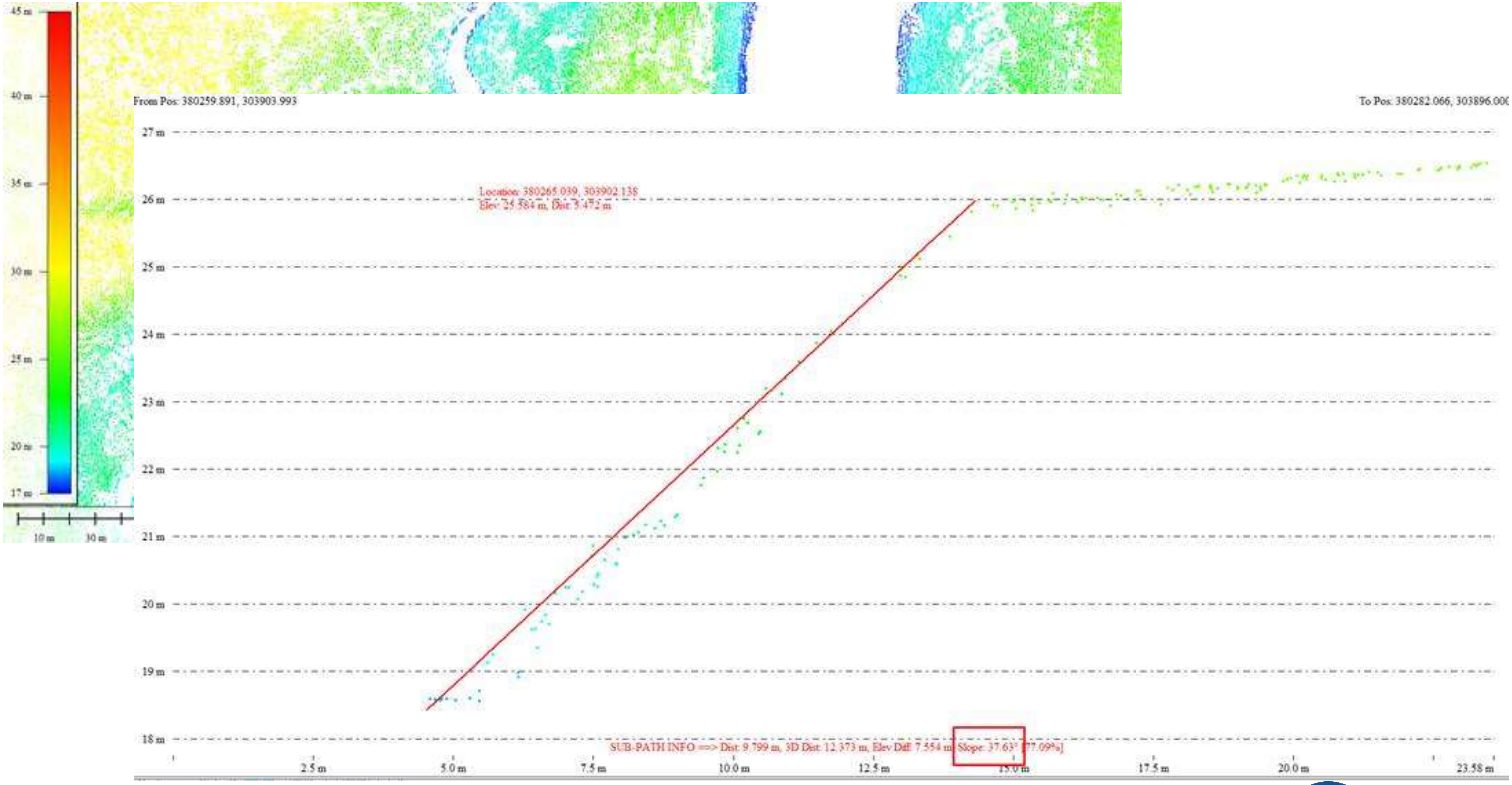
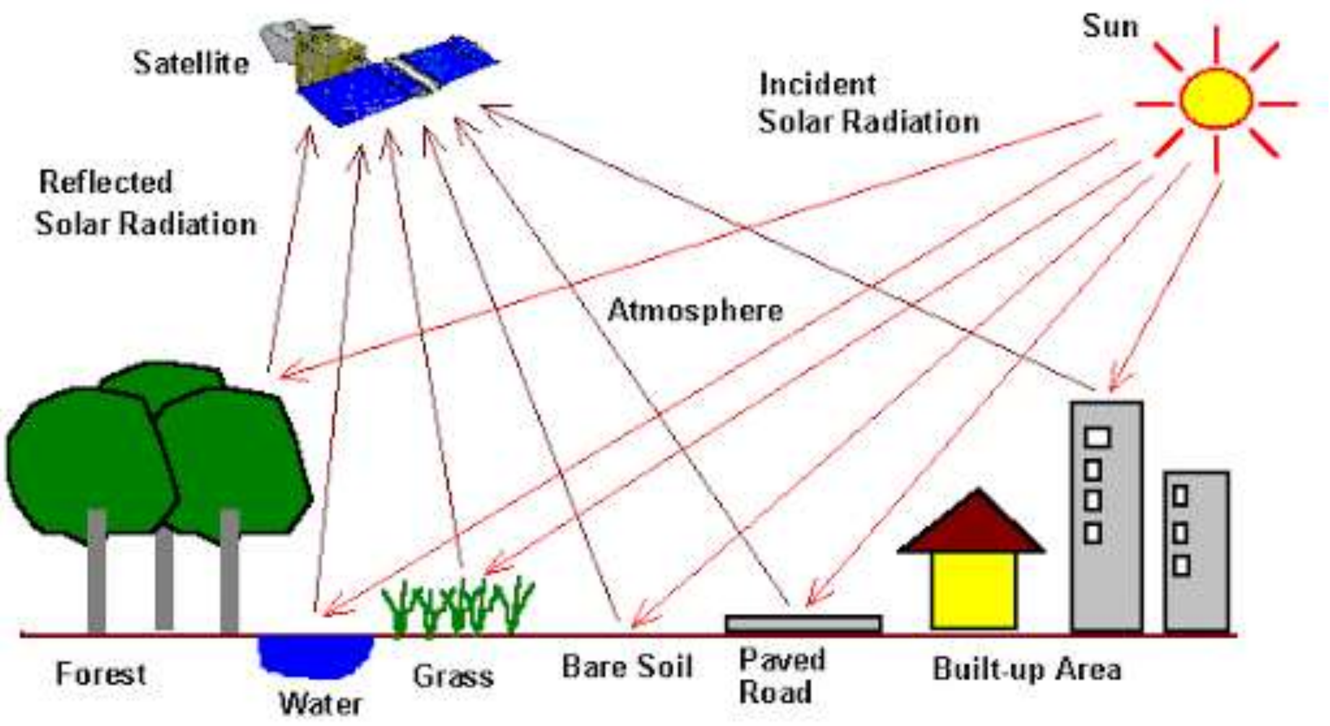
augstumv2s.tif
Value
High : 26
Low : 0


Izolīnijas >5m


From Pos: 380259.891, 303903.993
To Pos: 380282.066, 303896.00
Location: 380265.039, 303902.138
Elev: 25.584 m, Dist: 5.472 m
SUB-PATH INFO ==> Dist: 9.799 m, 3D Dist: 12.373 m, Elev Diff: 7.554 m, Slope: 37.63° [77.09%]
27 m
26 m
25 m
24 m
23 m
22 m
21 m
20 m
19 m
18 m
2.5 m
5.0 m
7.5 m
10.0 m
12.5 m
15.0 m
17.5 m
20.0 m
23.58 m
45 m
40 m
35 m
30 m
25 m
20 m
17 m
10 m
30 m

Satellites

- Sentinel-2 (10m)
- Landsat 8 (30m)
- Corona (1972) (2-5m)
- Google (1-2m)



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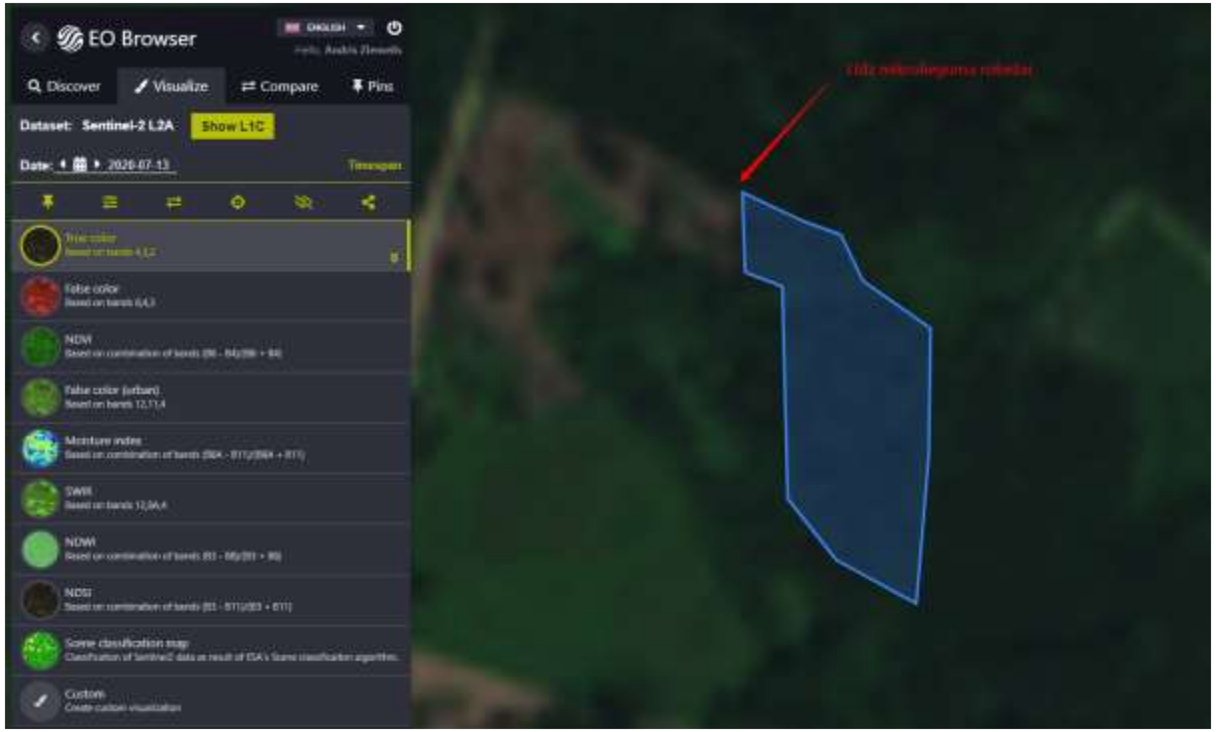
Sentinel-2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Visualize
Compare
Pins
Dataset: Sentinel-2 L2A
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Date:
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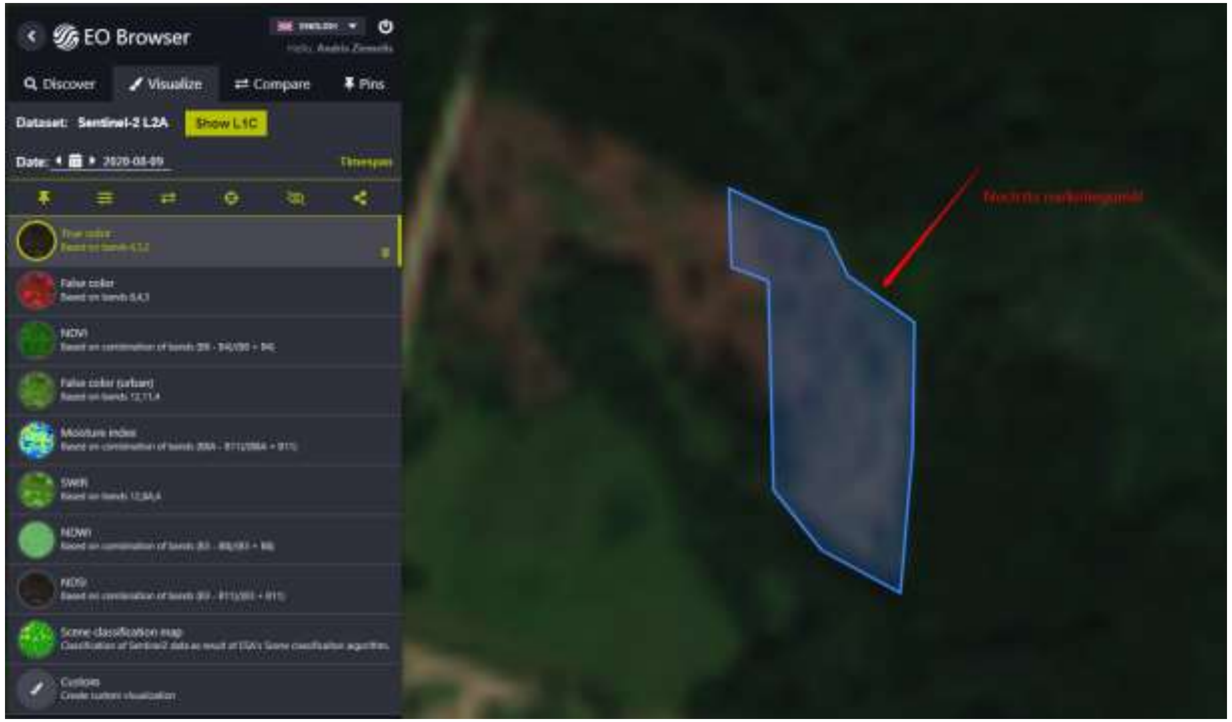
Timespan
False color
NDVI
False color (urban)
Moisture index
SWIR
NDWI
NDSI
Scene classification map
Custom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NDWI
NDSI
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Scientific work

FOREST MANAGEMENT IMPACT ON BLACK STORK (CICONIA NIGRA L.) HABITAT LANDSCAPE CHANGES IN THE FUTURE SCENARIO

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Abstract

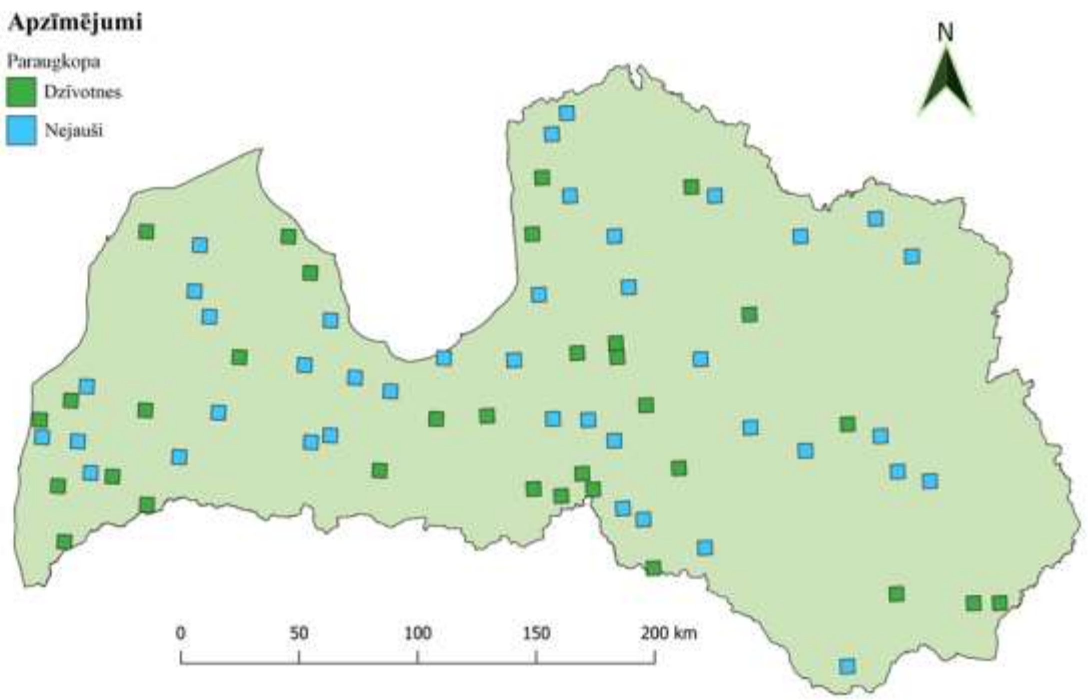
Forest management impact on black stork (Ciconia nigra L.) habitat landscape changes in the future scenario

Key Words: *habitat, suitable, forest stand, metapopulation, LANDIS*

In this study, potential landscape changes, and impacts on black stork habitats, considering the legislative framework and intensity of forestry activity, landscape scenarios for species habitats were modeled for the next 100 years. Using 32 micro-reserves and 40 randomly selected plots (6 x 6 km), LANDIS-II model identified a dynamic change in the forest landscape in time. Given the conditions applied to the metapopulation of the species, landscape characteristics were obtained using the Fragstats 4.2. model, thus describing the resulting changes in the forest landscape. The change in landscape metrics through statistical analyses was determined to reduce forest stands suitable for habitats over time and these stands will become more fragmented and isolated but over time significantly increases unsuitable stands. The scenario means that over time the availability of potential black stork sites is declining significantly and is becoming more isolated. In the current landscape inhabited by the black stork, there has been no statistically significant difference from the random landscape in Latvia, and over time, in the case of a future scenario, changes to the landscape of habitats do not differ from changes in the randomly chosen landscape. After 100 years, more suitable habitat sites are in randomly selected landscapes, linked to differences in the aging structure of forest stands between two samples and the planned management. Since trends in the results obtained and the current mechanism for protecting the micro-reserves of the black stork do not provide sustainable protection for the species, it is advisable to remove the status of micro-reserves. However, it would be possible to ensure the presence of the species preferred landscape sites by limiting the average amount to be felled in the forest landscape to less than the current average of 10%.

Methods

- 6 x 6 km (r=3km)
- 32 microreserves + 40 random samples
- LANDIS – II simulation
- Scenario with typical forest management practice



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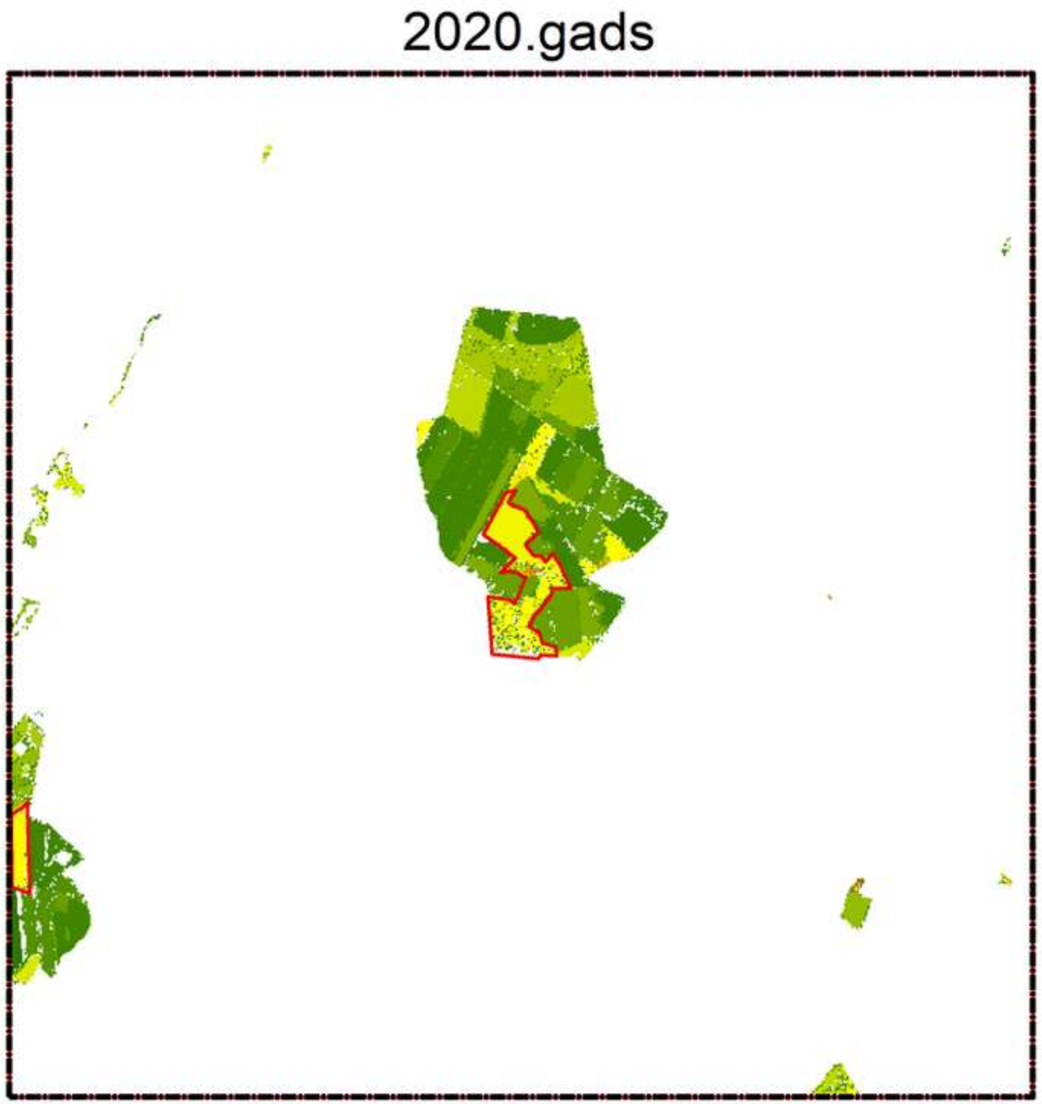
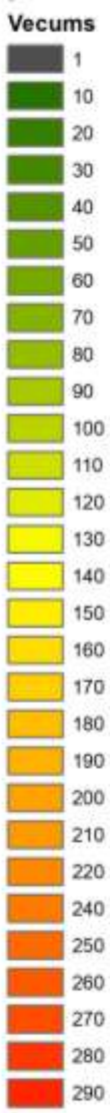
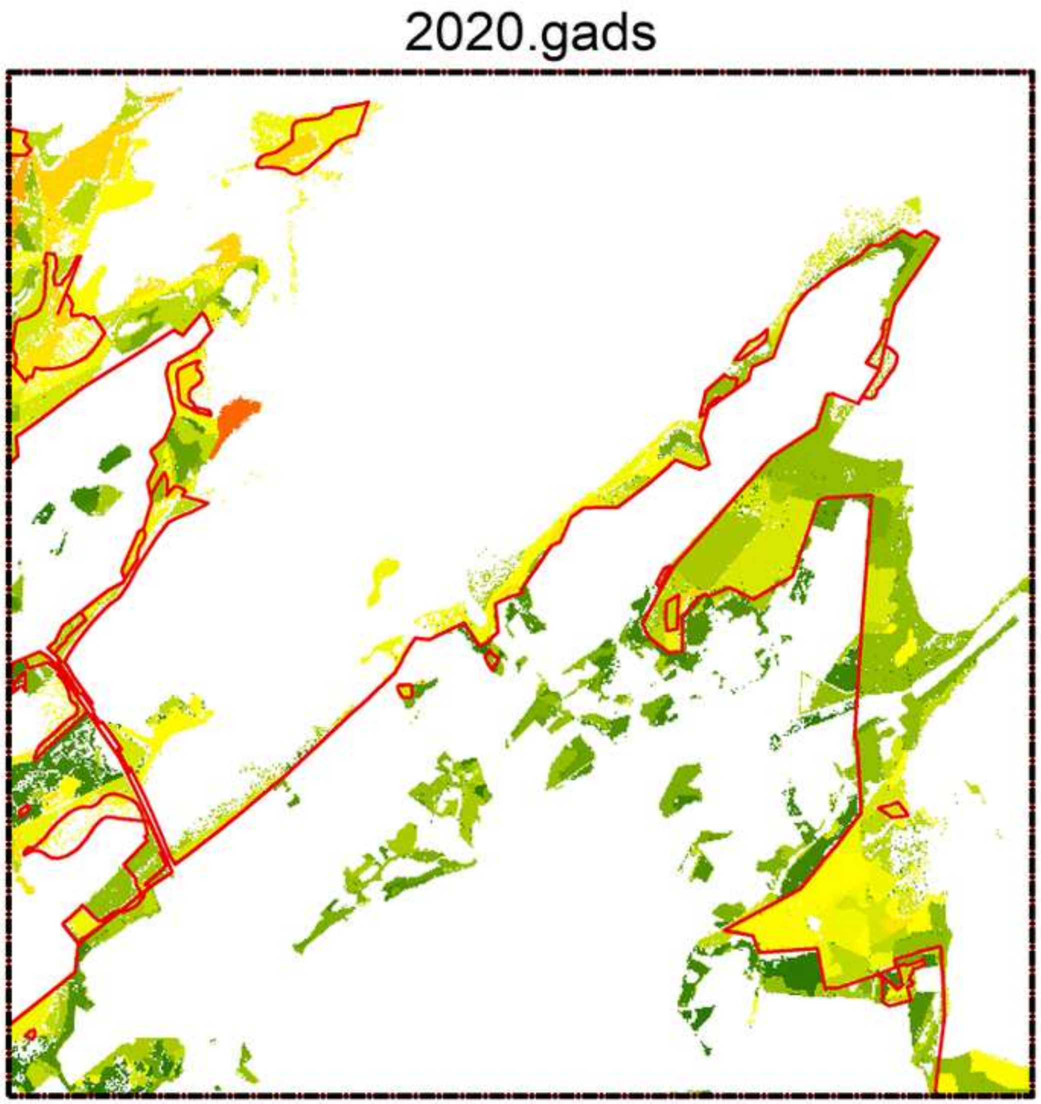
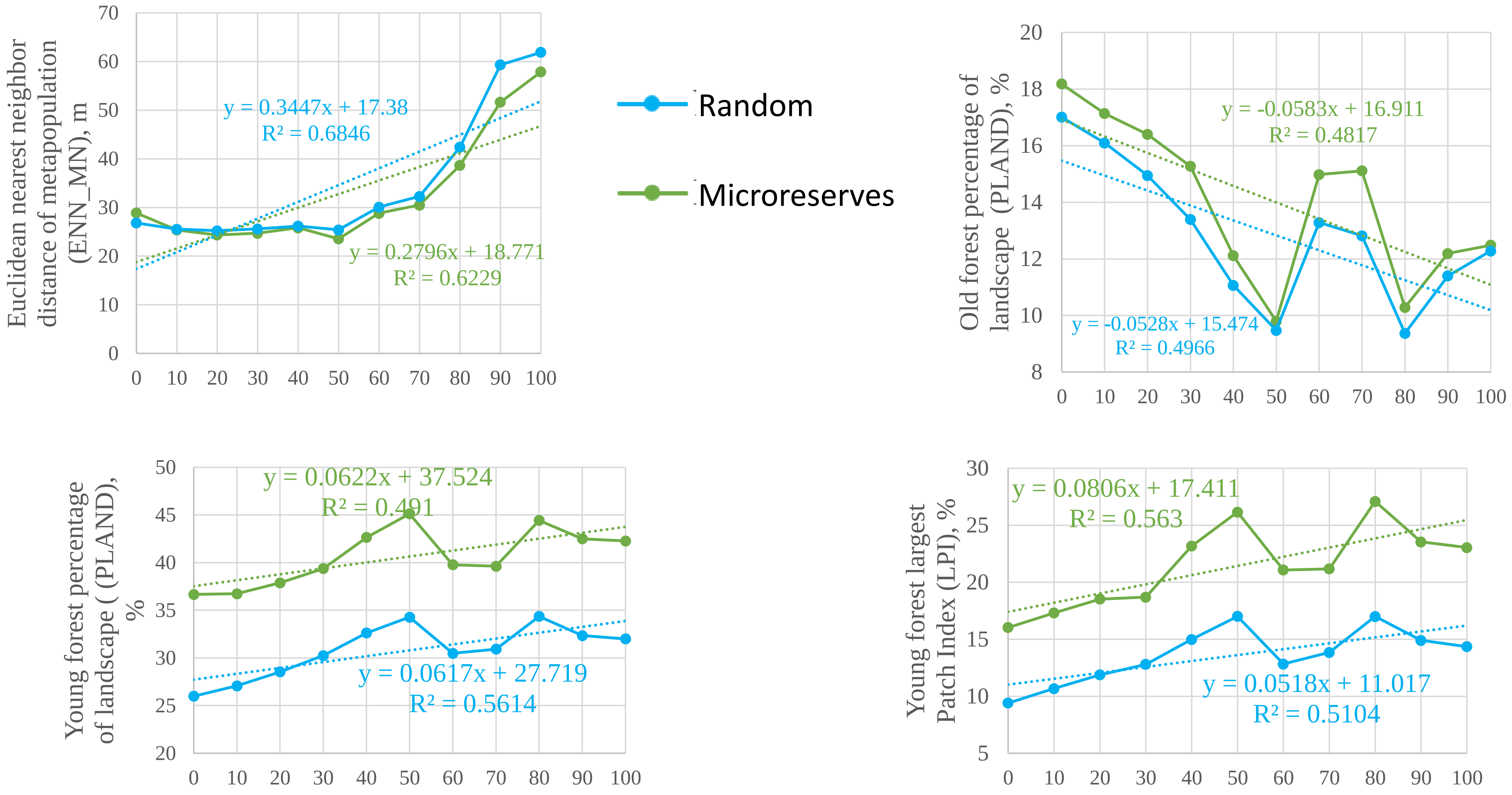
Microreserve landscape

Random point landscape









Euclidean nearest neighbor distance of metapopulation (ENN_MN), m
y = 0.3447x + 17.38
R² = 0.6846
y = 0.2796x + 18.771
R² = 0.6229
Random
Microreserves
Old forest percentage of landscape (PLAND), %
y = -0.0583x + 16.911
R² = 0.4817
y = -0.0528x + 15.474
R² = 0.4966
Young forest percentage of landscape ((PLAND), %
y = 0.0622x + 37.524
R² = 0.491
y = 0.0617x + 27.719
R² = 0.5614
Young forest largest Patch Index (LPI), %
y = 0.0806x + 17.411
R² = 0.563
y = 0.0518x + 11.017
R² = 0.5104

Impact of the legislative framework on the forest succession in the Gauja national park

LU 78. starptautiskā zinātniskā konference. Vides zinātne

NORMATĪVĀ REGULĒJUMA IETEKME UZ GAUJAS NACIONĀLĀ PARKA MEŽA EKOSISTĒMU SUKCESIJU

Andris Ziemelis

LU Ģeogrāfijas un Zemes zinātņu fakultāte, e-pasts: az08112@students.lu.lv

Likuma gars nosaka meža ekosistēmu nākotni, izvirzot ilgtermiņa mērķus tādus kā saglabāta bioloģiskā daudzveidība un izmantota ilgtspējīga mežu apsaimniekošana, nosakot virkni tagadnes nosacījumu un kārtību. Attiecībā uz īpaši aizsargājamo dabas teritoriju apsaimniekošanas un aizsardzības prasību noteikšanas kārtību, tiek izstrādāti dabas aizsardzības plāni, kuru izstrādes kārtībā ir konstatējamas juridiskas problēmas (Ziemelis 2019). Ņemot vērā vides taisnīguma apsvērumu un esošo likuma garu, minētie tagadnes labumi, kas saistīti ar meža ekosistēmām, ir jānodod arī nākamajām paaudzēm.

Izmantojot meža ekosistēmu attīstības simulācijas modeli LANDIS-II (Scheller et al. 2007) ar kokaugu sukcesijas (Mladenoff, He 1999) un mežsaimnieciskās darbības (Gustafson et al. 2000) algoritmu, modelēti divi 500 gadu nākotnes scenāriji Gaujas nacionālā parka (GNP) ainavā: I) dabiskās sukcesijas veidā (ar neiejaukšanos), II) normatīvā regulējuma noteiktā mežsaimnieciskās darbības ietekmē. Lai realizētu minētos scenārijus, sagatavoti četri informācijas avoti (1. att.): kokaugu sugu un to vecumgrupu izplatība ainavā, meža augšanas apstākļu tipi, mežsaimnieciskās darbības ierobežojumu veidi un virtuālie cirsmu lauki,

Where is a problem??

LATVIJAS REPUBLIKAS LIKUMS

Meža likums

Par īpaši aizsargājamām dabas teritorijām

Aizsargjoslu likums

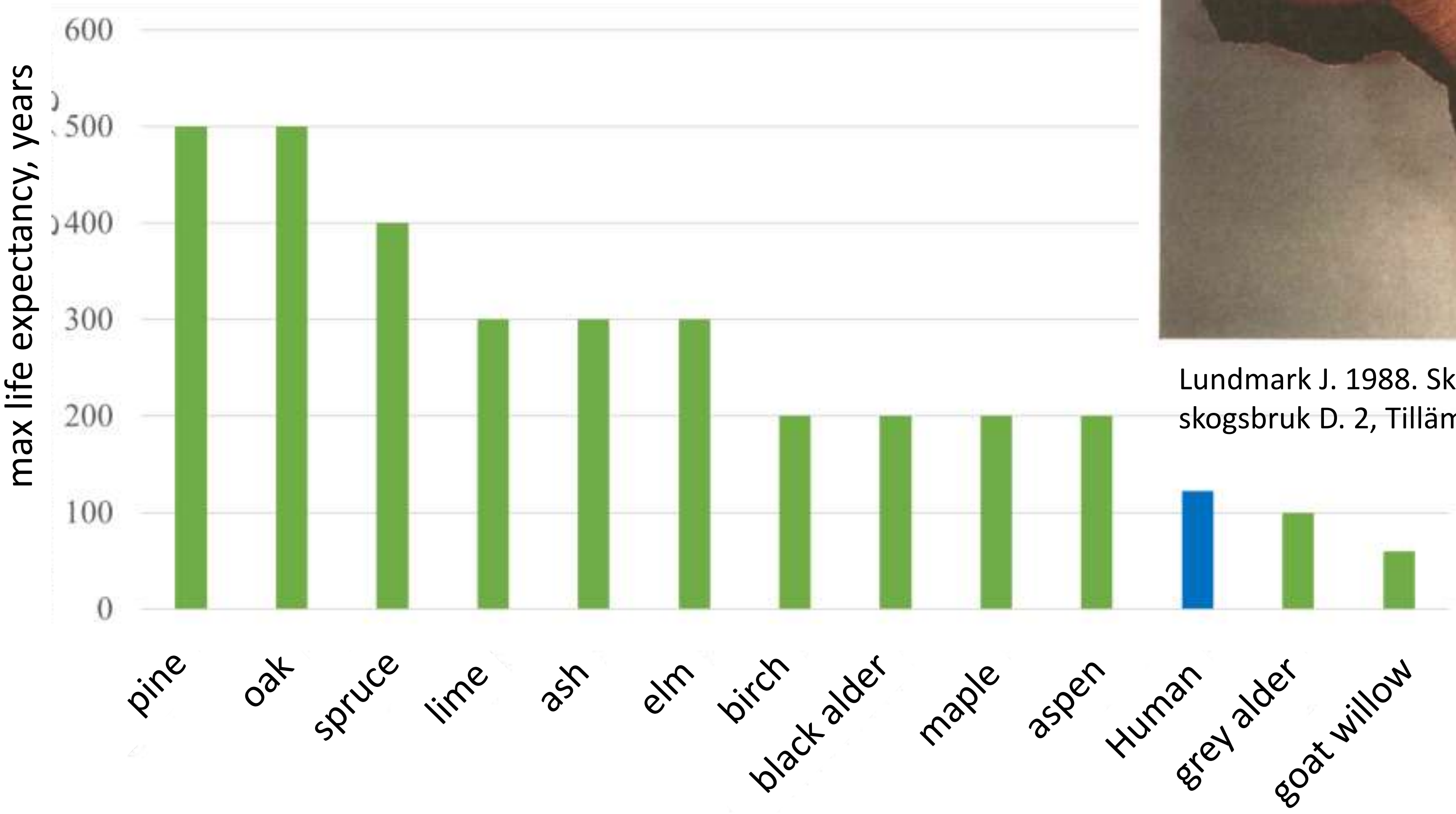
Gaujas nacionālā parka likums

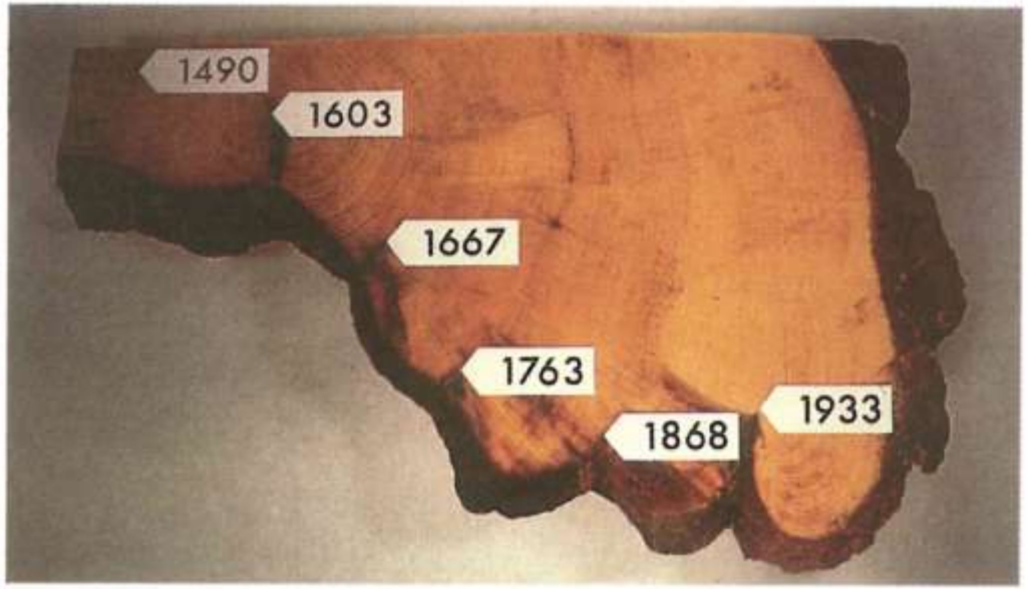
Meža atjaunošanas, meža ieaudzēšanas un plantāciju meža noteikumi

Īpaši aizsargājamo dabas teritoriju vispārējie aizsardzības un izmantošanas noteikumi

Gaujas nacionālā parka individuālie aizsardzības un izmantošanas noteikumi

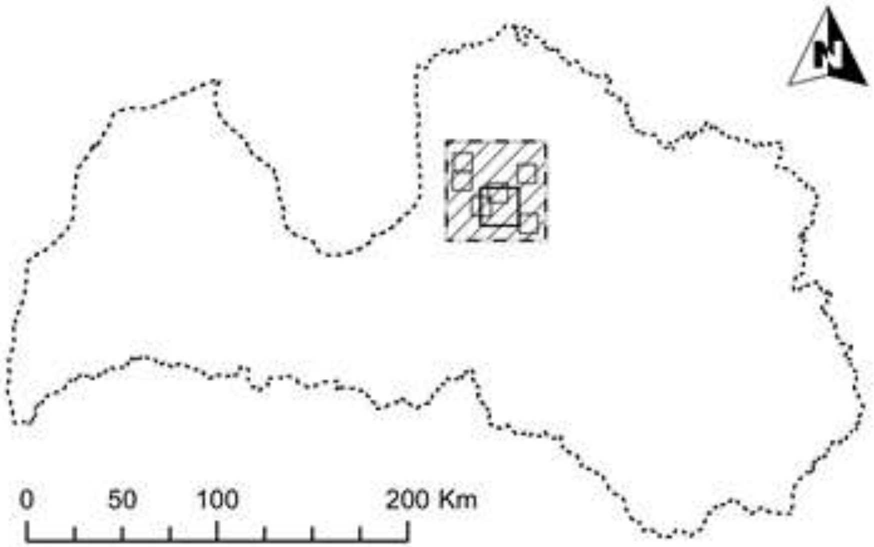
Noteikumi par mikroliegumu izveidošanas un apsaimniekošanas kārtību, to aizsardzību, kā arī mikroliegumu un to buferzonu noteikšanu

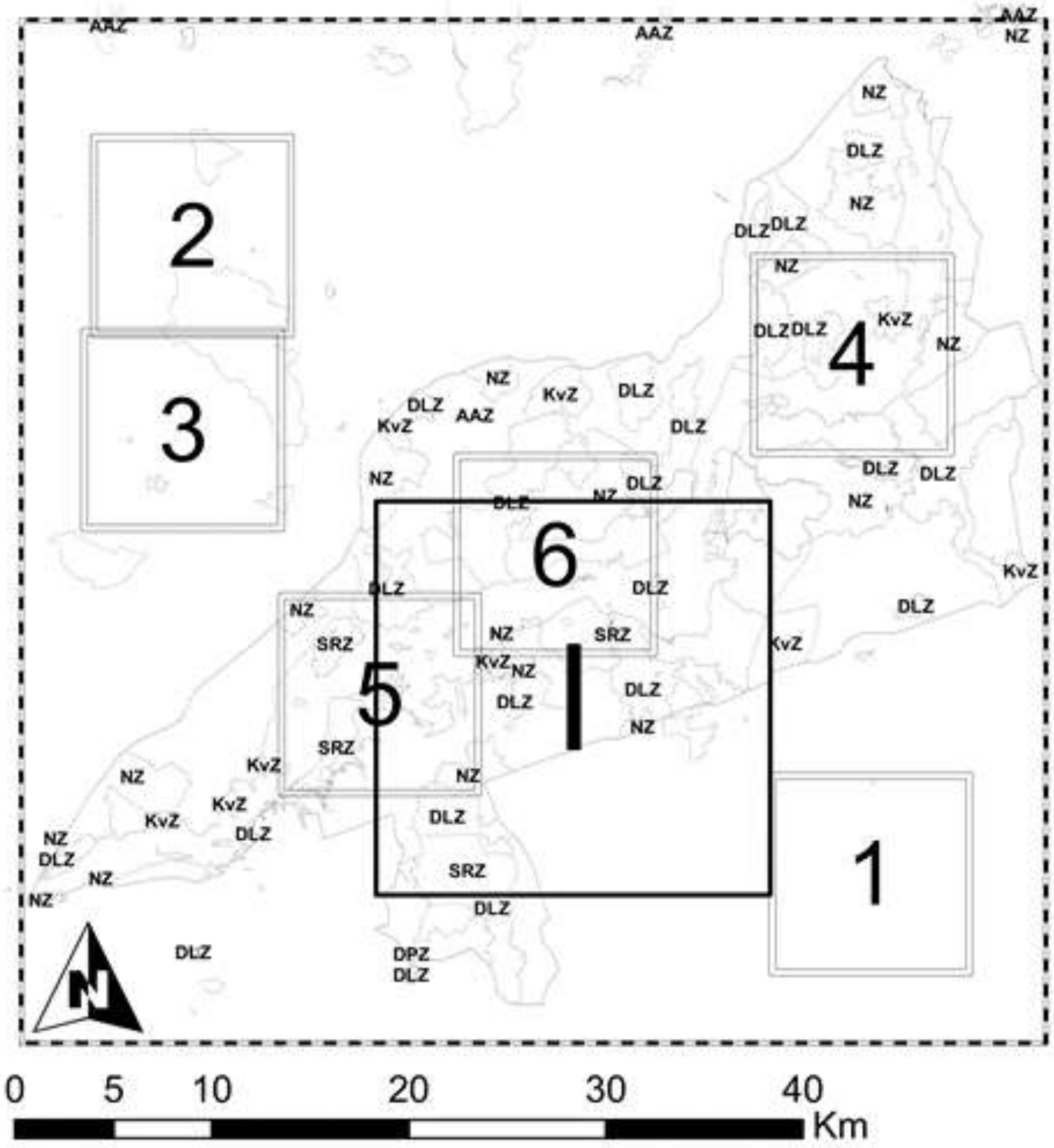




Lundmark J. 1988. Skogsmarkens ekologi ståndortsanpassat skogsbruk D. 2, Tillämpning. 360 p

Lange et al. 1978; Mauriņš, Zvirgzds 2006; Булыгин 1985, Creutzburg et al. 2017; The LANDIS II Foundation 2016, 5 Hof et al. 2018; Newton et al. 2013; Fryer 2011; Montoya 2014; Mangalis 2004, Punt 2020





Random plots 20x20km

Random plots 10x10km

plot 52x52km

Site zones

Natura 2000

Latvia`s border

Scenarios of forest succesion

- **Climax scenario (Nr.1.)**– without any disturbance,
- **Natural scenario (Nr.2)** – effect of wind and fire,
- **Legistative scenario (Nr.3)** – effect of antropogenic factors (legistative framework),
- **Alternative scenario (Nr.4) –** gap dynamics

Results

Territory of national park

1st un 4th scenarios

2nd scenario

3rd scenario

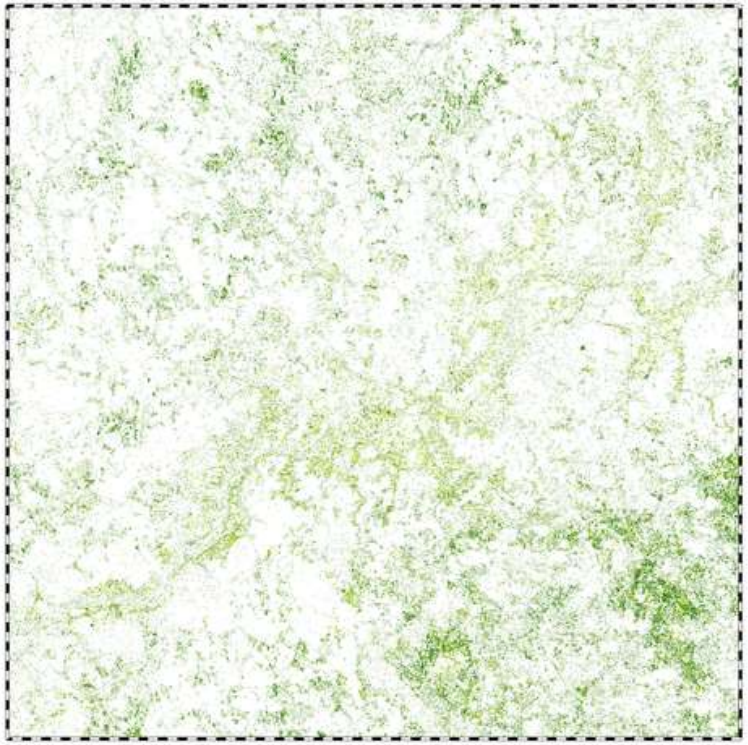
outside

3rd un 4th scenarios

2nd scenario

1st scenario

Sample plot 52x52km
Climax scenario



Years
1
10
400

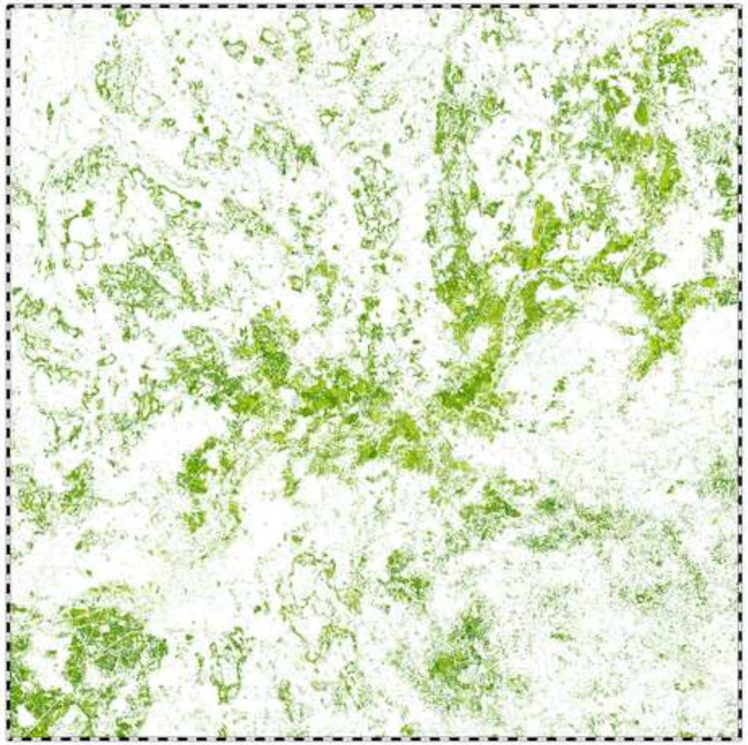
0 gadi

spruce

years
1
10
200

0 gadi

birch

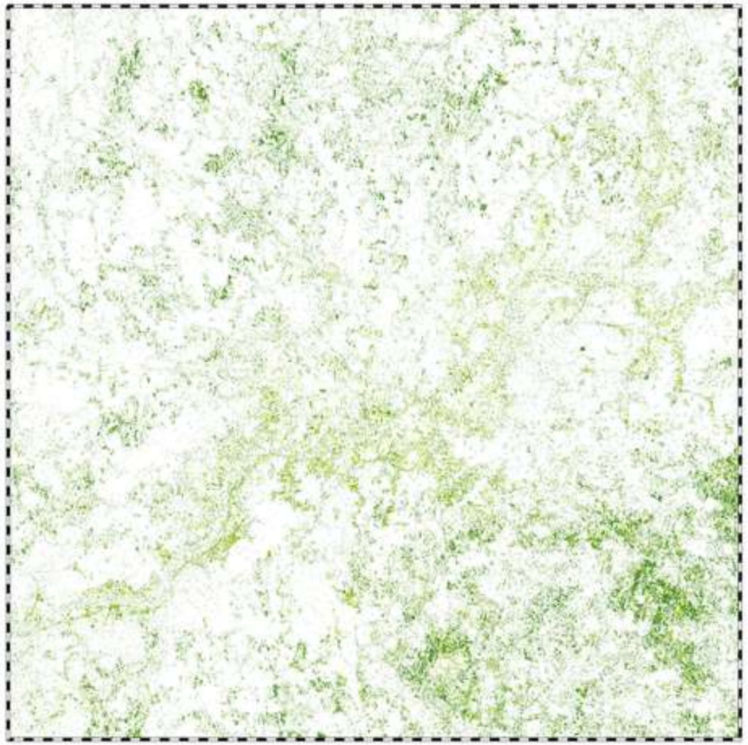


years
1
10
500

0 gadi

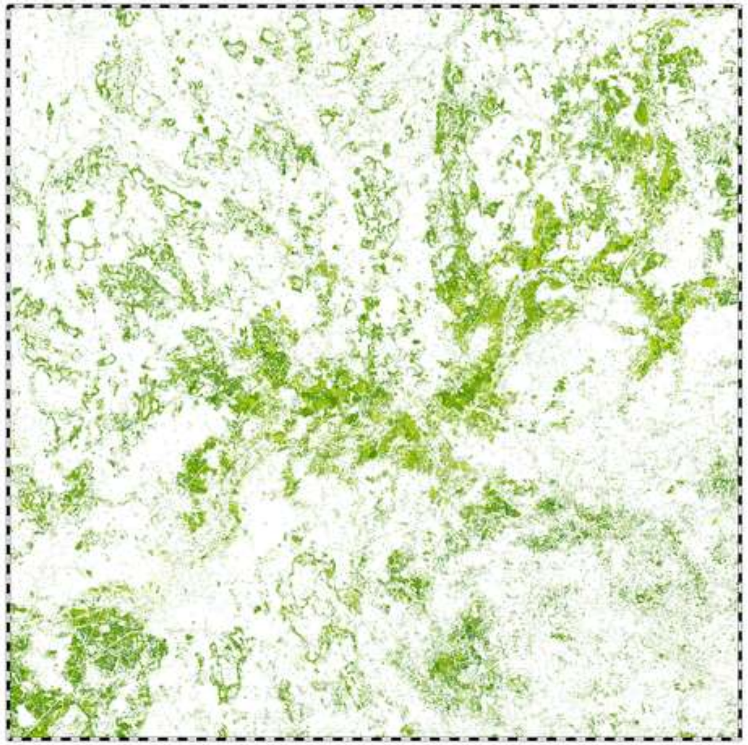
pine

Sample plot 52x52km
Legistative scenario

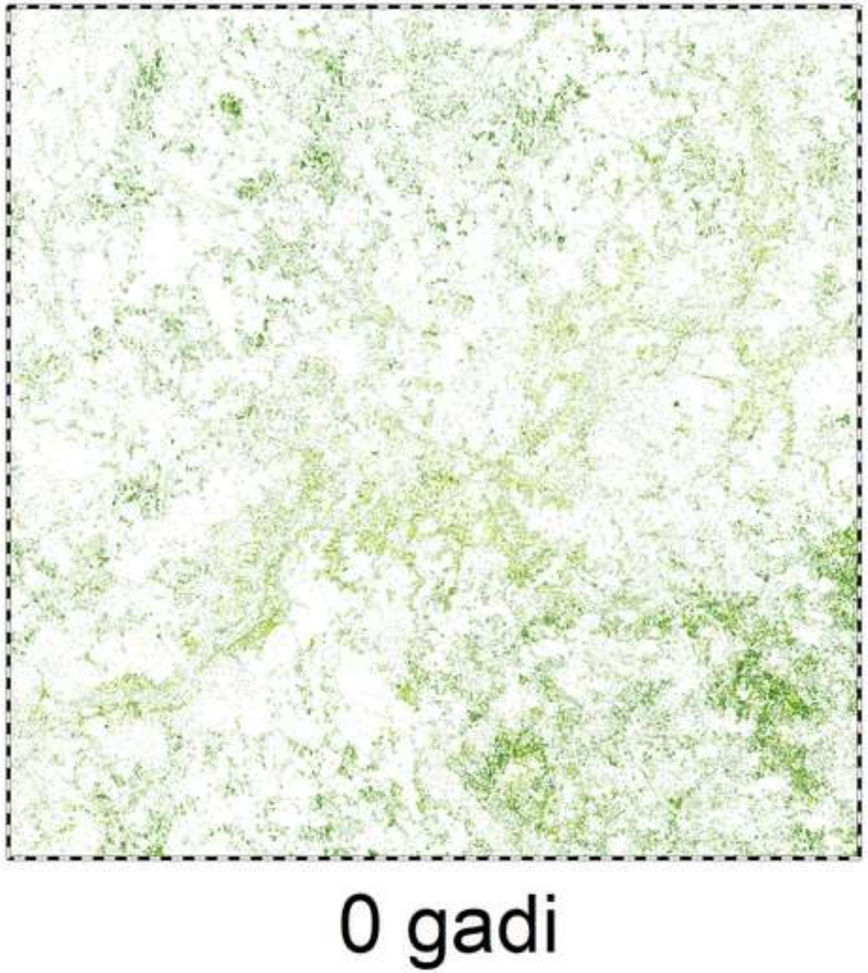


spruce

birch



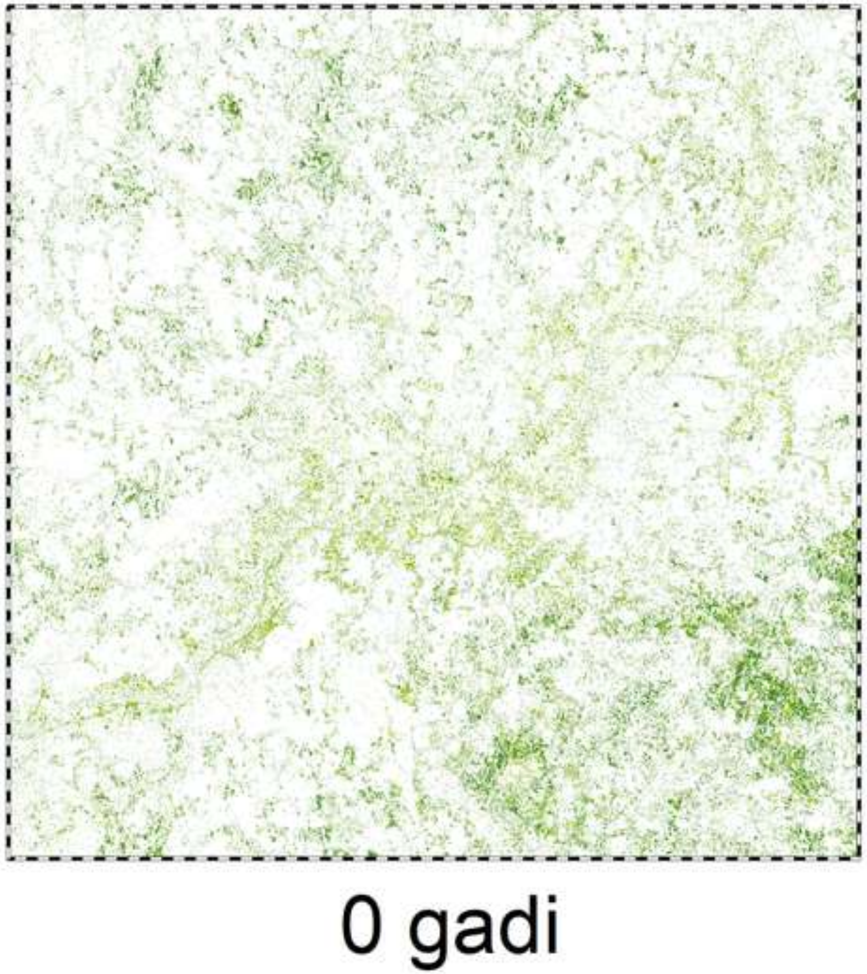
pine



climax scenario
spruce

Years

1
10
400



legistative scenario
spruce

Ziemelis, A. 2020. Meža apsaimniekošanas režīmu ietekme uz meža suckesijas gaitu Gaujas nacionālā parka teritorijā laika posmā no 2020.-2520.gadam. Maģistra darbs

0 gadi

climax scenario
birch

Years

1
10
200

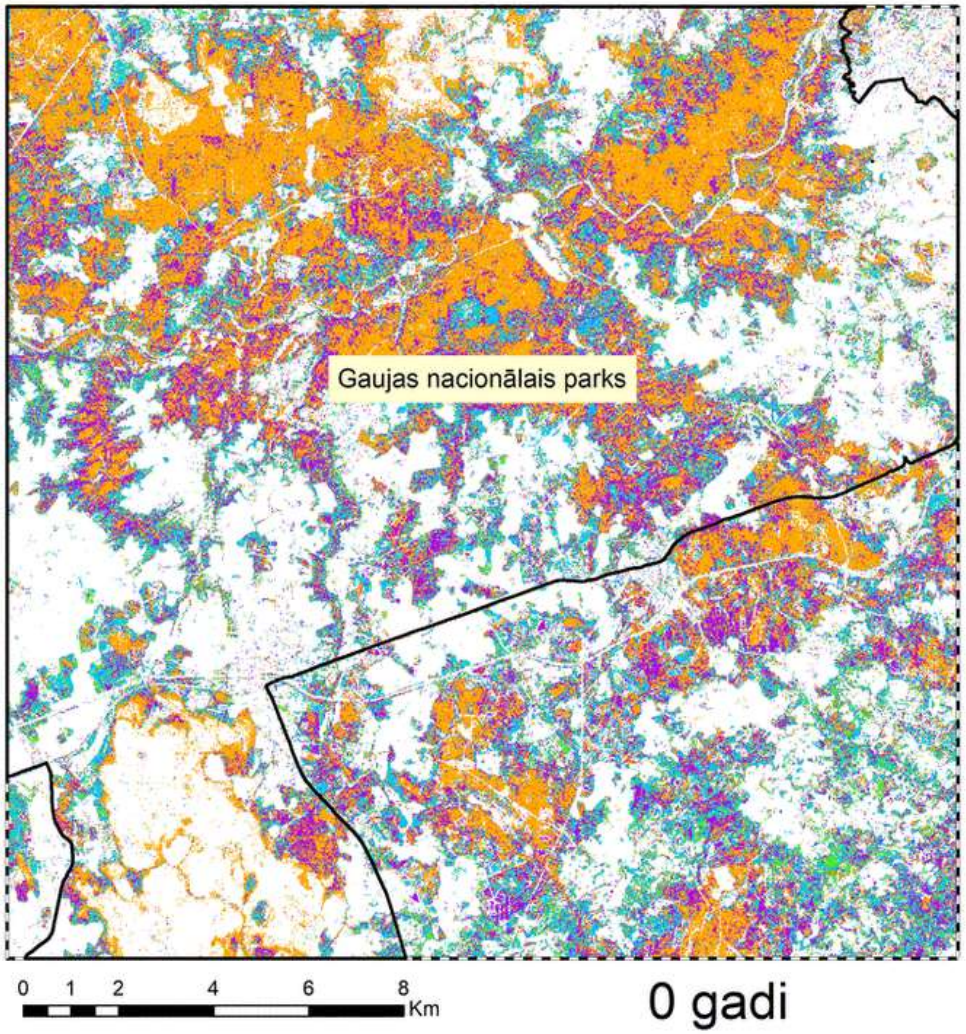
0 gadi

legistative scenario
birch

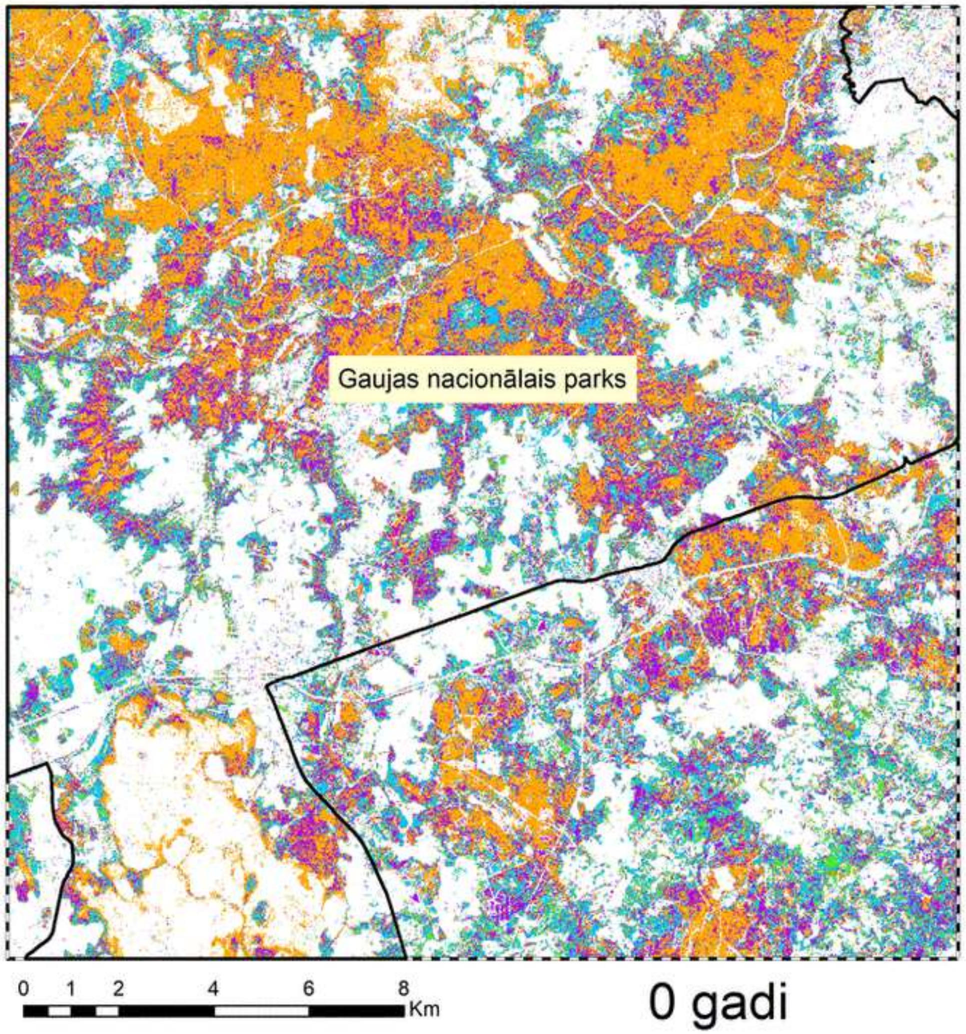
Ziemelis, A. 2020. Meža apsaimniekošanas režīmu ietekme uz meža suksesijas gaitu Gaujas nacionālā parka teritorijā laika posmā no 2020.-2520.gadam. Maģistra darbs

Random sample plot 20x20km

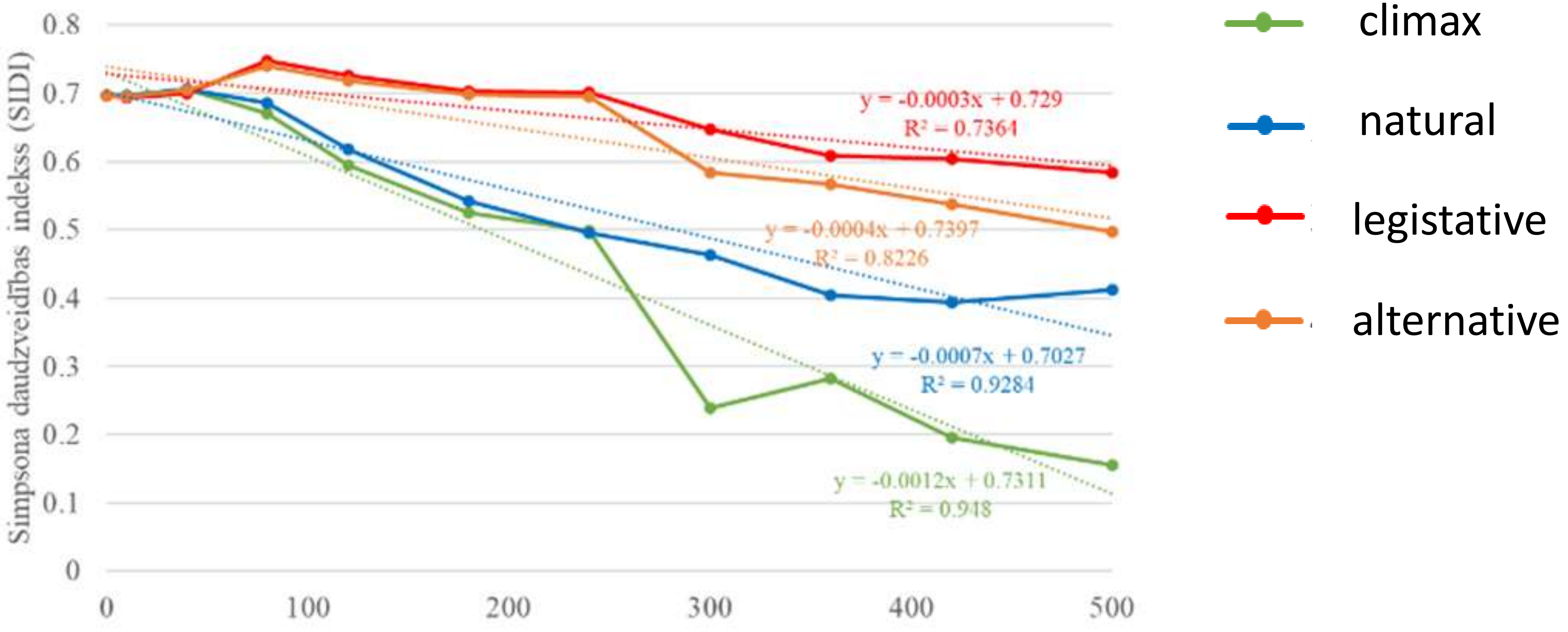
Climax scenario



Legistative scenario



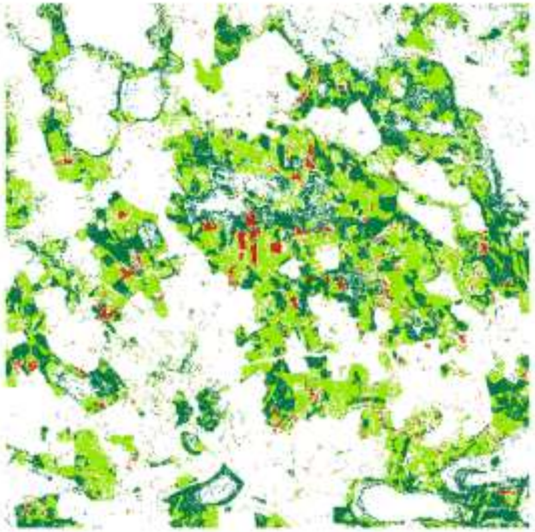
Dynamics of tree species diversity



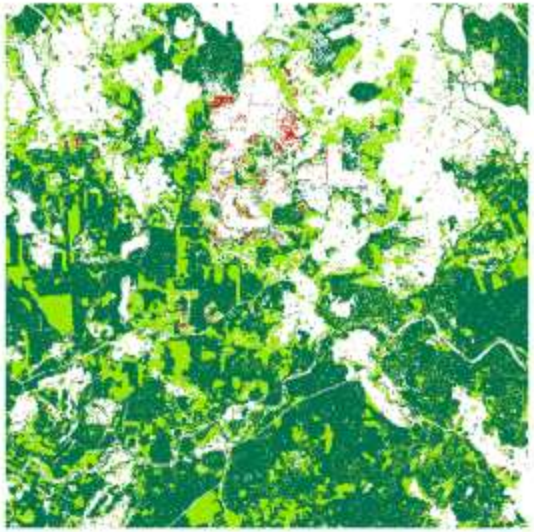
Random sample plots 10x10km
Legistative scenario

GNP

Outside



0 gadi

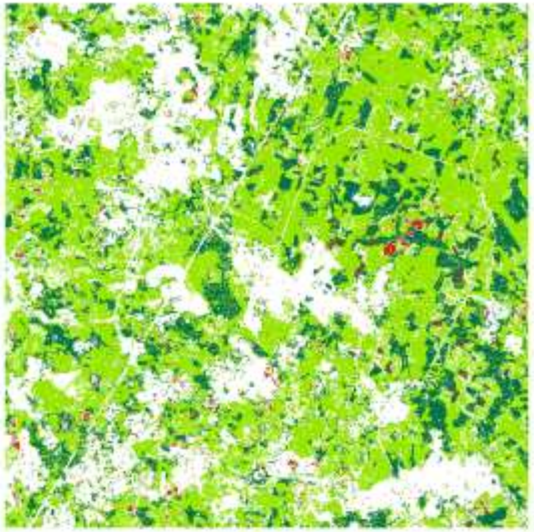


0 gadi

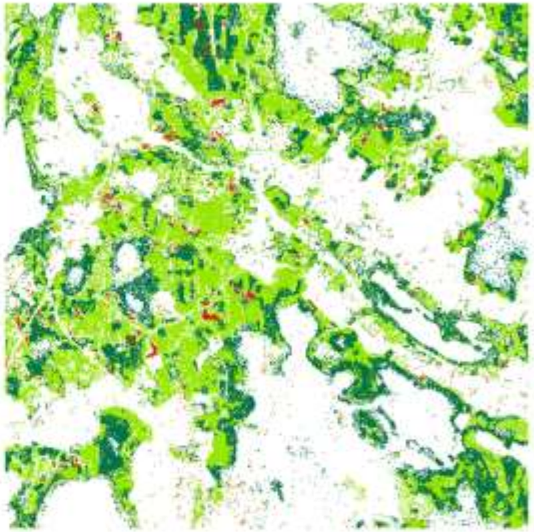
Old forests >70 years

Young forests <70 years

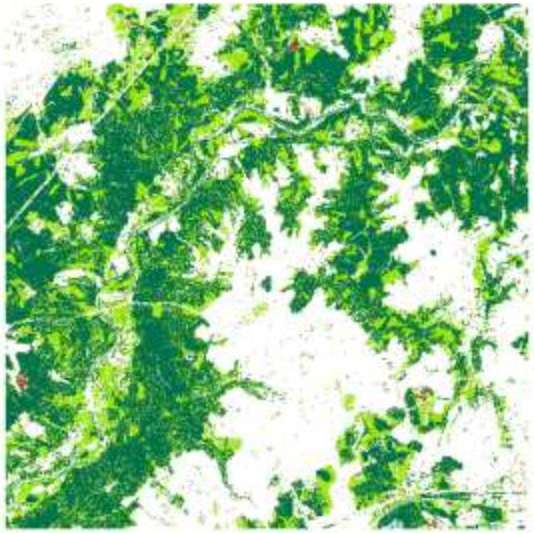
Disturbed area (clearcuts)



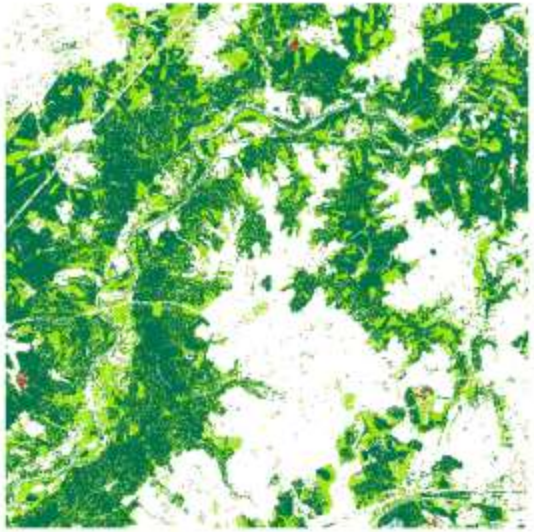
0 gadi



0 gadi



0 gadi



0 gadi

Validation of the results of the LANDIS forest simulation model

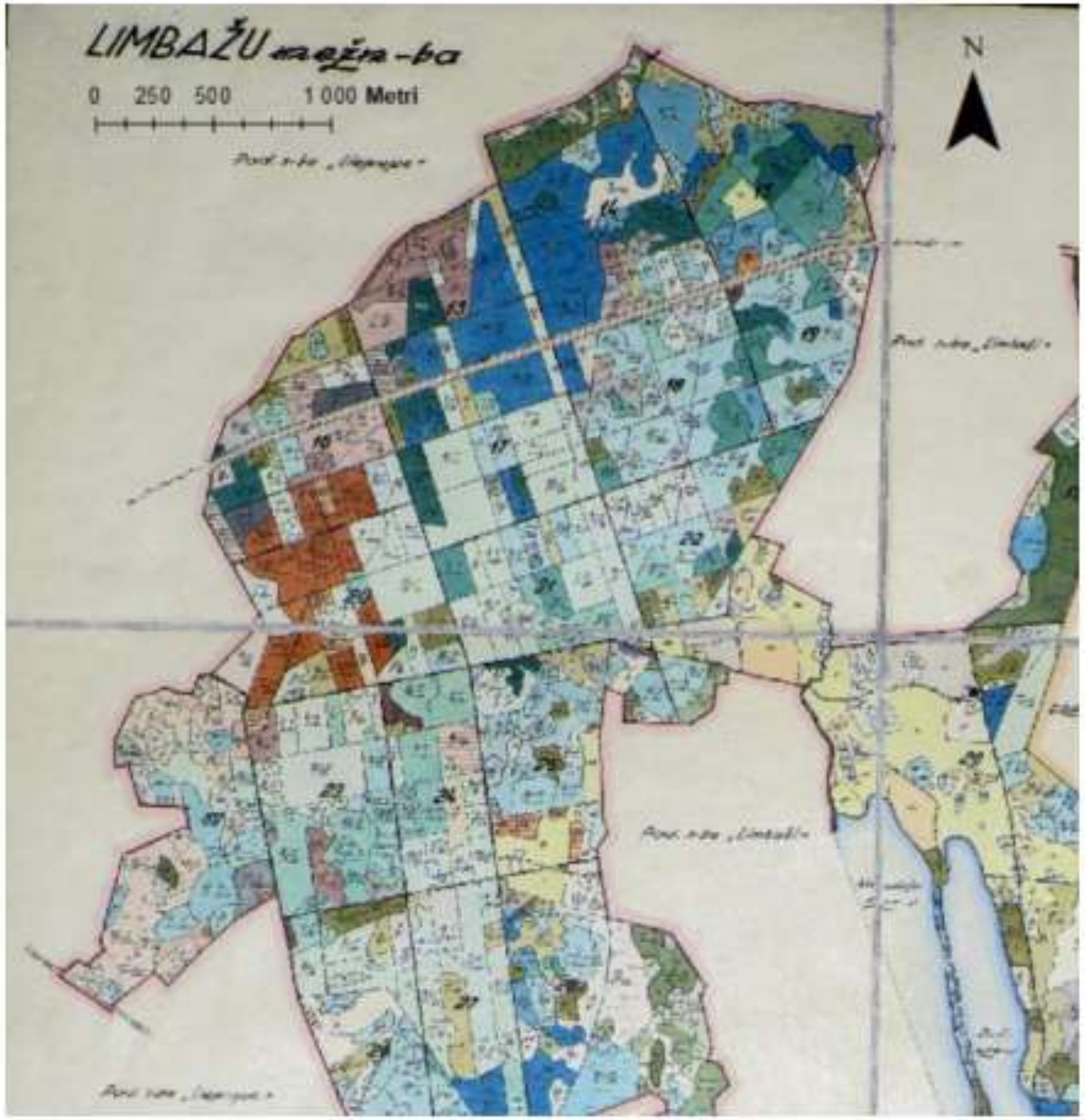
MEŽA SUKCESIJAS MODEĻA LANDIS II SIMULĀCIJAS REZULTĀTU VALIDĀCIJA LAIKA POSMĀ NO 1961.-2020. GADAM PSRS LIMBAŽU MEŽNIECĪBAS TERITORIJĀ

Gatis Patmalnieks, Andris Ziemelis

LU Ģeogrāfijas un Zemes zinātņu fakultāte, e-pasts: gp18017@lu.lv; az08112@lu.lv

Aizvien vairāk pieaug nepieciešamība pēc meža ainavu attīstības modeļu izmantošanas ekoloģiskajos pētījumos. Līdz šim Latvijā meža dinamiskā attīstības modelēšana ir veikta salīdzinoši maz, taču pēdējos gados veiktie pētījumi aizvien biežāk norāda uz nepieciešamību šos modeļus izmantot. Tie var kalpot kā analītiskais instruments lēmumu pieņemšanā meža apsaimniekošanā (Gustafson et al. 2010). Taču viens no būtiskākajiem trūkumiem šo modeļu izmantošanā ir spēja tos validēt. Modeļa validācija būtu definējama kā spēja novērtēt modeļa patiesību un parasti to definē kā konkrētā modeļa darbības novērtējumu, pamatojoties uz modeļa izejas datu salīdzinājumu ar pieejamiem empīriskajiem datiem. Ekoloģiskajiem modeļiem, kas simulē nākotnes notikumus, acīmredzami, validācija ir ierobežota vai pat nav iespējama, un tā būtu jāinterpretē kā realitātes vienkāršošana un tā simulācijas virziena

Forest inventory data (1961)



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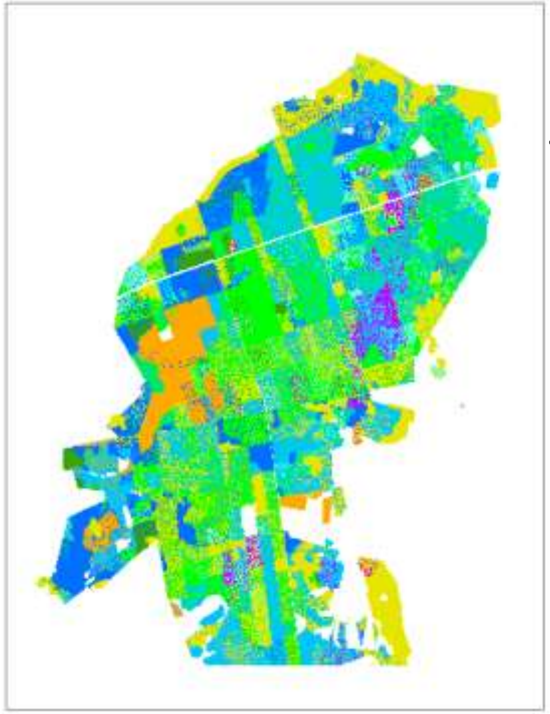
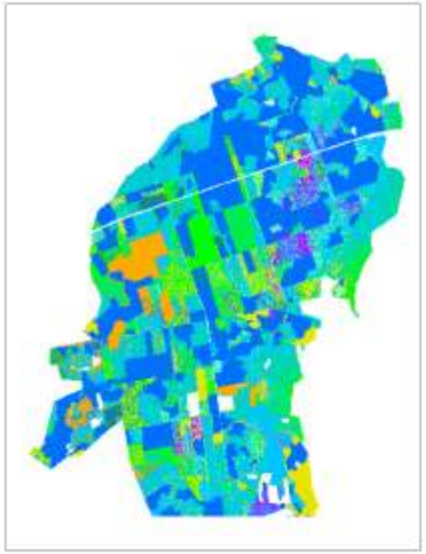
Validation



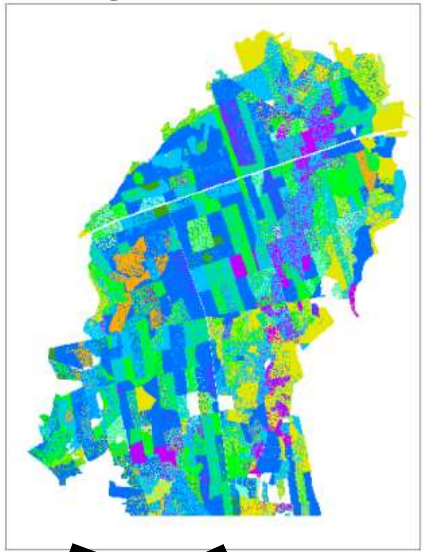
Digitised 1961 inventory data

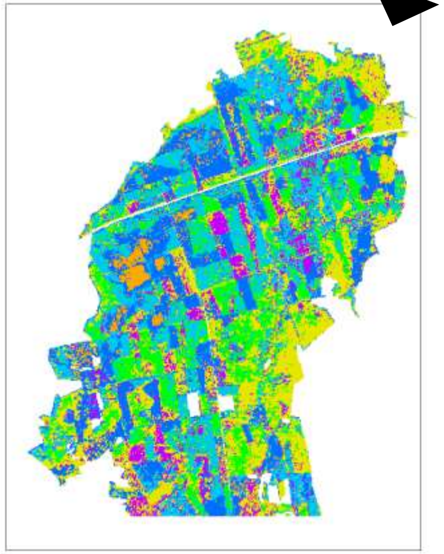
Simulation (60 years)

LANDIS-II

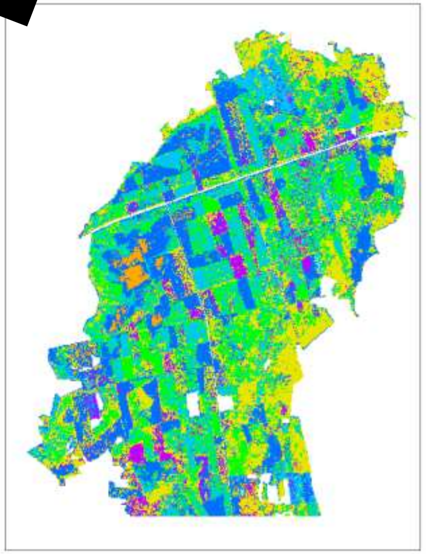


Digitised 2021 inventory data





Vector Support Machine



Random Forest Algorithm

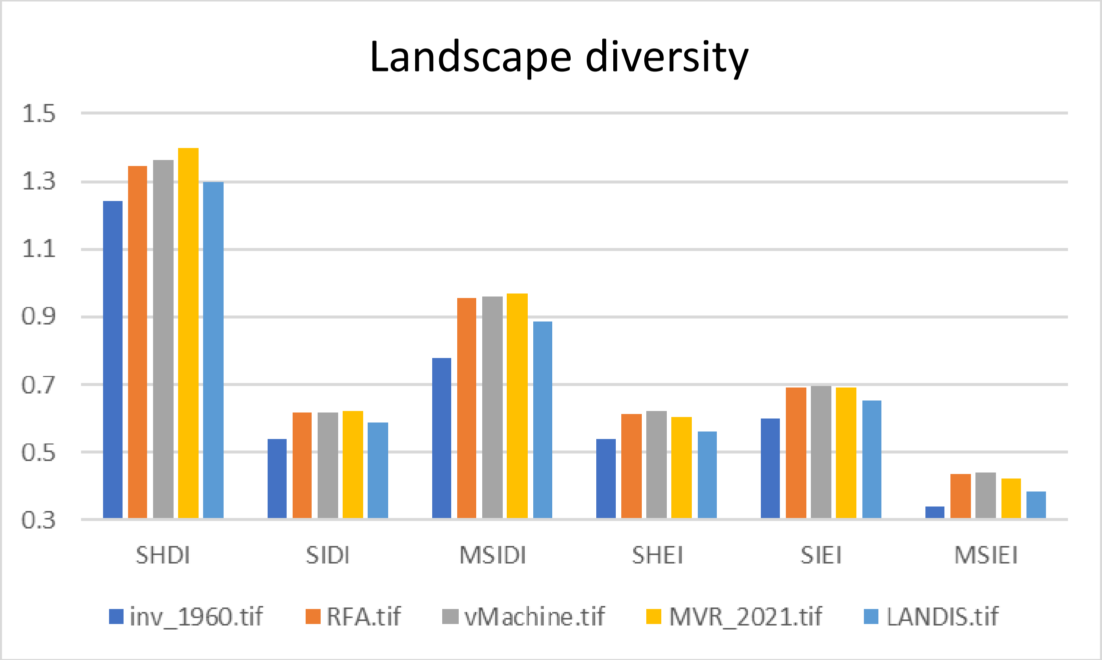
Sentinel-2
false colour

Patmalnieks, G., Ziemelis, A. 2021.

Correlations

			LANDIS-II	inv_196	MVR_2021	vMachine	RFA
Kendall's tau_b	LANDIS-II	Correlation Coefficient	1.000	.453**	.210**	.129**	.133**
		Sig. (2-tailed)	.	.000	.000	.000	.000
		N	722	651	721	714	722
	inv_196	Correlation Coefficient	.453**	1.000	.263**	.202**	.217**
		Sig. (2-tailed)	.000	.	.000	.000	.000
		N	651	652	651	648	652
	MVR_2021	Correlation Coefficient	.210**	.263**	1.000	.312**	.410**
		Sig. (2-tailed)	.000	.000	.	.000	.000
		N	721	651	731	723	731
	vMachine	Correlation Coefficient	.129**	.202**	.312**	1.000	.560**
		Sig. (2-tailed)	.000	.000	.000	.	.000
		N	714	648	723	724	724
	RFA	Correlation Coefficient	.133**	.217**	.410**	.560**	1.000
		Sig. (2-tailed)	.000	.000	.000	.000	.
		N	722	652	731	724	732

**. Correlation is significant at the 0.01 level (2-tailed).



Row Labels	inv_1960.tif		LANDIS.tif	MVR_2021.tif	RFA.tif	vMachine.tif
Aspen	193.34	>	134.95	166.4	226.2	185.75
Gray alder	189.64	>	74.03	147.15	259.26	272.53
Birch	246.21	<	333.18	290.62	221.87	239.47
Spruce	88.74	<	317.75	282.86	227.05	188.36
Black alder	23.31		21.82	71.36	66.92	108.02
Ash	41.47	>	31.75	40.65	4.37	7.02
Oak	16.68		17.37	9.34	2.43	0.09
Pine	46.86		36.58	24.56	16.4	24.3

Patmalnieks, G., Ziemelis, A. 2021. nepublicēti dati

Deep learning algorithm for detection of dead trees in the protected areas

DZIĻĀS MAŠĪNMĀCĪŠANĀS ALGORITMA IZMANTOŠANA AIZSARGĀJAMO TERITORIJU IETEKMES NOTEIKŠANĀ UZ SAUSOKŅU IZPLATĪBU ZIEMEĻKURZEMĒ

Andris ZIEMELIS
LU Ģeogrāfijas un Zemes zinātņu fakultāte, e-pasts: az08112@students.lu.lv

Pēdējos gados attālajā izpētē ar vien biežāk tiek izmantota datorredze, kas ļauj rastra attēlos detektēt lietotājam vēlamos objektus, piemēram, aisbergus, kuģus, transportlīdzekļus, ēkas, ūdenstilpes vai pat atsevišķus dzīvnieku indivīdus, ja ir pietiekami augstas izšķirtspējas attēli. Kopumā jāsecina, ka ir salīdzinoši liela izvēle un iespējas kā veikt objektu detektēšanu rastra attēlos. Visbiežāk tiek lietoti *TensorFlow* un *PyTorch*, kas ir atvērtie pirmkodi (angļu: open source), pieejamie modeļi, tādi kā R-CNN, FasterR-CNN, RetinaNet, SingleShotDetector, YOLOv3 un citi.

Objektu detektēšanas procesā lietotājs parasti saskaras ar diviem izaicinājumiem: 1) detektējamie objekti ir pārāk mazi, kas apgrūtina struktūru atpazīšanu, 2) attēlos izplatītas ēnas, gaismas un citi ārējie faktori, kas izmaina pikseļu vērtības. YOLOv3 modelis daļēji atrisina iepriekšminētos izaicinājumus. Tas ir salīdzinoši ātrs un precīzs reālā laika objektu

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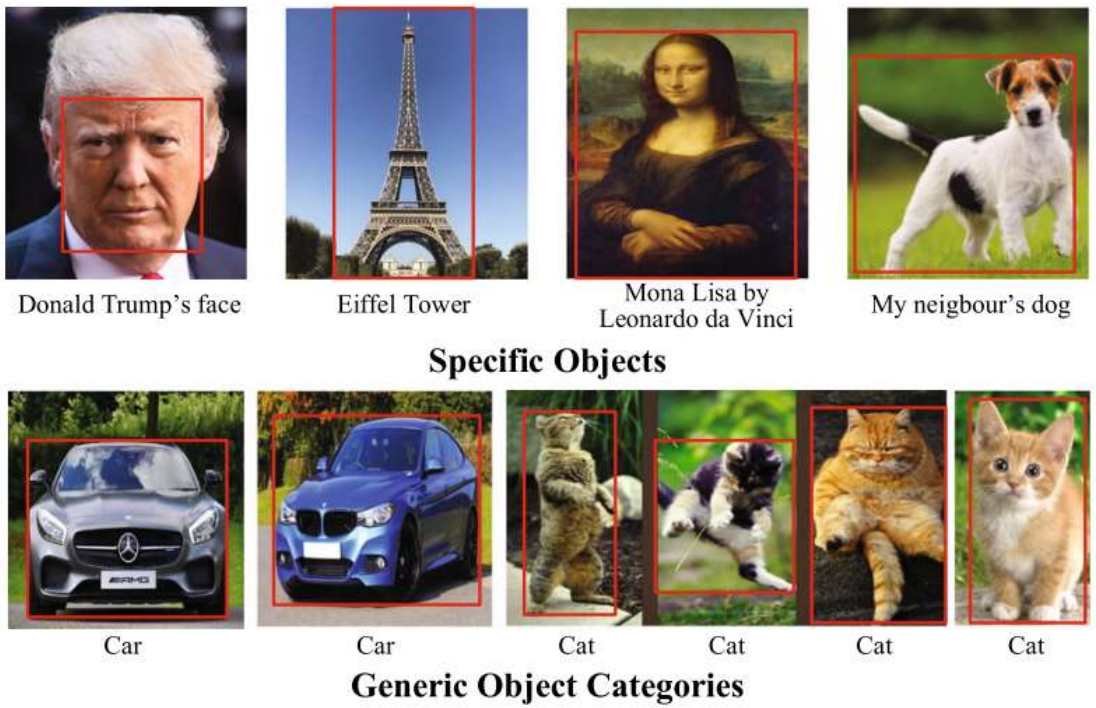
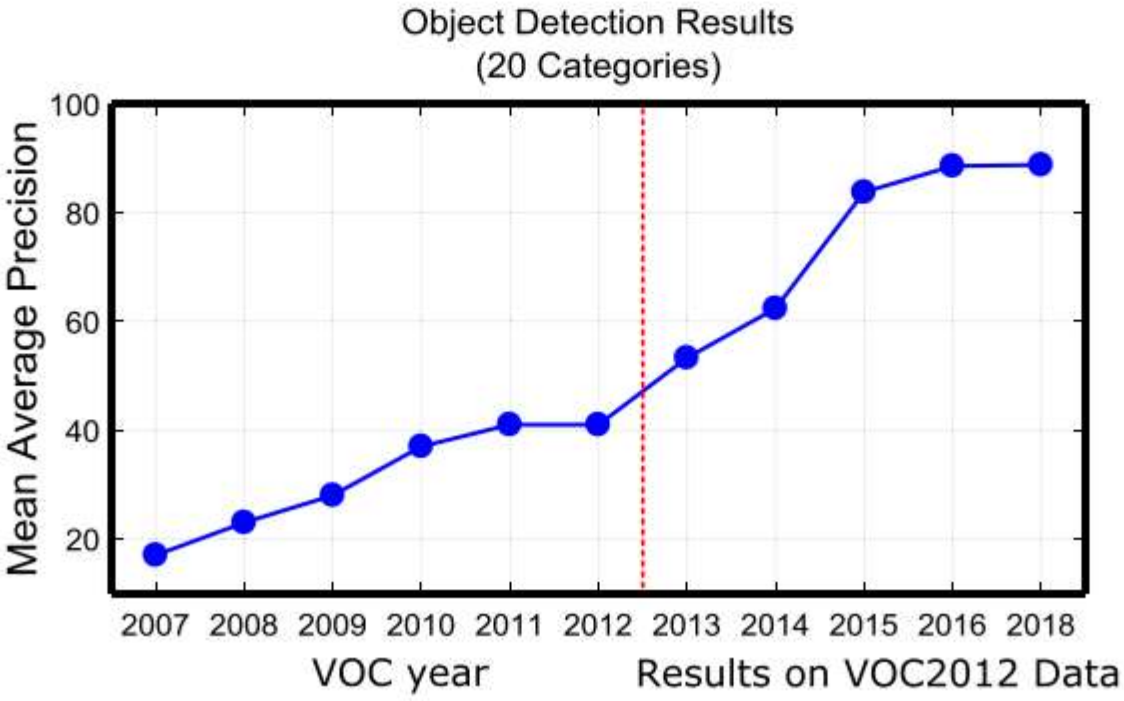
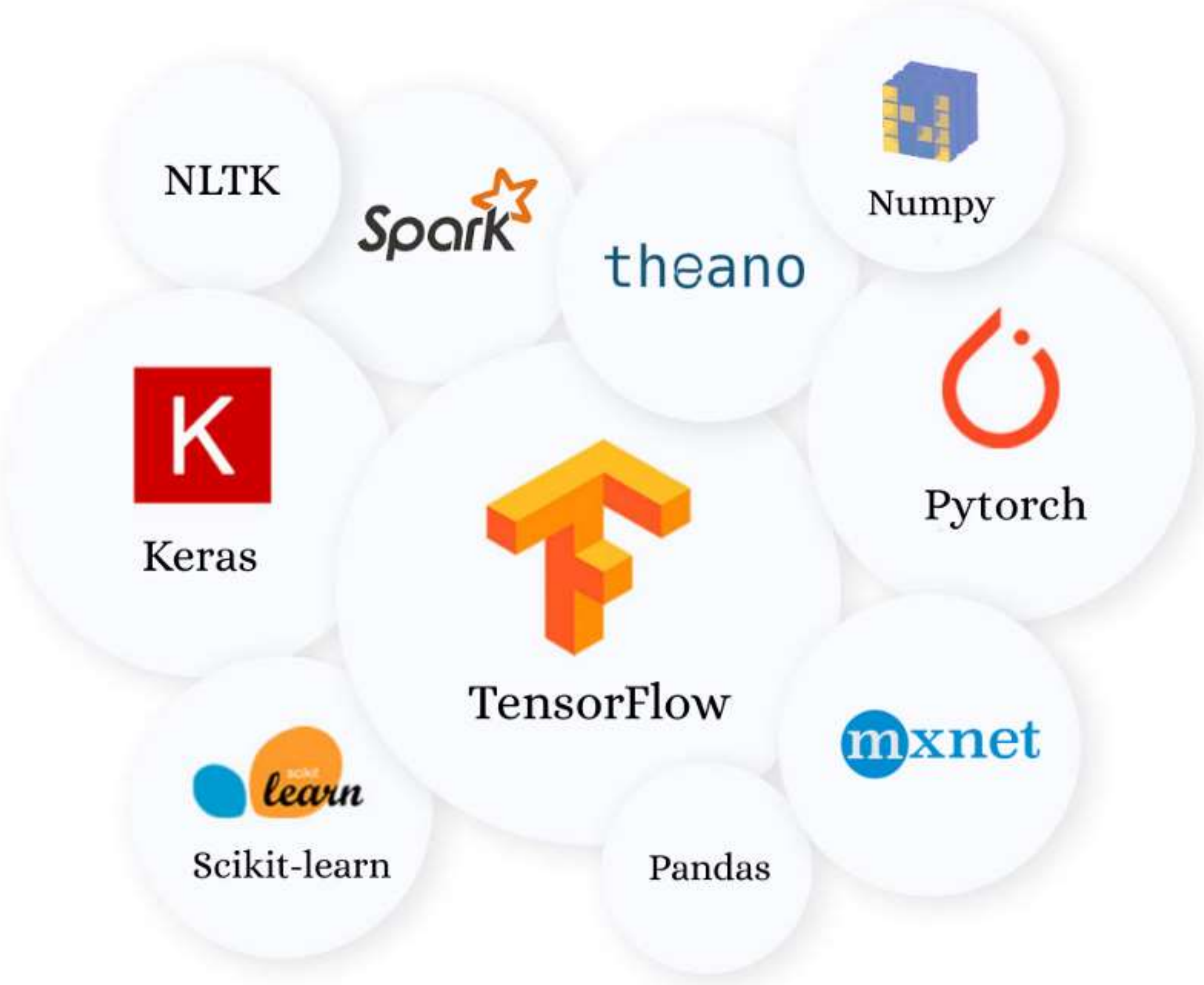
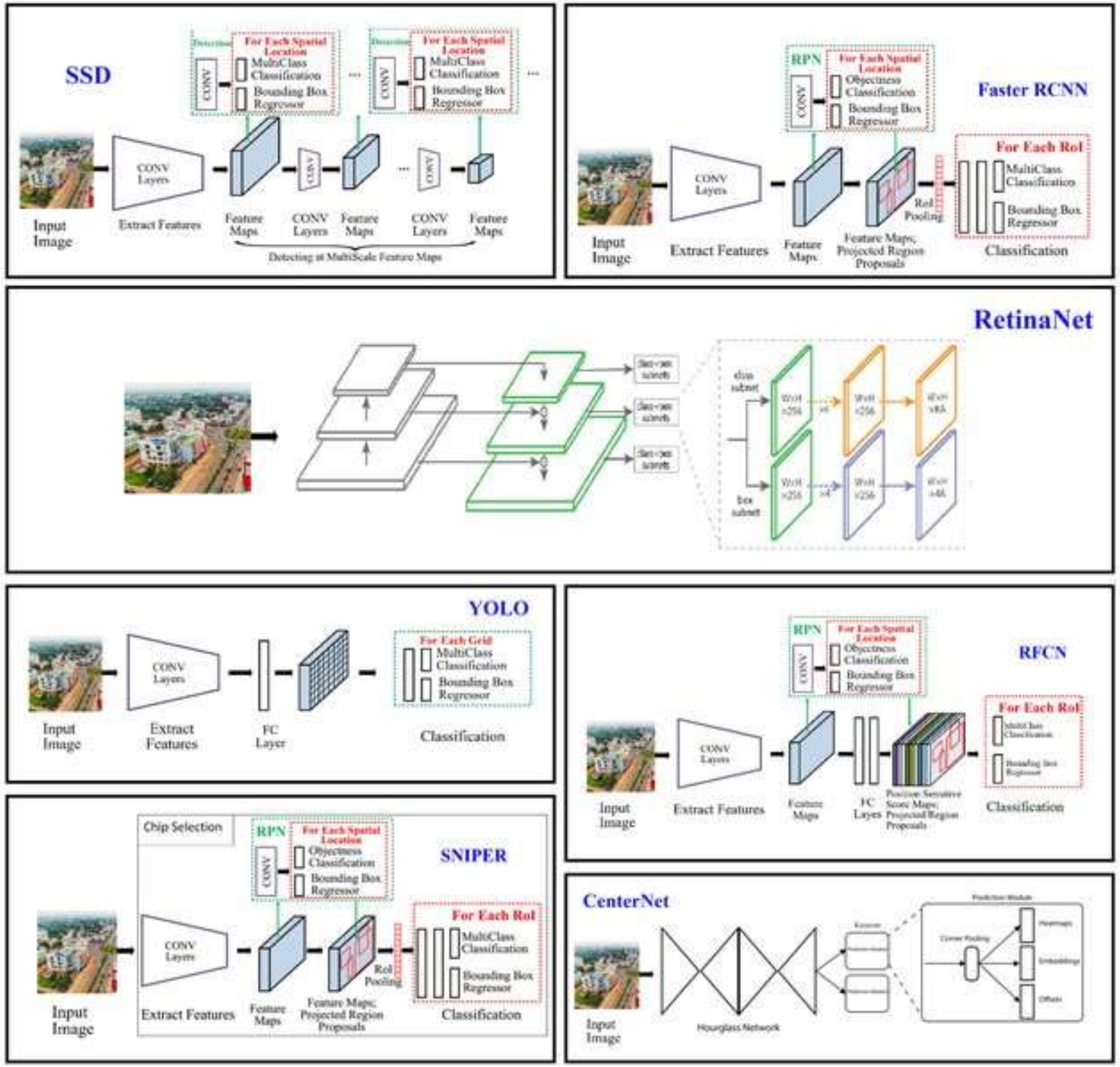
Problem





Liu, L., Ouyang, W., Wang, X., Fieguth, P., Chen, J., Liu, X., & Pietikäinen, M. (2020). Deep learning for generic object detection: A surveyInternational Journal of Computer Vision, 128(2), 261–318.

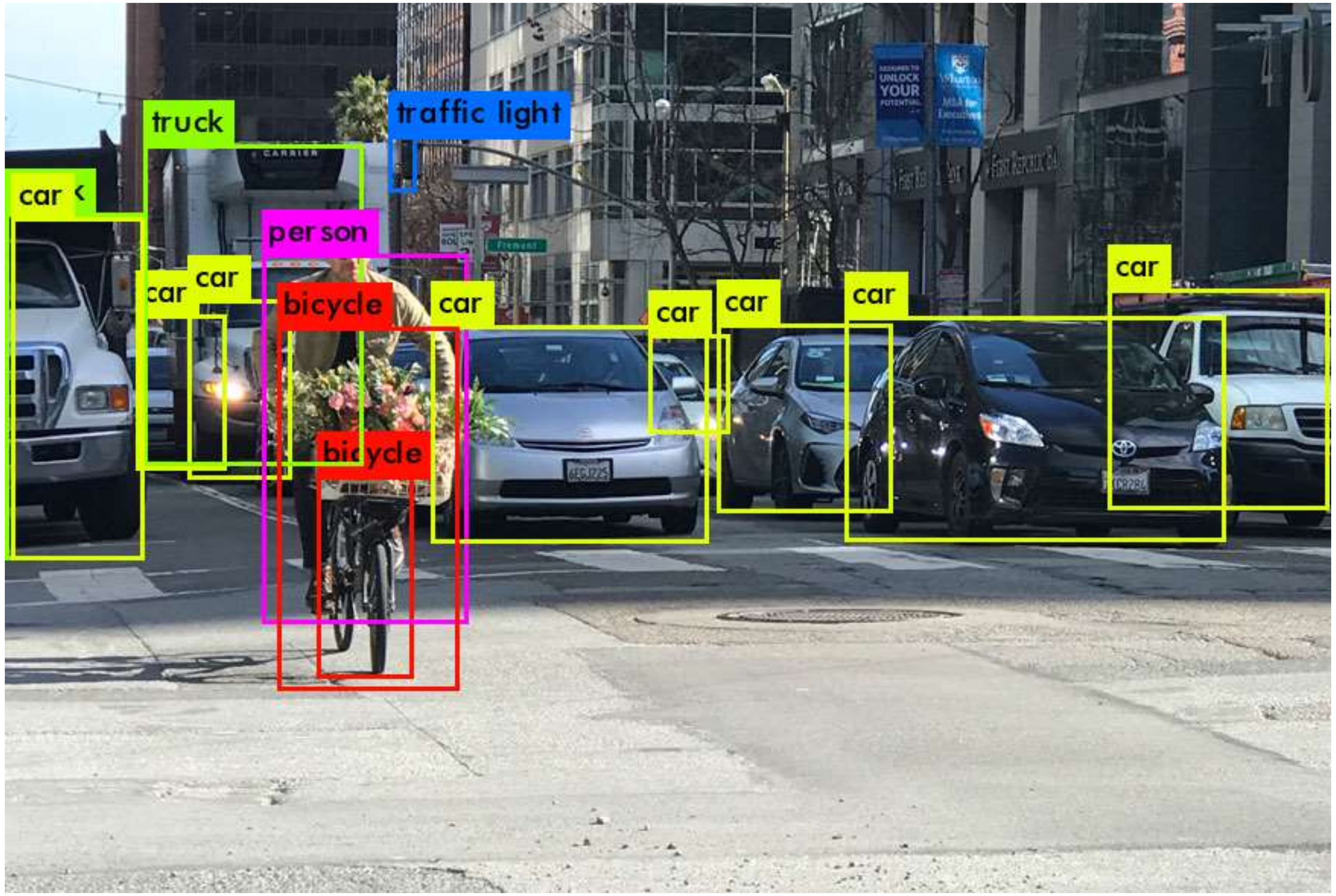

NLTK
Spark
theano
Numpy
Keras
TensorFlow
Pytorch
mxnet
learn
Scikit-learn
Pandas



Architecture	Training Time (hours)
Faster R-CNN	8.20
RFCN	4.30
SNIPER	62.50
RetinaNet	10.61
CenterNet	5.3
YOLOv3	4.70
SSD	251.18

Nguyen, Khang, et al. "Detecting objects from space: An evaluation of deep-learning modern approaches." Electronics 9.4 (2020): 583.

You Only Look Once - YOLO

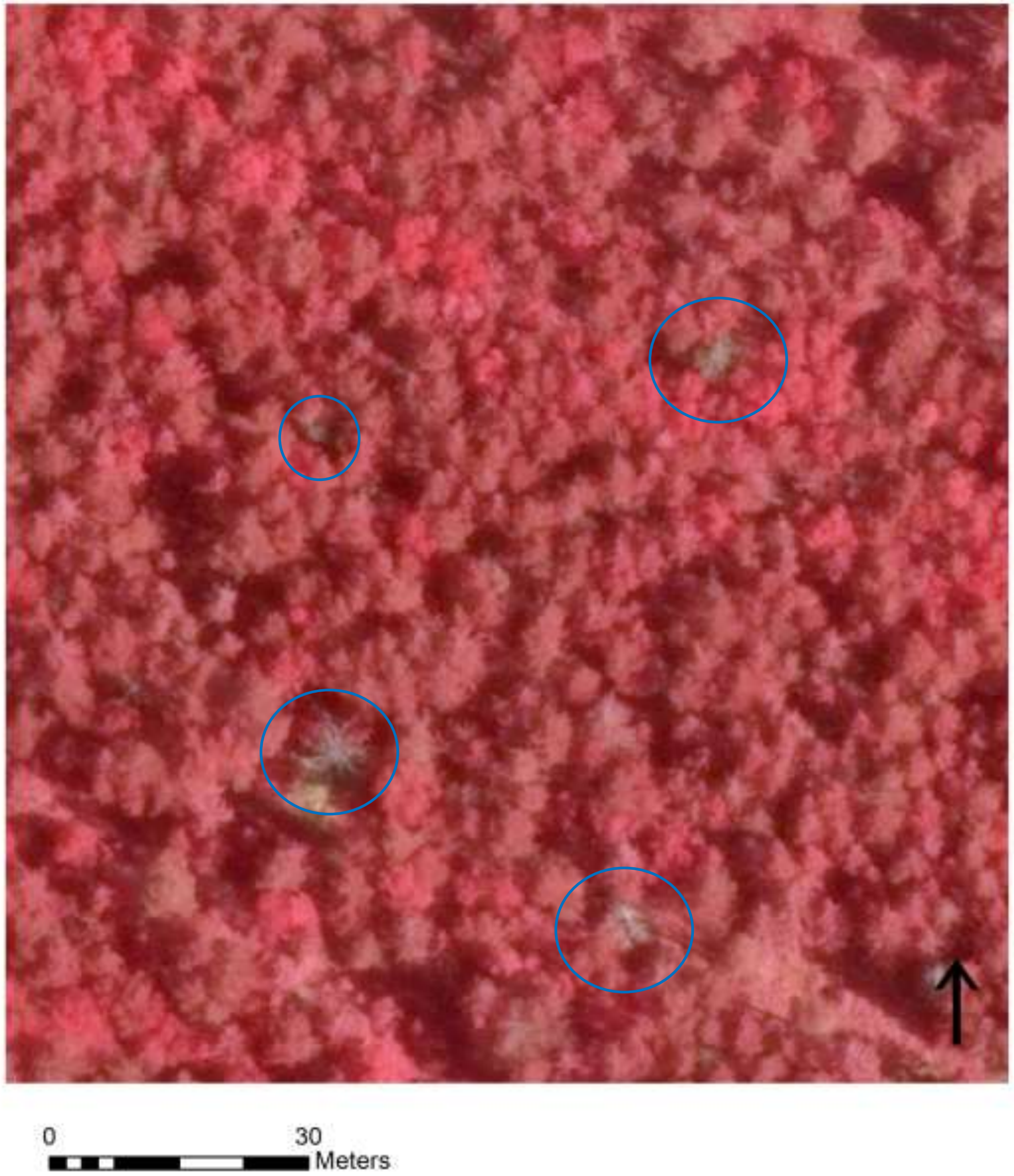


ArcGIS Pro

Deep Learning Libraries Installers for ArcGIS

Nr.4233

- National park
- Five nature reserves
- 2 natural monuments
- Several microreserves



- 25x25cm
- Used 773 objects
- 15% for validation
- 85% for YOLOv3 model training

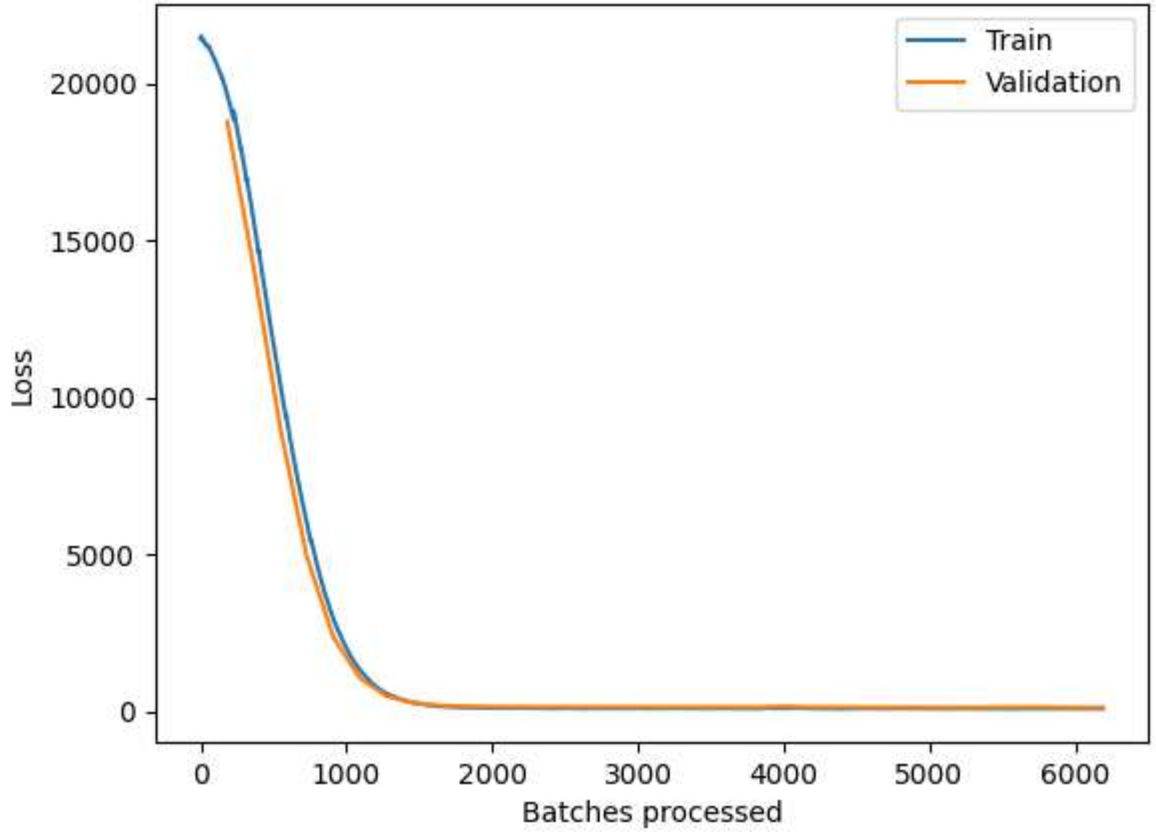
Used GeForce GTX 1060 6Gb

Analysis of the model

Where is problem, why only 45%?

Accuracy: {'Tree (dead)': 0.45956426777287085}

Sample Results



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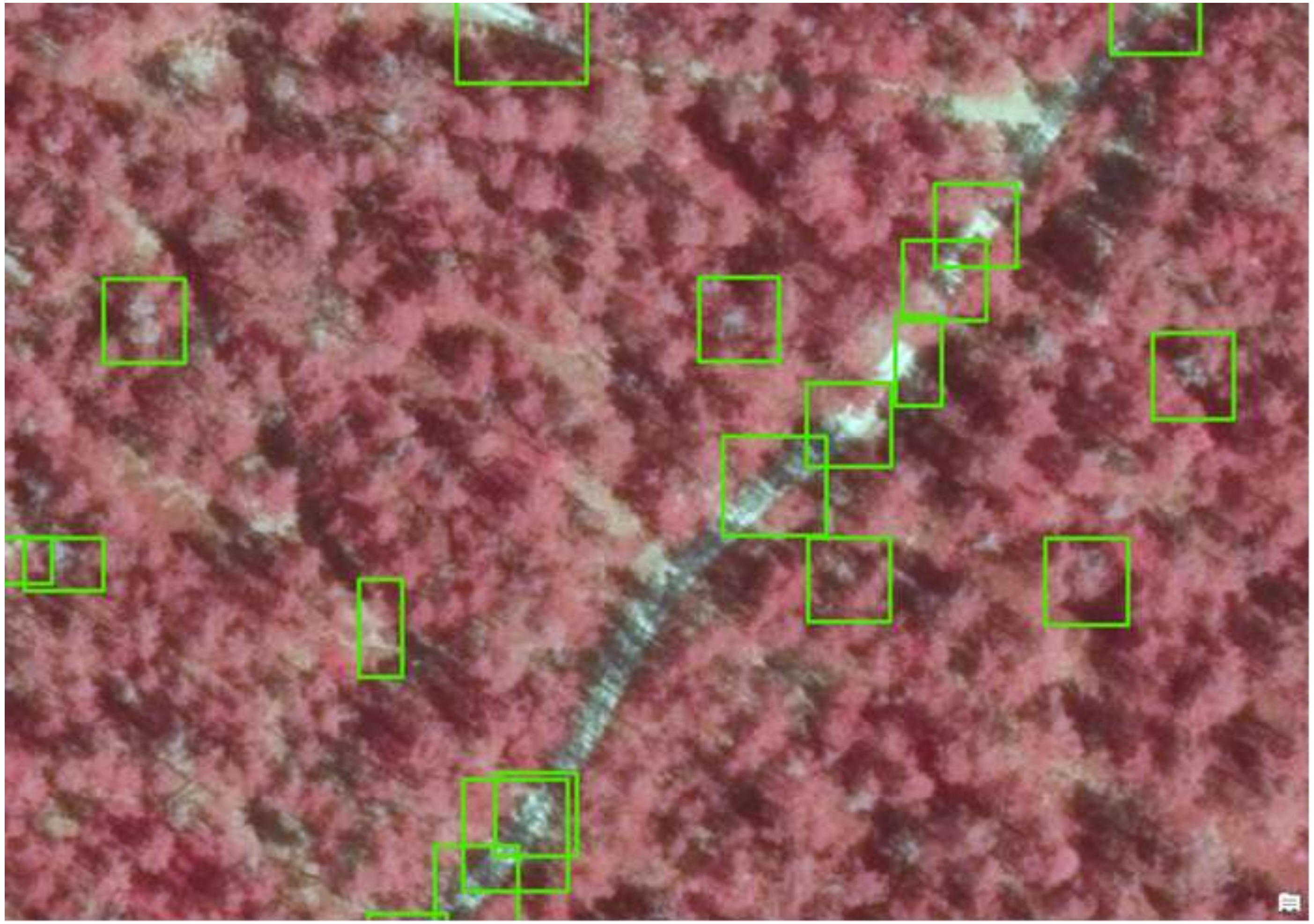
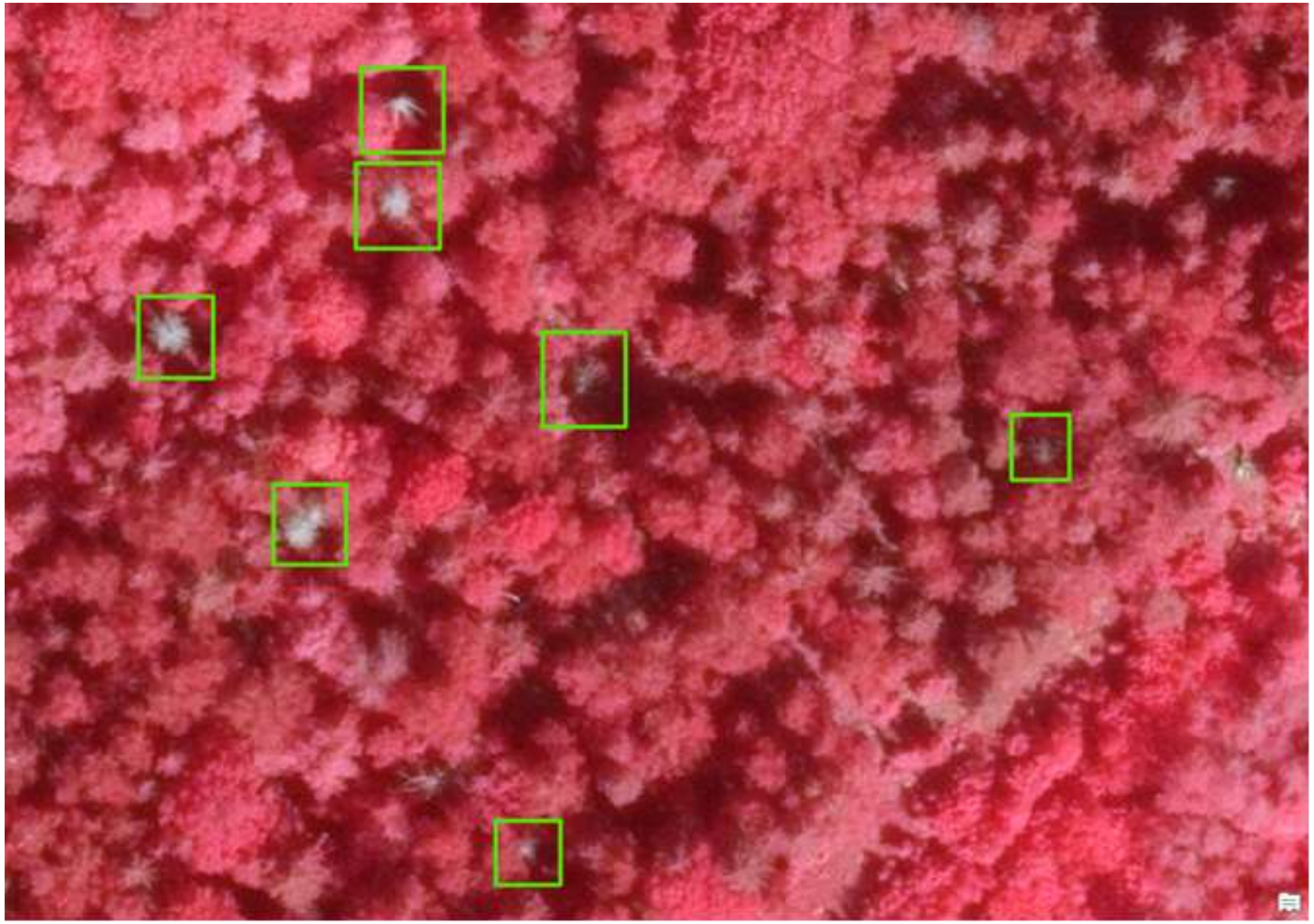
Errors in model results

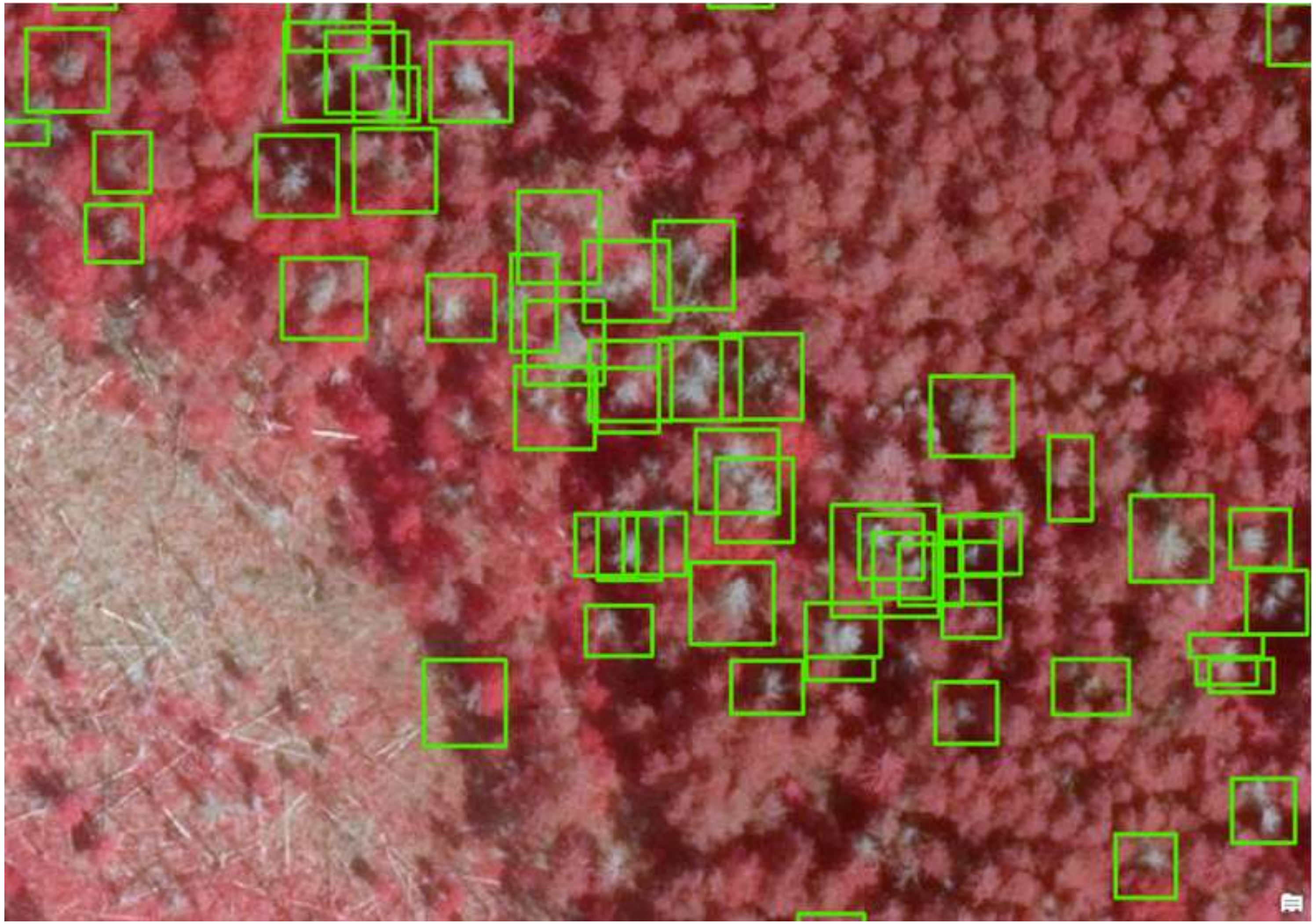


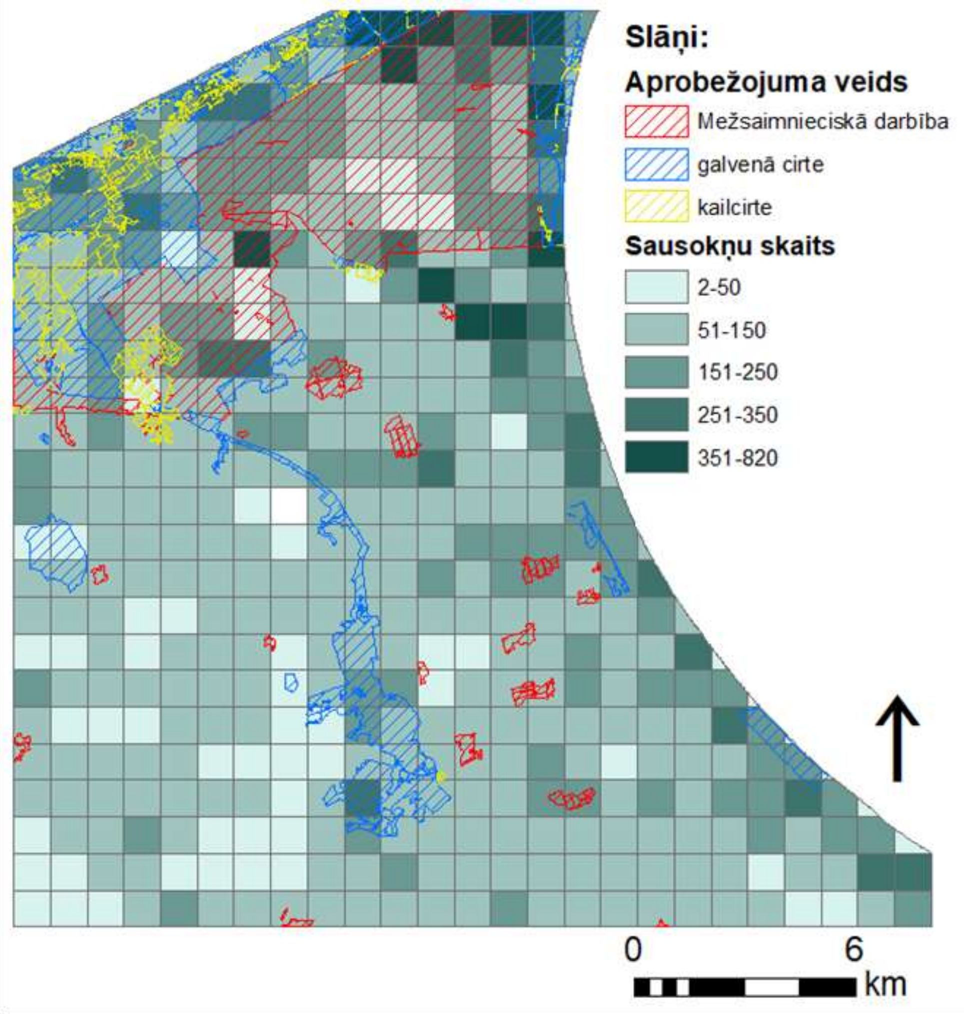
Good job?

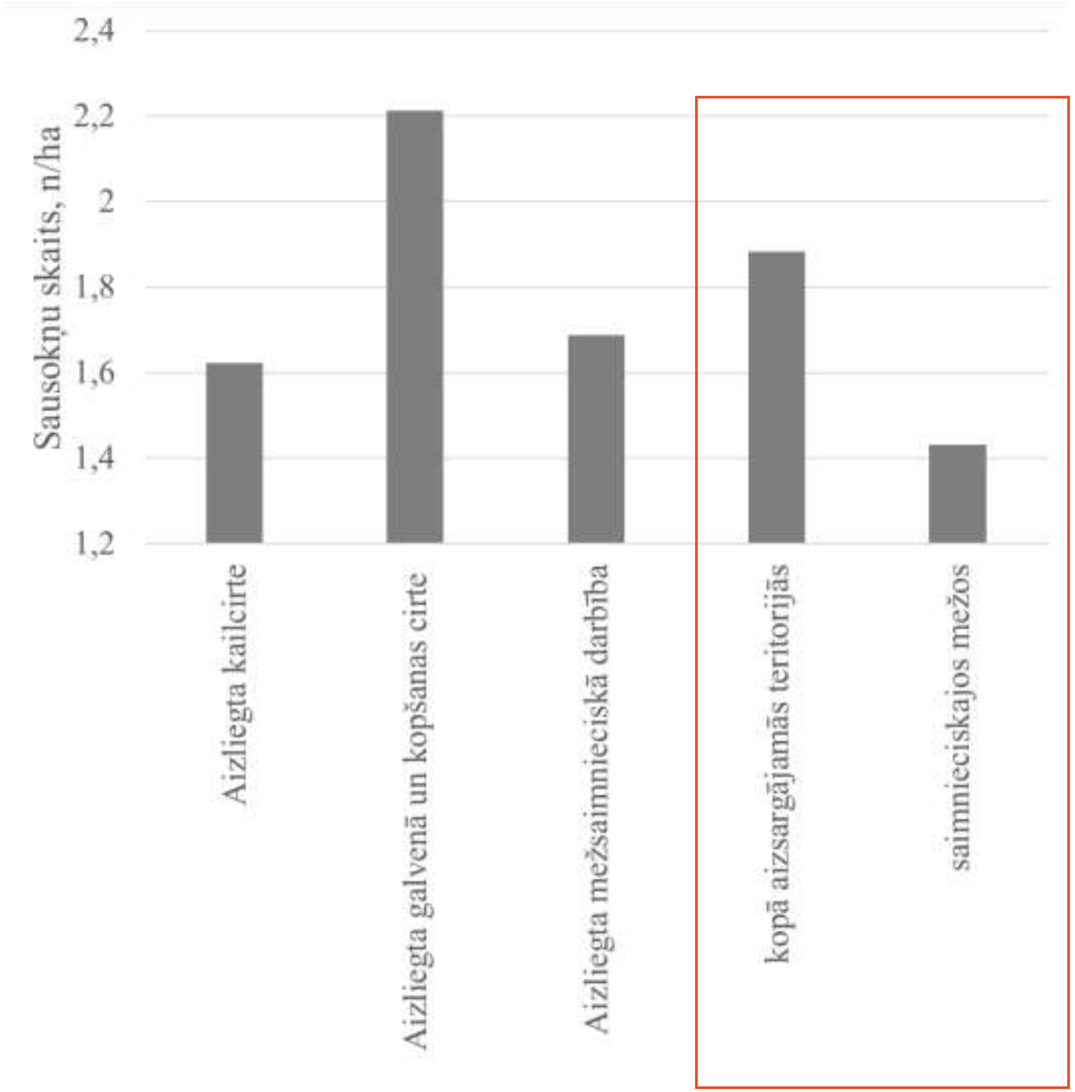


Map Nr.4233-53-51 (National park)

Map Nr.4233-43-23 (outside of national park)




Slāņi:
Aprobežojuma veids
Mežsaimnieciskā darbība
galvenā cirte
kailcirte
Sausokņu skaits
2-50
51-150
151-250
251-350
351-820
0
6
km


Sausokņu skaits, n/ha
2,4
2,2
2
1,8
1,6
1,4
1,2
Aizliegta kailcirte
Aizliegta galvenā un kopšanas cirte
Aizliegta mežsaimnieciskā darbība
kopā aizsargājamās teritorijās
saimnieciskajos mežos

Future plans

- Need to group information into categories (succesion stages) and use this data for computing effect of disturbance to biodiversity.

Why are we losing biodiversity..

http://www.dabasdati.lv/site/img/pub/1/3/199/l1421840579.jpg

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ECOLOGICAL SUCCESSION

It is the observed changes in an ecological community over time.

How does an ecological community develop? Ecological succession describes this process of development, identifying how the community began as well as how and when it stabilizes.

Thanks a lot
for your attention!

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