poljoprivredni fakultet osijek
1960

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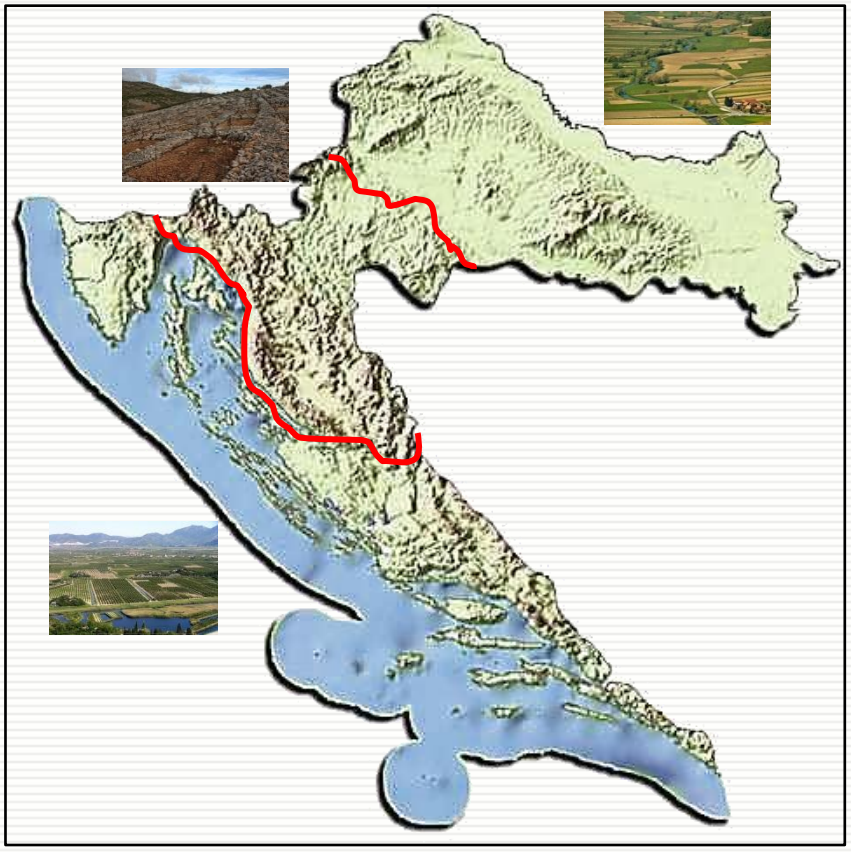
Summer School
Current Trends in Agronomy for Sustainable Agriculture
9th–13th September 2013, Brno, Czech Republic

Status, perspectives and sustainability of cropping systems practices in Croatia

Prof. dr. sc. Danijel Jug

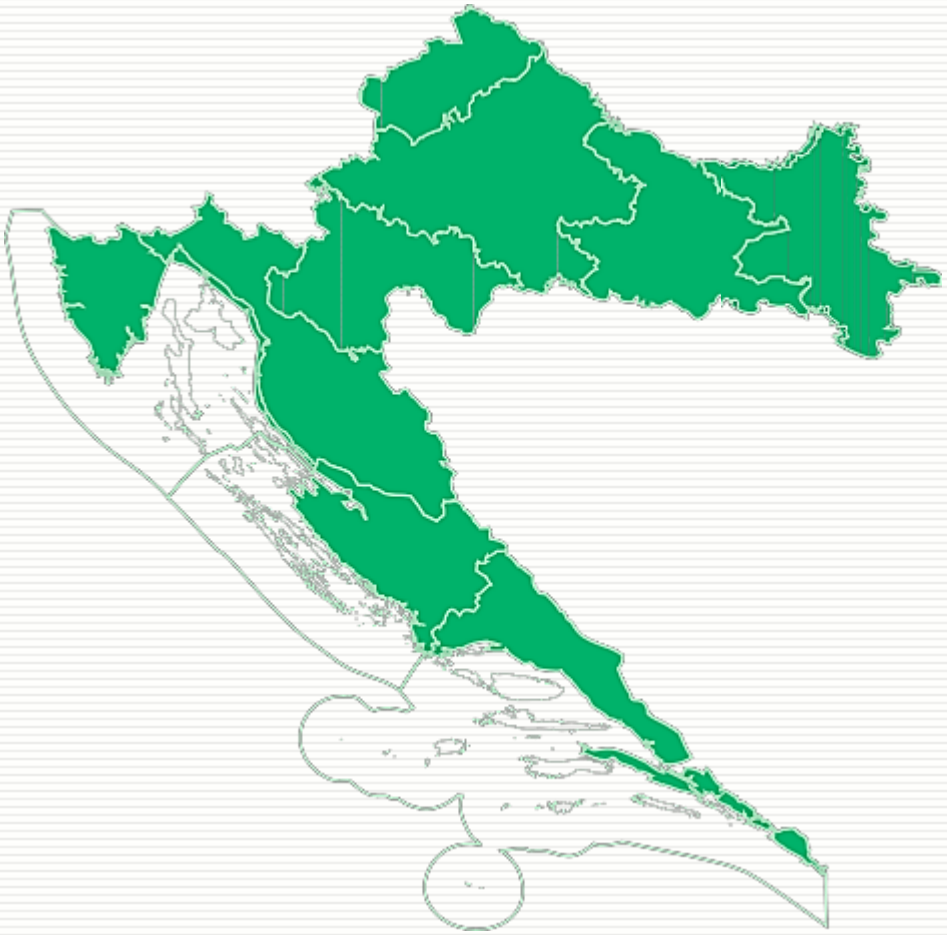
Current status of Croatian agriculture
(introductory word)



Pannonian region

Mountain region

Adriatic region



Land area *(total)* :: 5 660 000 ha

Utilized agricultural area :: 1 326 000 ha (23%)

Arable land :: 892 000 ha (67%)

Cereals :: 576 000 ha (65%)

80% - Private entities (family farm)

20% - Legal entities

Slavonia and Baranja Region

cca 50% of total Croatia cereal production

"Statistical Yearbook of the Republic of Croatia 2012, page 246-274"

Area under cultivation and production of some important crops

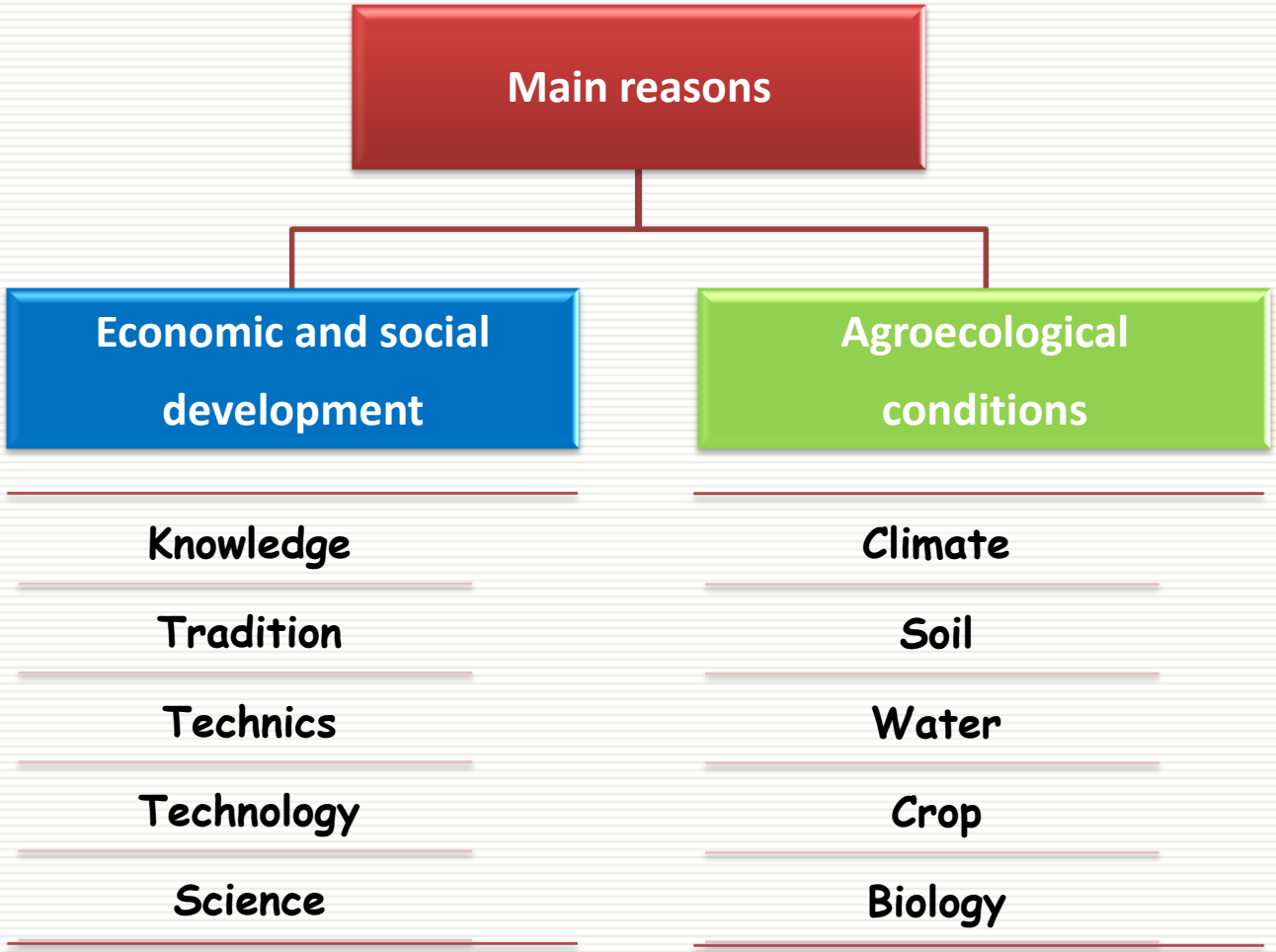
Crop	Harvested area (000 ha)	Yield per ha (t)
Maize	305	5.7
Wheat	150	5.2
Barley	48	4.0
Sunflowers	30	2.8
Soybean	59	2.5
Sugar beets	22	53.8
Rape seed	18	2.8

"Statistical Yearbook of the Republic of Croatia 2012, page 246-274"

Average crop yields vary from year-to-year mainly because of climate aberrations.

BUT → Indicated many other problems in CRO crop production !!!

Different regions → different approaches to crop production



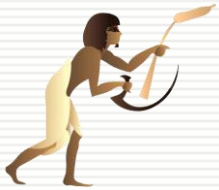
Some negative examples (facts):

- Irrigated area is less than 1% of the total arable land
- Large fragmentation of agricultural land (property - estate)
- Not defined Inheritance of farmland (further fragmentation)
- A large proportion of the agricultural population in total of active population
- Aging of the agricultural households
- The low level of applied knowledge of farmers (education) - the traditional approach
- Low level of science implementation
- Low and inadequate investment

Reducing of production - low productivity

Out of the total registered farms (cca 250 000), 63% avail of less than three hectares of land, and medium to large farms (from 20 to 300 hectares) avail about 32% of agricultural land

Current status of soil tillage in Croatia



Three main stage in history of soil tillage:

Development in continuity

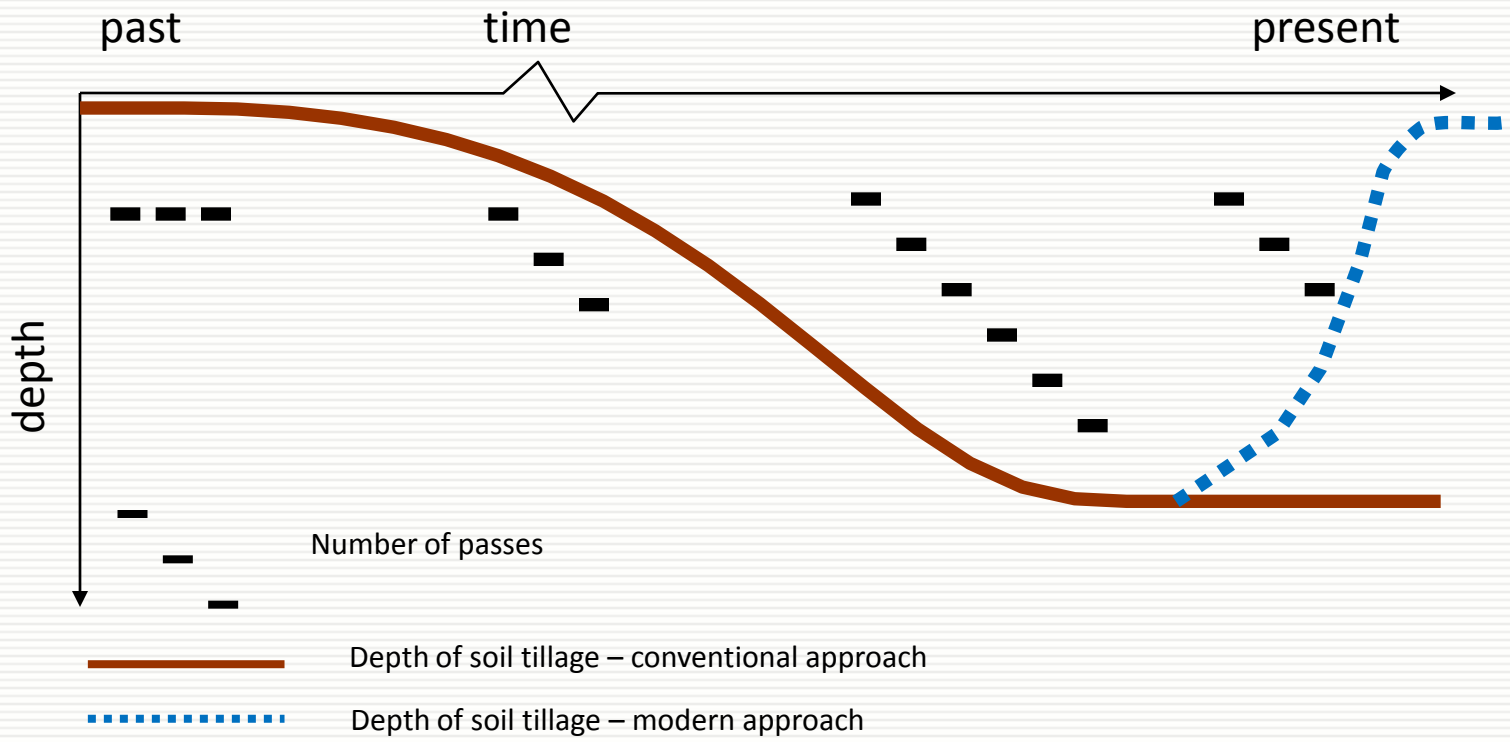
by machine

by bracing

by hand

Degradation in continuity

Depth and traffics during the course of history of soil tillage



- Present state: “two-way” soil tillage
  - ***stagnation*** depth of soil tillage
  - ***decrease*** of depth and number of passes

Invention of the first efficient ploughs in the 18th century marked a revolution in agriculture

Farmers were then thought: "*more intensive treatment - higher yields*", but the truth was „*more intensive treatment – more soil degradation*".

Soil monitoring - First step in the protection of the soil and conservation of natural functions of soil and prevention of degradation processes.

Soil Monitoring implies continuous monitoring of certain parameters of soil for the purpose of gathering information about the changes and the characteristics of soil, and identifying the type and intensity of soil degradation.

EC – (*Thematic Strategy for Soil Protection, Communication COM(2006) 231*) identified 8 most important threats to soil:

Erosion - Organic matter decline – Salinization – Compaction - Landslides and flooding – Contamination – Sealing - Biodiversity decline










Most important soil degrading processes in CRO are:

- Water erosion and
- Soil compaction,

both mainly because of inadequate agricultural practice.

These degradation processes vary from region to region, with different degrees of severity.

Soil tillage for major crops in Croatia is

≈ 90%

Conventional soil tillage, but with a tendency to increase the area under reduced or conservation tillage systems

No official statistics data

Predominant approach in crop production is still conventional approach, with all positive and negative consequences. According this, **soil tillage**, as a one of the main technology operations in crop production, **are mostly conventional**

Main paradigm for that approach is

"…Soil need to plough for high yields…"

or

… *"if these low yields are with application of ploughing, how low would have been with application of reduced soil tillage?!..."*

- Proponents of traditional approach to conventional tillage enumerating many advantages of ploughing as most important and indispensable tillage treatment in that approach
- But, in the lights of the newest research this approach are not sustainable (many negative sides)

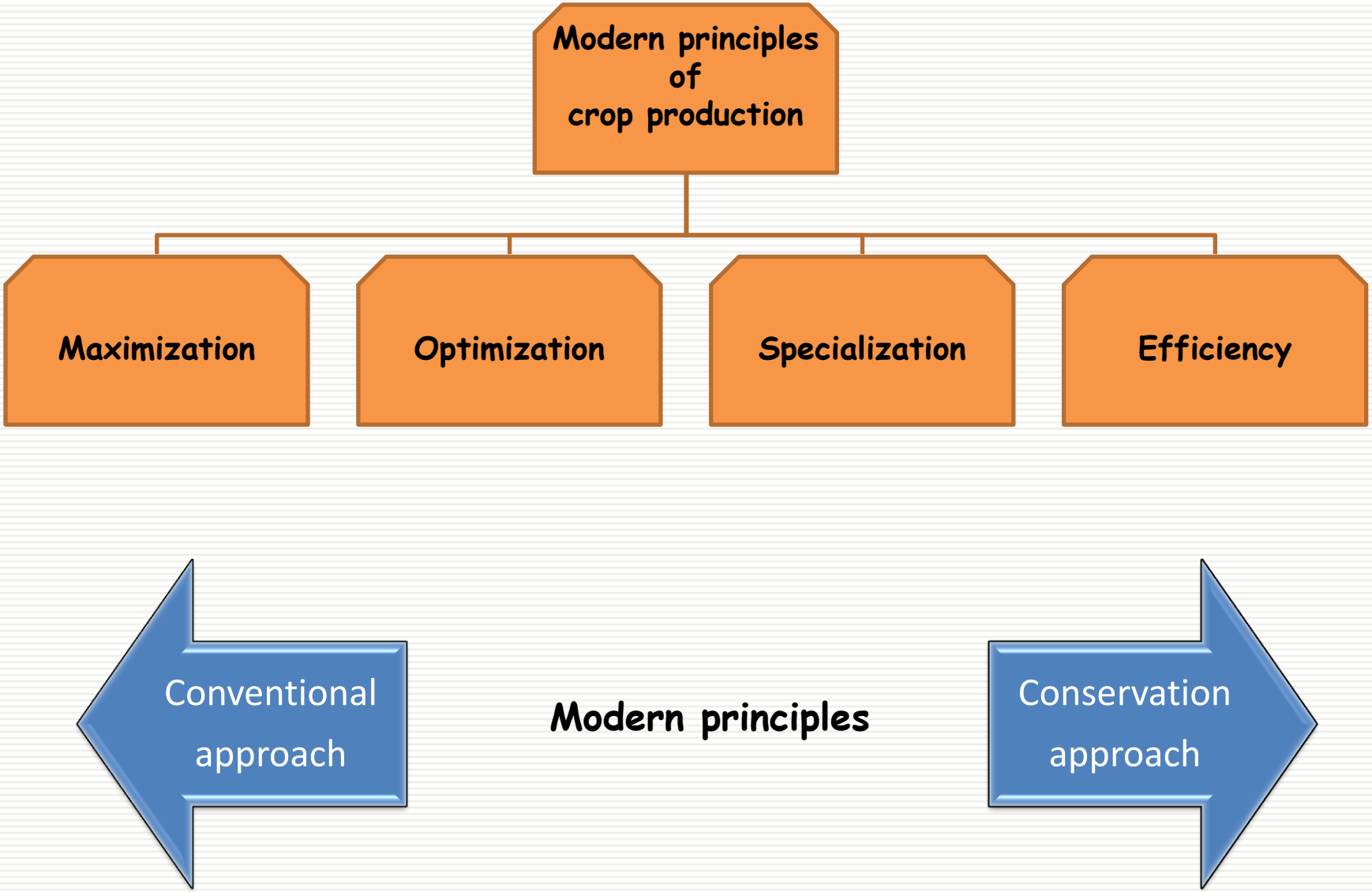
Increasing emphasis on the negative aspects of conventional tillage, especially on::

- chemical properties of soil
- physical properties of soil
- biological properties of soil
- water and air pollution
- organizational effectiveness
- economic feasibility, etc.

One of the possible ways to solve and / or mitigate these problems is the application of conservation - reduced tillage systems.

but

Reduced tillage systems have, in addition to positive and some negative sides !!!


Modern principles of crop production
Maximization
Optimization
Specialization
Efficiency
Conventional approach
Modern principles
Conservation approach

Definition of::

- Conventional soil tillage
- Conservation soil tillage
- Reduced soil tillage

:: including advantages and disadvantages of each soil tillage systems depending of goals

Main demand of soil tillage

Depth of soil tillage and number of passes machinery and tools for tillage, should be harmonized with the natural conditions, and adjust the level of production must be economically justified.

NO UNIQUE OPTIMAL BASIC SOIL TILLAGE TREATMENTS !!!

Soil tillage trends in Croatia

At the present time in the Republic of Croatia in the crop production almost always used conventional tillage, and reduced soil tillage in most cases the only economically feasible for reasons of production, or as an alternative system

In the region of Slavonia and Baranja are still ploughing as a primary soil tillage treatment, applied to about 94% of the area (Košutić et al., 2005). However, the estimate is that at last few years some form of reduced tillage is applied from 10-15% (Jug et al., 2010)

In last ten years in Croatia, research of reduced and conservation tillage are significantly intensified from many aspects, but in many times with divergent results, which imply on needs for further and more intensive approach to research

Adoption of reduced or conservation tillage systems in Croatia are still relatively slow, and one of the most important reasons is delaying synergistic approach in relation scientific community – Agricultural Advisory Service – farmers

The most common and most applied reduced tillage system is diskharrowing as basic tillage treatment for winter wheat

For this reason, in eastern part of Croatia is very “popular” discontinuous tillage systems

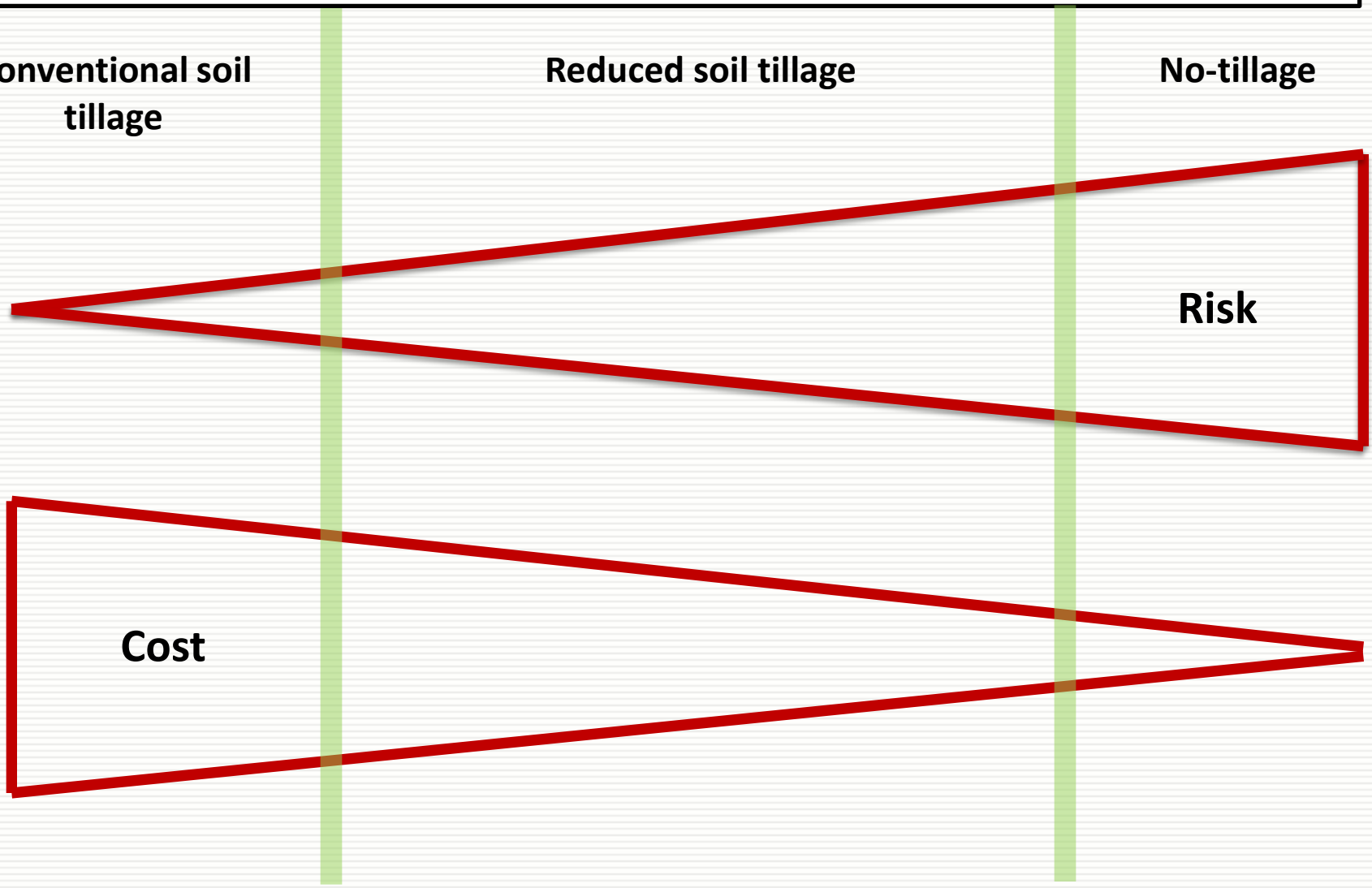
Soil chiseling applied instead ploughing is usually performed as a measure of repair of compacted soil mainly breaking tillage pan, which followed by diskharrowing, and very rare as a primary tillage systems

Application of No-tillage systems are very rare and on a very small area, which is primarily the result of insufficient knowledge of farmers, but also the lack of quality tools and machinery for direct sowing

Frequency occurrence of the extreme rainfall, longer dry periods and shorter rainy periods suggests tillage technique keeping arable soils free of tillage-induced soil compaction, maintaining soils water infiltration and storing capacity and others

Important reason in „make-decision“ process

risk<=>cost



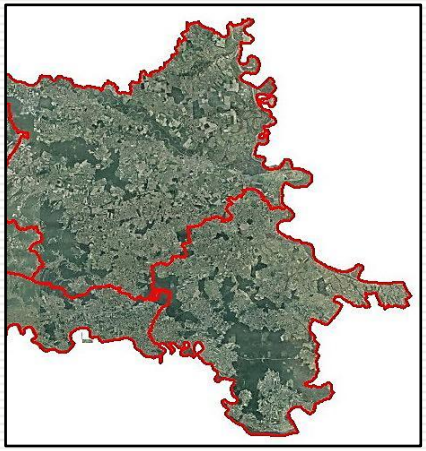
Addition to the mentioned objectives monitoring system can be useful in predicting (forecasting) crop production.

ARKOD - the Land Parcel Identification System (LPIS) ::

National program that establishes a database that keeps track of the actual use of agricultural land.

ARKOD aims at getting a clear picture of how much land in Croatia used for agricultural production, regardless of the crop that is grown on them.

Such regulated and transparent system is mainly a prerequisite for obtaining EU subsidies for agricultural production.





PREGLEDNIK
ARKOD
Podaci
Pretraživanja
Rezultati
Rezultati
DKP: 434 x
DKP: 427
DKP: 432
Hrastin
DKP: 425
DKP: 434
Broj kat. čestice: 434
Šifra KO: 320595
Ime KO: Hrastin
Površina: 0.69 ha
Basic information about any parcel (land unit) registered in ARKOD system
1838184
1826204
1837563
423
1892336
425
426
427
1837636
1826148
429
430
431
432
433
1838057
435
1826157
1435938
1826125
573
1826037
416
415
414
1864012
412
1435971
50 m
© 2012 Agencija za plaćanja u poljoprivredi, ribarstvu i ruralnom razvoju
E N: 664220 5034115,25 45°25'39,68" N 18°35'55,19" E

Case study - example

On this base layer (ARKOD - the Land Parcel Identification System -LPIS) on Faculty of Agriculture in Osijek, was developed sophisticated software systems, which takes into account the *specificum* of any particular land unit (parcel).

General information ::

- Project name :: "Soil fertility control on family farms" (Osijek-Baranja County)
- Project duration :: 2003-2013 year (still ongoing)
- Samples № :: over 25 000
- Analyses № :: over 1 000 000 (data and information)
- arable crops (≈90% samples), vineyards, orchards

Model :: Integration of ARKOD and Interpretative base land resources (IBaze) in Osijek-Baranja County

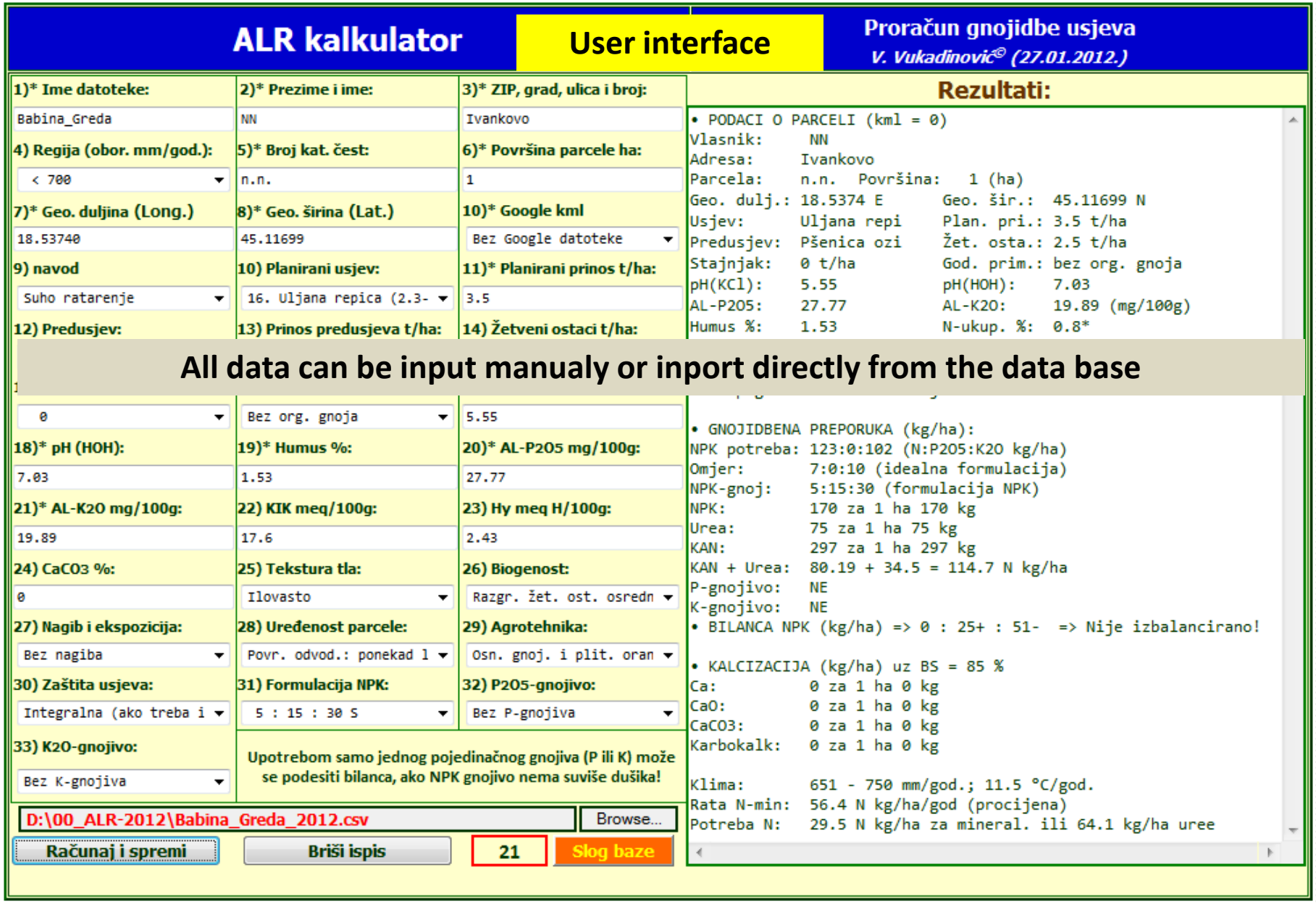
- This model, beside basic information about soil (physical, chemical and biological properties), include other indicators of land suitability for crop production (climatic, ecological, orographic, hydrological, agrotechnical etc.)

- Geopositioning (soil samples position) with GPS device

- Geostatistics and visualization of thematic charts

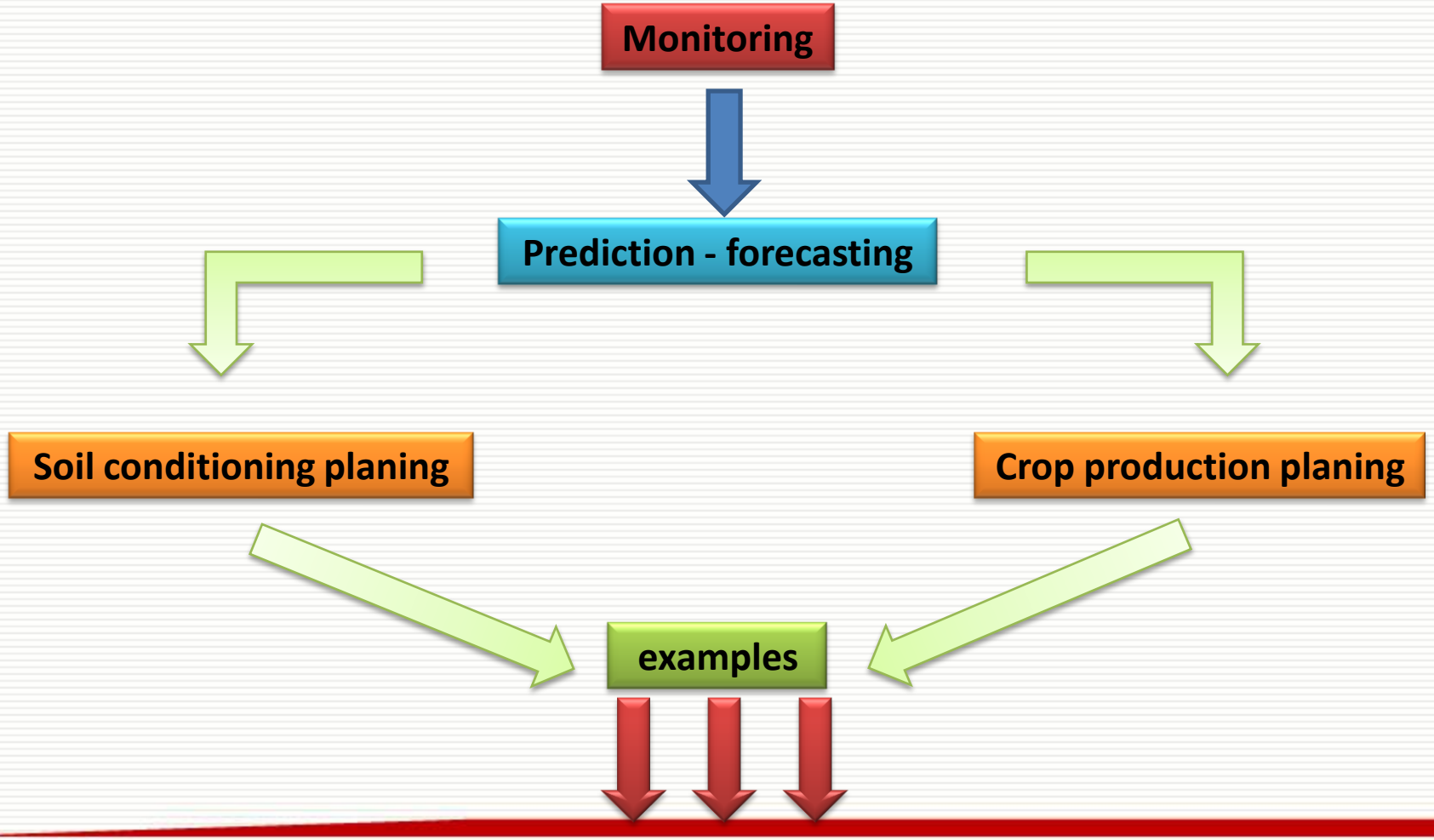
- The model is supported by an original computer program (ALRxp) for determining the relative benefits of soil for crops, need for liming, soil conditioning and fertilization recommendation, mineralization potential for a specific parcel of land and crops in conventional, integrated or organic production.

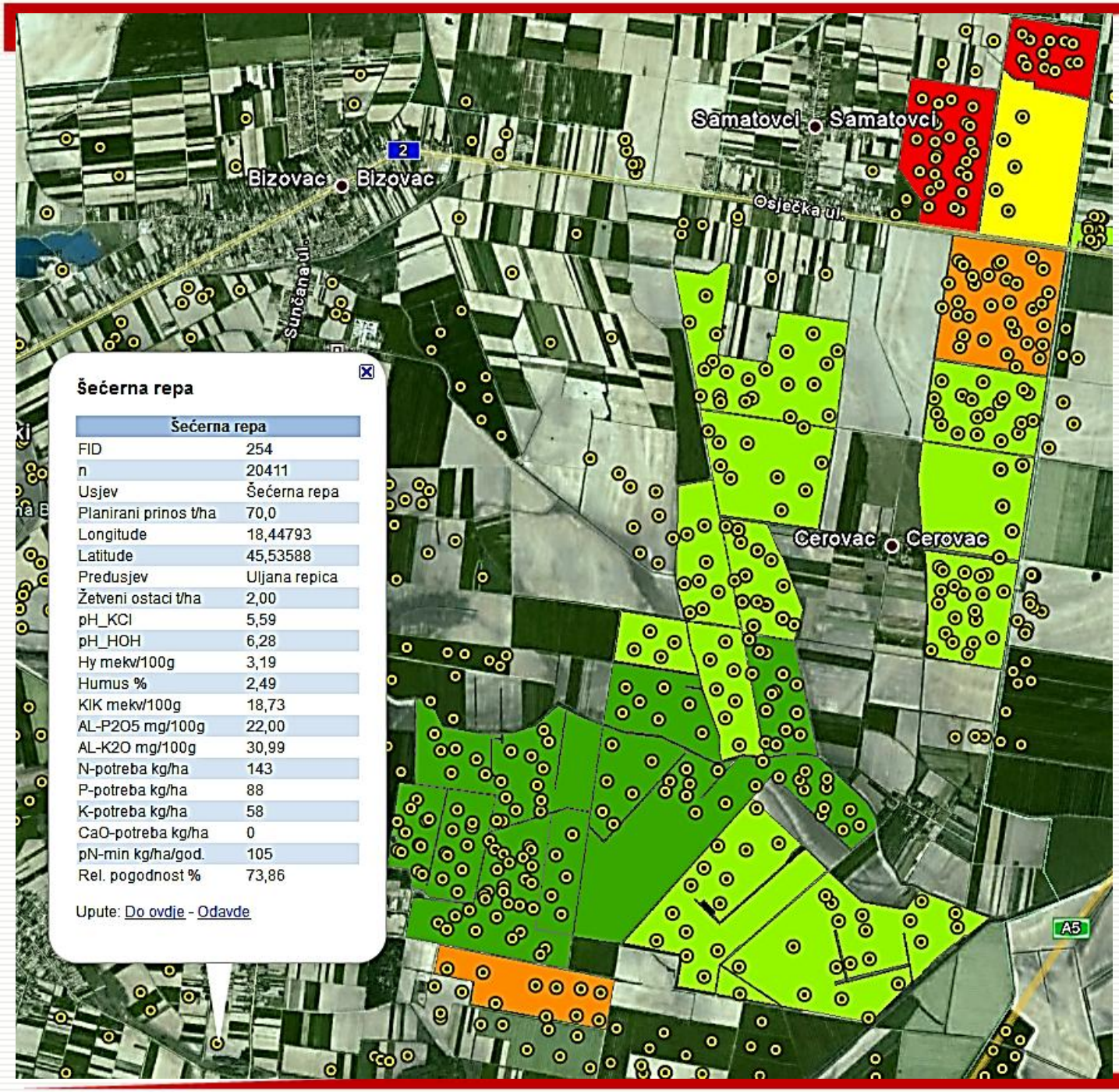
- Computer-assisted design fertilization recommendation is carried out for 40 crops and 43 pre-crop (including fallow), and includes the most preferred mineral and / or organic fertilizers available in CRO.


ALR kalkulator
User interface
Proračun gnojidbe usjeva
V. Vukadinović© (27.01.2012.)
1)* Ime datoteke:
Babina_Greda
2)* Prezime i ime:
NN
3)* ZIP, grad, ulica i broj:
Ivankovo
4) Regija (obor. mm/god.):
< 700
5)* Broj kat. čest:
n.n.
6)* Površina parcele ha:
1
7)* Geo. duljina (Long.)
18.53740
8)* Geo. širina (Lat.)
45.11699
10)* Google kml
Bez Google datoteke
9) navod
Suho ratarenje
10) Planirani usjev:
16. Uljana repica (2.3-
11)* Planirani prinos t/ha:
3.5
12) Predusjev:
13) Prinos predusjeva t/ha:
14) Žetveni ostaci t/ha:
Rezultati:
• PODACI O PARCELI (kml = 0)
Vlasnik: NN
Adresa: Ivankovo
Parcela: n.n. Površina: 1 (ha)
Geo. dulj.: 18.5374 E Geo. šir.: 45.11699 N
Usjev: Uljana repi Plan. pri.: 3.5 t/ha
Predusjev: Pšenica ozi Žet. osta.: 2.5 t/ha
Stajnjak: 0 t/ha God. prim.: bez org. gnoja
pH(KCl): 5.55 pH(HOH): 7.03
AL-P2O5: 27.77 AL-K2O: 19.89 (mg/100g)
Humus %: 1.53 N-ukup. %: 0.8*
All data can be input manualy or inport directly from the data base
0
Bez org. gnoja
5.55
18)* pH (HOH):
19)* Humus %:
20)* AL-P2O5 mg/100g:
7.03
1.53
27.77
21)* AL-K2O mg/100g:
22) KIK meq/100g:
23) Hy meq H/100g:
19.89
17.6
2.43
24) CaCO3 %:
25) Tekstura tla:
26) Biogenost:
0
Ilovasto
Razgr. žet. ost. osredn
27) Nagib i ekspozicija:
28) Uređenost parcele:
29) Agrotehnika:
Bez nagiba
Povr. odvod.: ponekad l
Osn. gnoj. i plit. oran
30) Zaštita usjeva:
31) Formulacija NPK:
32) P2O5-gnojivo:
Integralna (ako treba i
5 : 15 : 30 S
Bez P-gnojiva
33) K2O-gnojivo:
Bez K-gnojiva
Upotrebom samo jednog pojedinačnog gnojiva (P ili K) može se podesiti bilanca, ako NPK gnojivo nema suviše dušika!
• GNOJIDBENA PREPORUKA (kg/ha):
NPK potreba: 123:0:102 (N:P2O5:K2O kg/ha)
Omjer: 7:0:10 (idealna formulacija)
NPK-gnoj: 5:15:30 (formulacija NPK)
NPK: 170 za 1 ha 170 kg
Urea: 75 za 1 ha 75 kg
KAN: 297 za 1 ha 297 kg
KAN + Urea: 80.19 + 34.5 = 114.7 N kg/ha
P-gnojivo: NE
K-gnojivo: NE
• BILANCA NPK (kg/ha) => 0 : 25+ : 51- => Nije izbalancirano!
• KALCIZACIJA (kg/ha) uz BS = 85 %
Ca: 0 za 1 ha 0 kg
CaO: 0 za 1 ha 0 kg
CaCO3: 0 za 1 ha 0 kg
Karbokalk: 0 za 1 ha 0 kg
Klima: 651 - 750 mm/god.; 11.5 °C/god.
Rata N-min: 56.4 N kg/ha/god (procijena)
Potreba N: 29.5 N kg/ha za mineral. ili 64.1 kg/ha uree
D:\00_ALR-2012\Babina_Greda_2012.csv
Browse...
Računaj i spremi
Briši ispis
21
Slog baze

All export data (from Model) can be used for visualization (charts) and geostatistical analyses

Which can be used for



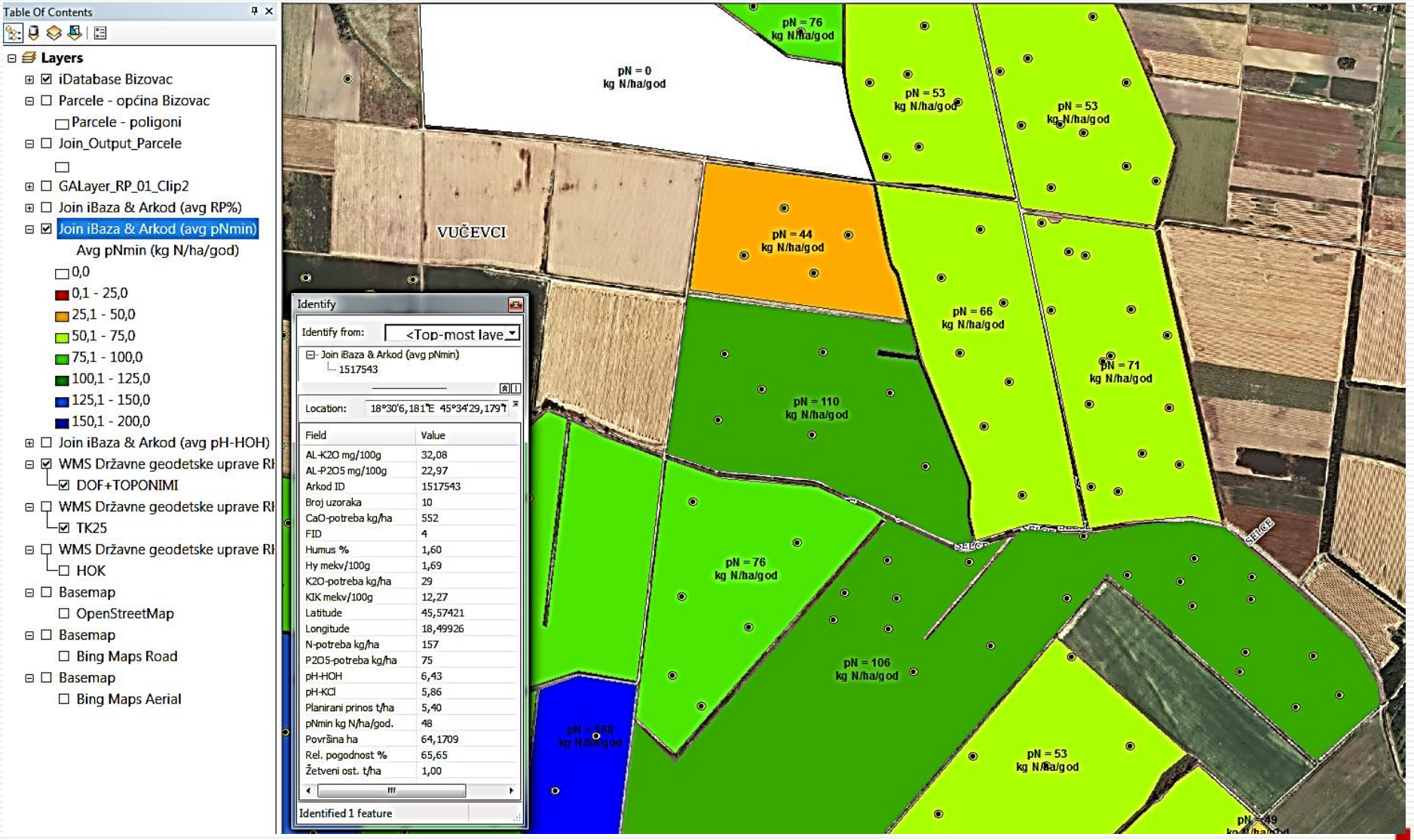


Integration of
Arkod and iBaze

Visual presentation with Google API (Application Programming Interface)

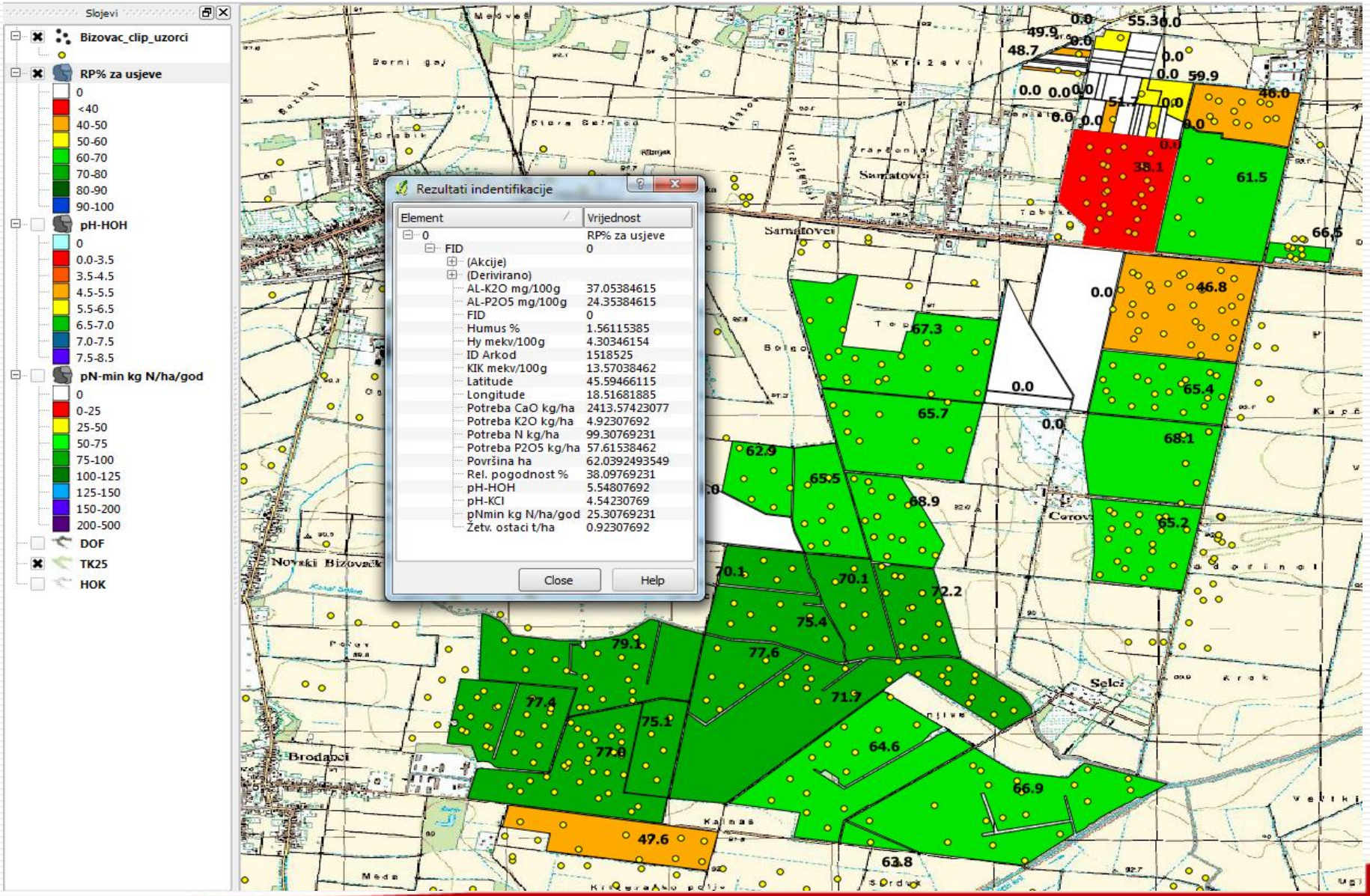
Integration of *Arkod and iBaze in* ArcMap v10.3

Potential of N-mineralization (kg N/ha/Y) distinguished by a color in 5 classes from red to green



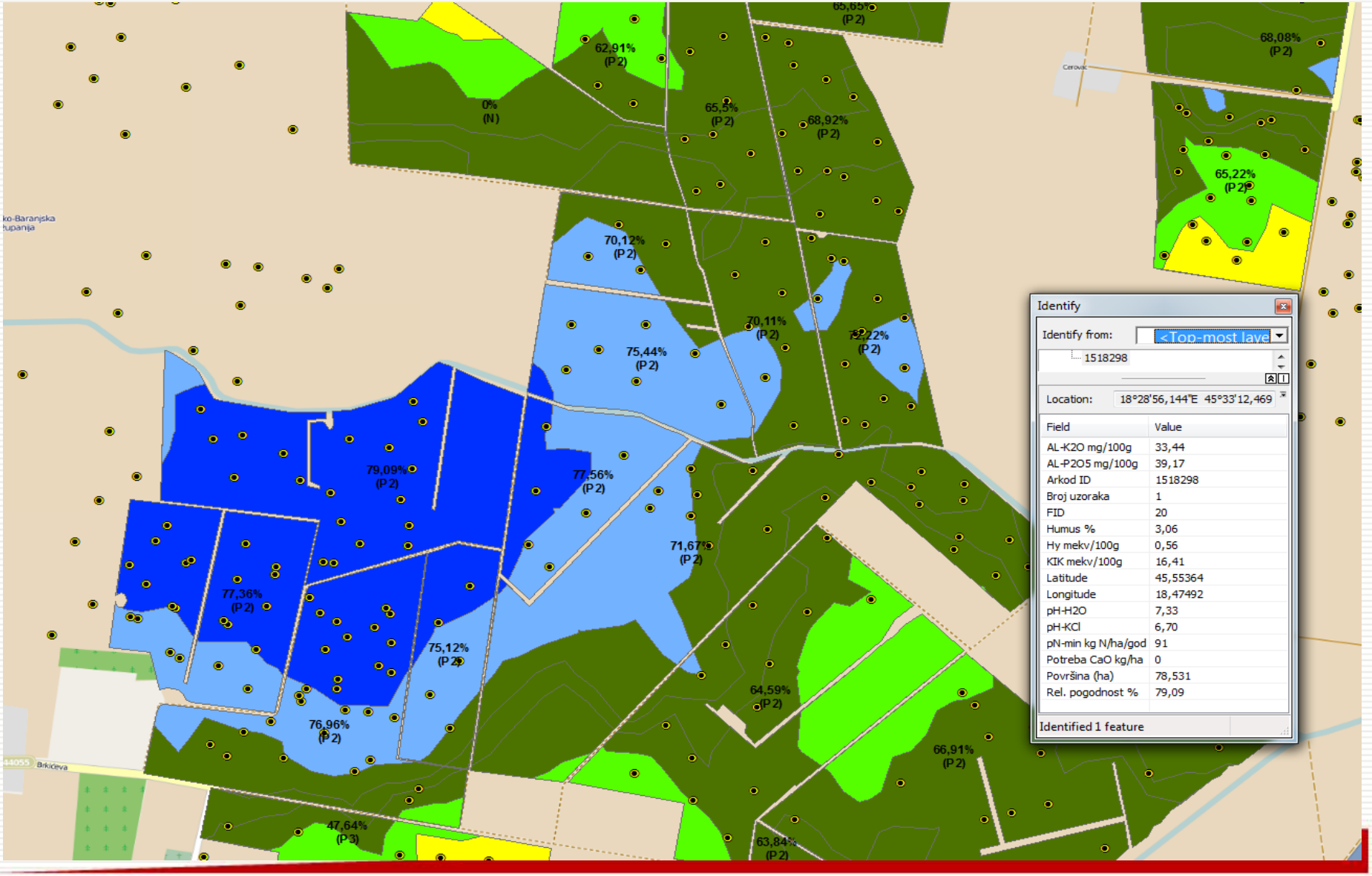
Integration of *Arkod and iBaze in* QGIS 1.8.0

Relative suitability for crops distinguished by a color in 5 classes from red to green



Forcasting of relative suitability for crops using geostatistical analyses method

[LINK - iBase]



Final remarks

- **Each land unit (parcel - plot) can be associated with any attribute which are observed (analyzed).**
- **This Model is a very useful tool for decision makers and policy makers** and for any other users (private or legal entities)
- **Model can take it into account high variability of soil types (large heterogeneity) on relative small area.**
- **Very simple user interface**
- **Model can be easily adapted for diferent agroecological conditions**
- **Croatia has a great potential for crop production – using this type of Model (multydisciplinary approach) this potential can be more .....!!!**

„What is the main demand of soil tillage?

„Depth of soil tillage and number of passes machinery and tools for tillage, should be harmonized with the natural conditions, and adjust the level of production must be economically justified“ **and conclusion:** ***„No unique optimal basic soil tillage treatments !!!“***

Thank you very much for your attention !!!

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