EFOP-3.6.1-16-2016-00004
ÁTFOGÓ FEJLESZTÉSEK A PÉCSI TUDOMÁNYEGYETEMEN
AZ INTELLIGENS SZAKOSODÁS MEGVALÓSÍTÁSA ÉRDEKÉBEN

FARM SUPPORT VIA CROP YIELD MEASUREMENTS BY SATELLITE DATA

GÁBOR CSORNAI
COSIMA LTD.

SZÉCHENYI 2020
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BEFEKTETÉS A JÖVŐBE

CONTENT

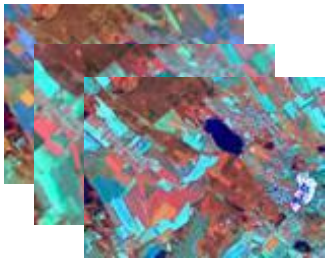
- How does crop matters fit into the global LCLUC issues? Ag=37% of global land, arable: 10% /global land area (= 30% of Earth surface)
- Remarks to crop monitoring in Hungary – in relation to LUC
- Farms' crop monitoring by optical satellite data
- Go beyond parcels: PA applications and their potential
- What is the contribution to the final goals: environment sustainability, recovery

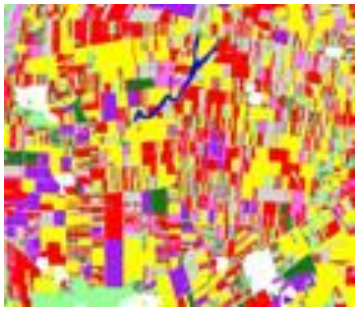
Rising Carbon Dioxide Levels Will Help and Hurt Crops | NASA
https://www.nasa.gov/.../nasa-study-rising-carbon-dioxide-levels-will-... Oldal lefordítása
2016. máj. 3. - "The impact on **crop** water **productivity** and **yield** is strongest in ... As for wheat, doubled **carbon dioxide** levels bring about **yield** ..... and a key player in developing a **relationship** between NASA and the city of Rio de Janeiro.

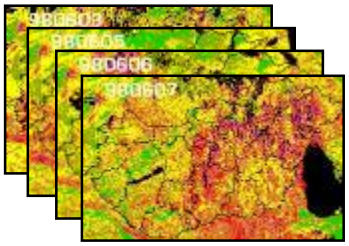
November 30, 2012
The carbon dioxide content of the atmosphere continues to climb and heat up the climate. The gas is, however, indispensable for plants, as they use the carbon it provides to form glucose and other important substances. Therefore, the more carbon dioxide the better? The equation is unfortunately not as simple as that. The plants, which ensure our basic food supply today, have not been bred for vertical growth but for short stalks and high grain yields. Scientists from the Max Planck Institute of Molecular Plant Physiology and the University of Potsdam have now discovered that an increase in carbon dioxide levels could cancel out the beneficial effects of dwarf varieties.

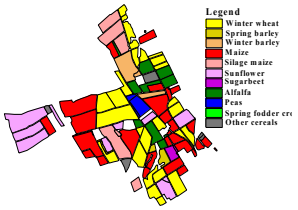
CROPMON (1997-2003)
Objective crop production forecast for counties and state level, Hungary

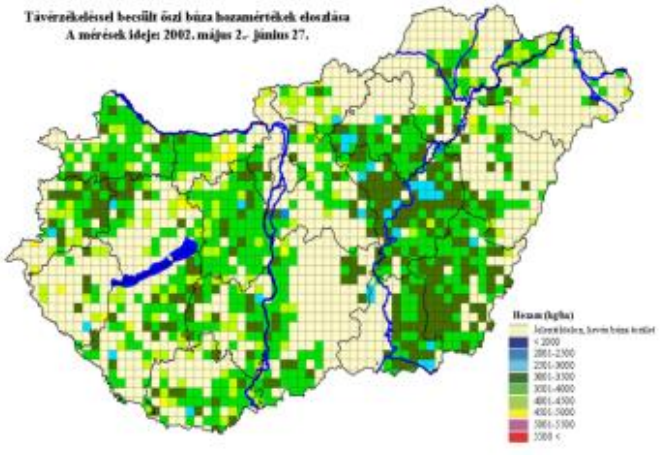
NATIONAL, REGIONAL LEVEL











Wheat yield distribution

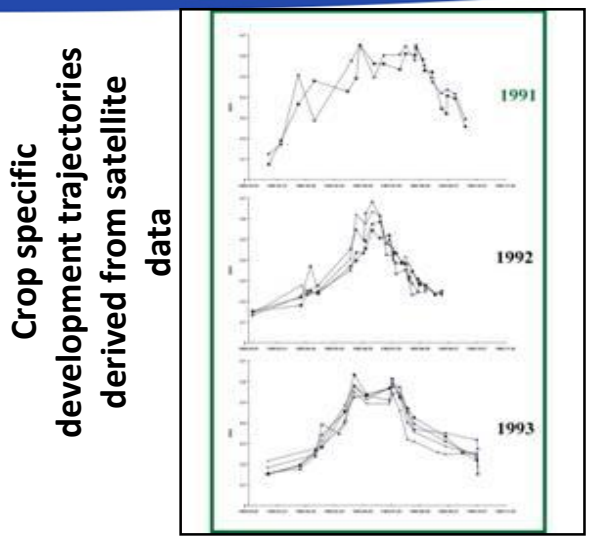
1. Megye	Őszi búza (ha)	Őszi árpa (ha)	Tavaszi árpa (ha)
2. Pest, Budapest	69 694	13 522	7 871
Közép-Magyarország	***69 694***	***13 522***	***7 871***
Fejér	82 809	8 603	4 659
Komárom-Esztergom	30 598	5 621	4 744
Veszprém	36 982	15 751	9 654
Közép-Dunántúl	***150 389***	***29 975***	***19 057***
Győr-Moson-Sopron	68 062	13 965	24 257
Vas	39 011	7 456	13 853
Zala	22 241	7 441	6 030
Nyugat-Dunántúl	***129 314***	***28 862***	***44 140***
Baranya	55 873	13 734	5 959
Somogy	50 241	11 666	2 018
Tolna	54 666	10 264	1 965
Dél-Dunántúl	***160 780***	***35 664***	***9 942***
Borsod-Abaúj-Zemplén	58 269	5 249	20 885
Heves	52 188	6 397	10 906
Nógrád	22 031	2 040	6 673
Észak-Magyarország	***132 488***	***13 686***	***38 464***
Hajdú-Bihar	68 156	8 238	8 487
Jász-Nagykun-Szolnok	116 323	14 016	15 198
Szabolcs-Szatmár-Bereg	36 212	5 087	3 284
Észak-Alföld	***220 691***	***27 341***	***26 969***
Bács-Kiskun	93 202	27 864	6 043
Békés	124 146	21 279	3 893
Csongrád	70 870	17 375	2 930
Dél-Alföld	***288 218***	***66 518***	***12 866***

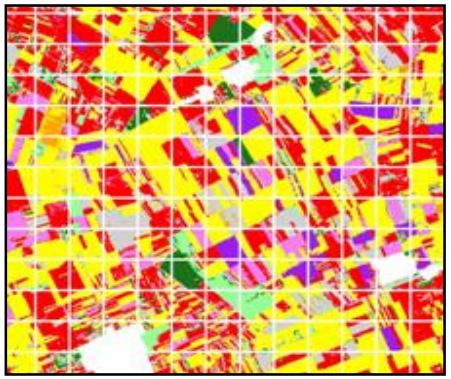
1. Megye	Őszi búza (kg/ha)	Őszi árpa (kg/ha)	Tavaszi árpa (kg/ha)
2. Pest, Budapest	3 650	3 146	2 540
Közép-Magyarország	***3 650***	***3 146***	***2 540***
Fejér	4 180	3 802	3 298
Komárom-Esztergom	3 909	3 486	2 834
Veszprém	3 760	3 407	3 031
Közép-Dunántúl	***4 022***	***3 535***	***3 047***
Győr-Moson-Sopron	3 712	3 378	3 307
Vas	3 626	3 250	3 245
Zala	3 861	3 610	3 152
Nyugat-Dunántúl	***3 712***	***3 405***	***3 266***
Baranya	4 346	3 867	2 934
Somogy	3 718	3 572	2 959
Tolna	4 179	3 957	3 040
Dél-Dunántúl	***4 093***	***3 796***	***2 960***
Borsod-Abaúj-Zemplén	3 328	2 912	2 721
Heves	3 116	2 977	2 614
Nógrád	3 193	2 841	2 541
Észak-Magyarország	***3 222***	***2 932***	***2 659***
Hajdú-Bihar	3 681	3 148	2 396
Jász-Nagykun-Szolnok	3 365	3 261	2 572
Szabolcs-Szatmár-Bereg	3 636	3 156	2 663
Észak-Alföld	***3 507***	***3 207***	***2 528***
Bács-Kiskun	3 700	3 207	2 234
Békés	3 461	3 265	2 387
Csongrád	3 421	2 976	2 582
Dél-Alföld	***3 528***	***3 165***	***2 360***

CROPMON (1997-2003)
Objective crop production forecast for counties and state level, Hungary

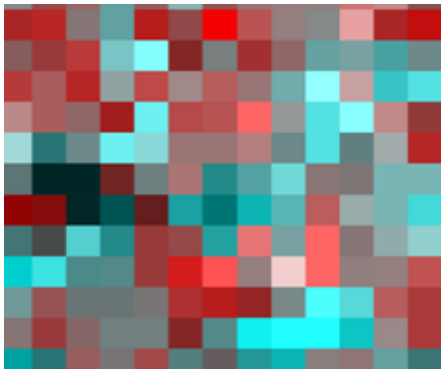
COSIMA

- **Basics:**
  - **combination of spatial with spectral/temporal information (high res. + AVHRR)**
  - **NOAA AVHRR images and crop maps => crop specific temporal profiles**
- **Features:**
  - **generic: works for several crops**
  - **year independent**
  - **area independent**
  - **reliable, accurate, timely**





Part of a crop map with 1.1 km grid overlay, corresponding to the NOAA AVHRR pixel size



Corresponding subset of a NOAA AVHRR colour composite

High and low resolution satellite data integration- high fidelity spatial-temporal crop development data set.

CROPMON 1997-2003

Lessons from CROPMON = a technical model for the integration of 2 scales of satellite data and 2 themes:

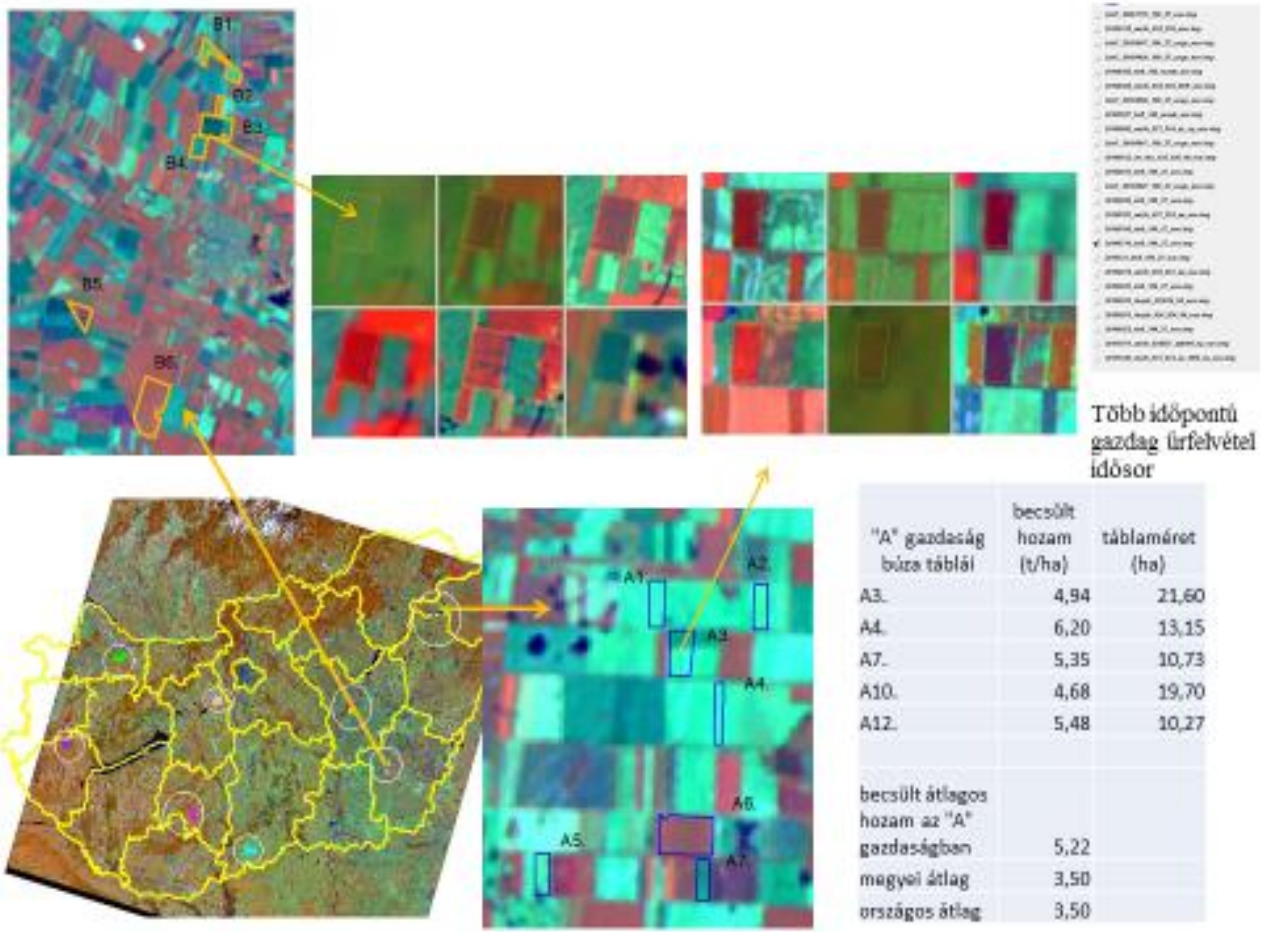
- The crop development/change (NOAA AVHRR series) and
- Crop type (Landsat series).

This combination resulted in crop specific radiation parameters that were appropriate both is spatial and temporal assessment.

This approach (combination) can be used in the MODIS era as well.

On the users' side: CROPMON supported grain production management at state level.

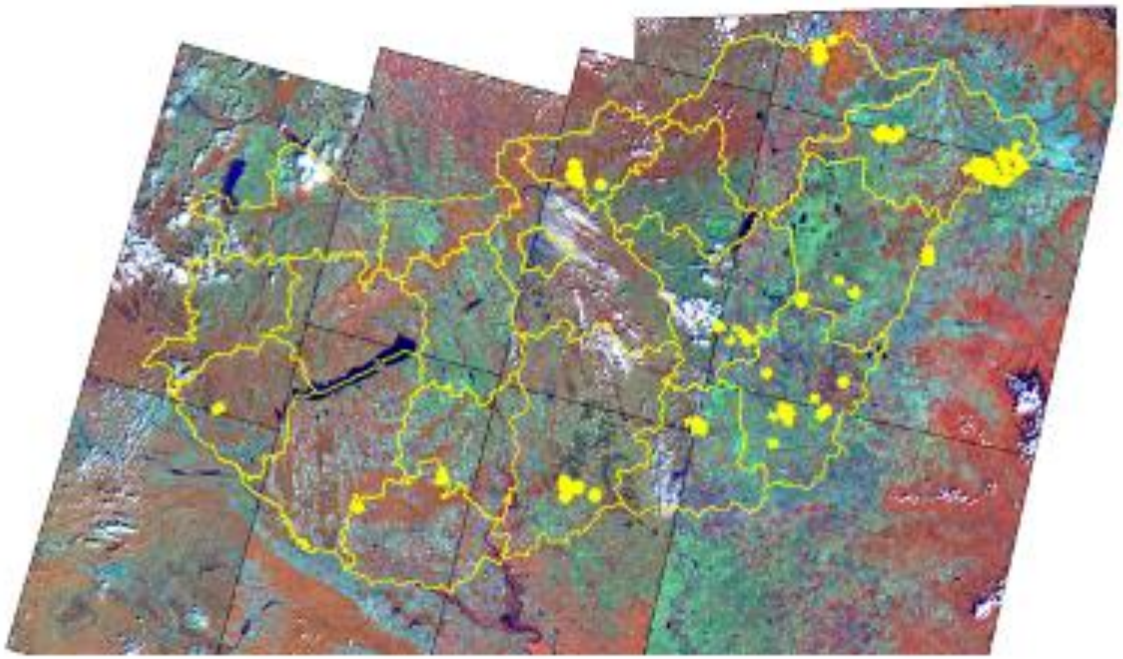
MONITORING SERVICES PROVISION FOR FARMS



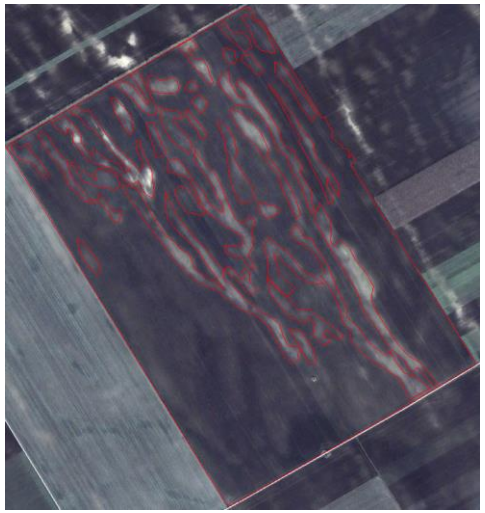
Több időpontú gazdag űrfelvétel idősor

"A" gazdaság búza táblái	becsült hozam (t/ha)	táblaméret (ha)
A3.	4,94	21,60
A4.	6,20	13,15
A7.	5,35	10,73
A10.	4,68	19,70
A12.	5,48	10,27
becsült átlagos hozam az "A" gazdaságban	5,22	
megyei átlag	3,50	
országos átlag	3,50	

SERVICE PROVISION AREAS FOR FARMS PER FIELD UP TO 2015



HOW TO HELP CONTROL THE CULTIVATION IN PA/SSM ENVIRONMENT?

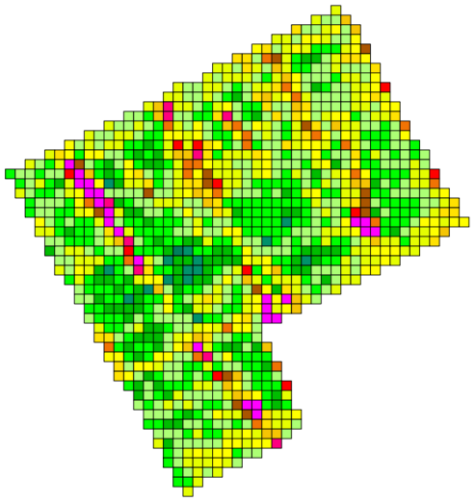



Very heterogeneous areas
Heterogeneity is not extreme, it is just the natural state of fields!

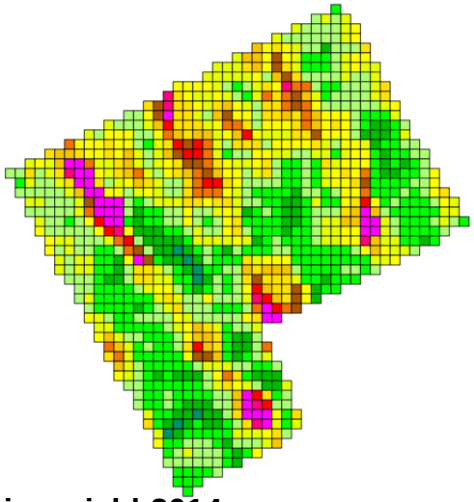
The main goal to optimize the benefit and adjust the cultivation to the ‚capability' of the cell/grid (Site Specific Management)

The developed technique provides an opportunity for the application the optimal cultivation in the first years (4-6) instead of the repeated update/loss in treatments.

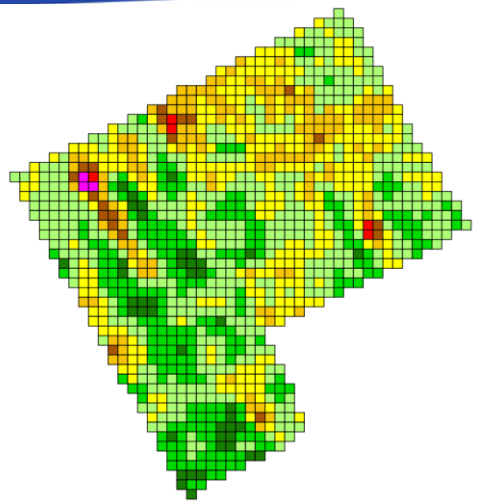
COSIMA CAN MEASURE THE YIELDS AT PA/SSM SCALE FOR AS MANY YEARS AS NEEDED



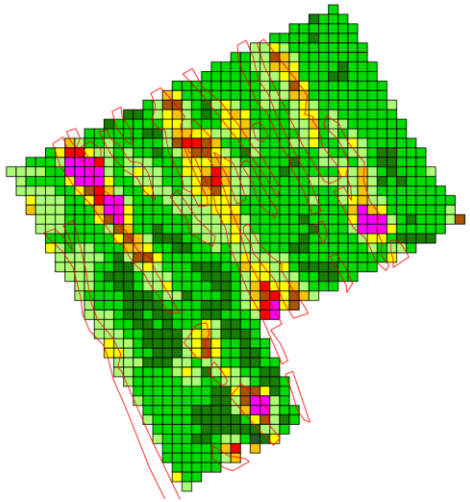
Prec combine-2014



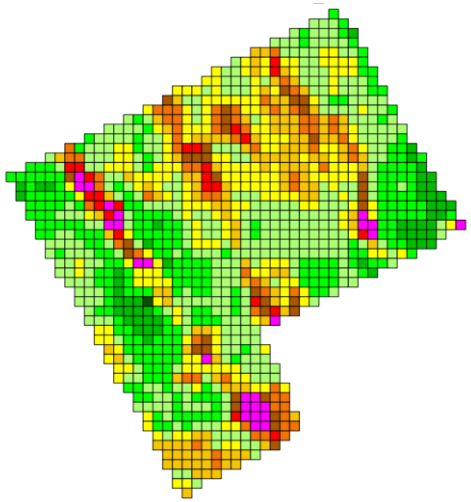
Cosima yield-2014



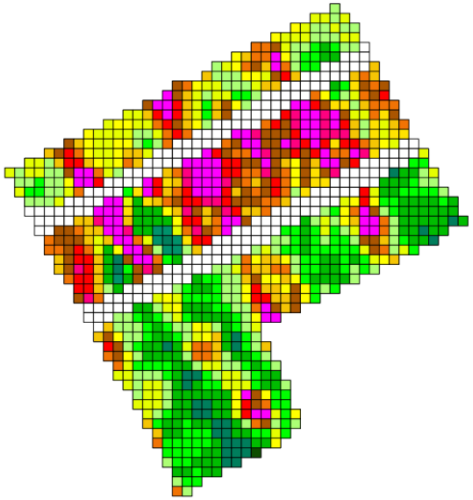
Cosima yield-2010 wheat



Cosima –sunflower yield 2011

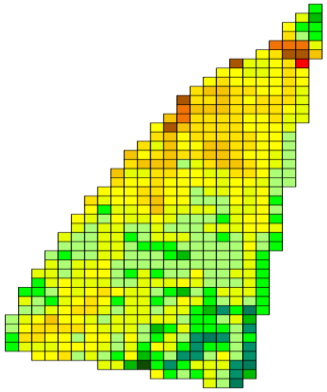


Cosima -2013 soybean

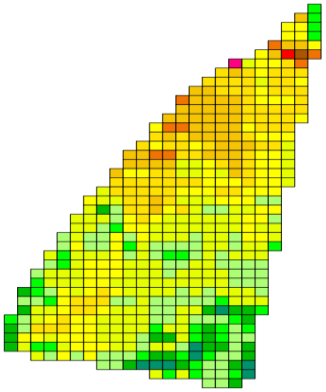


Cosima -2015 sunflower+corn

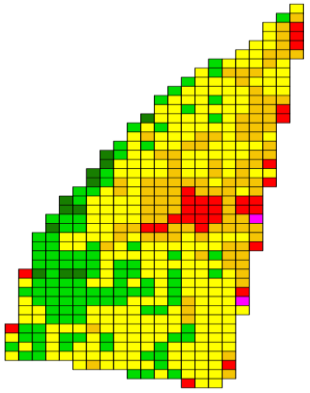
East Hungary: 5 years of yield measurements for parcel-grids



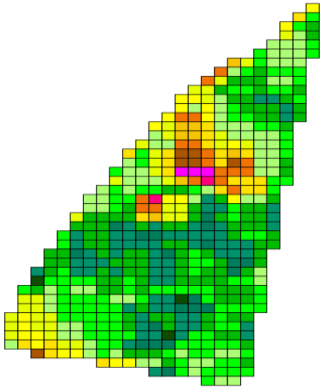
precision yield by the harvester, 2014



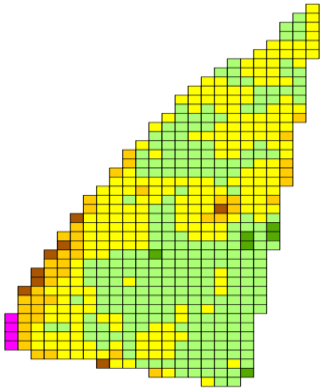
COSIMA, 2014, maize



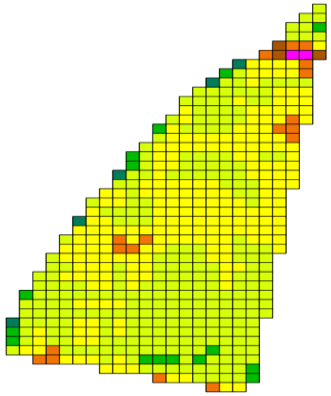
COSIMA, 2010, wheat



COSIMA, 2011, maize

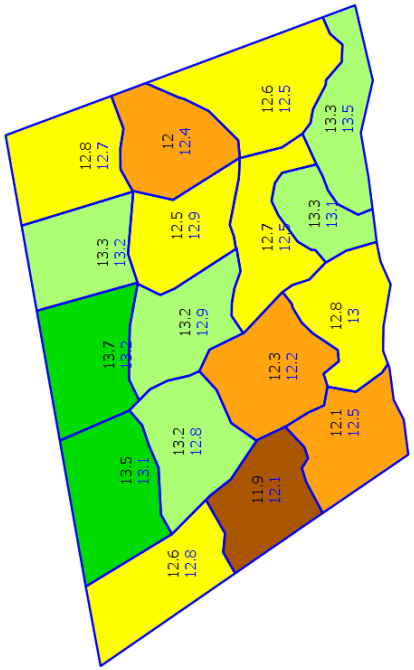


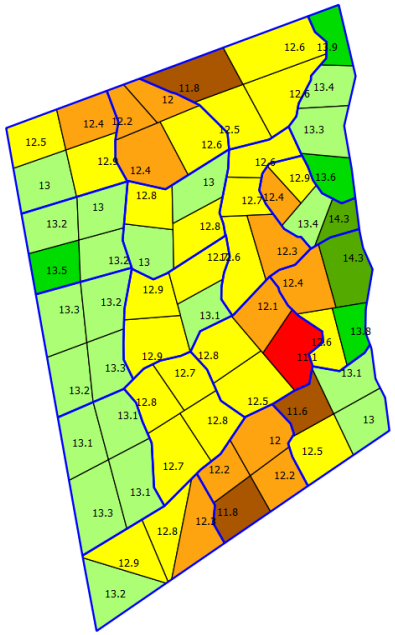
COSIMA, 2013, sunflower

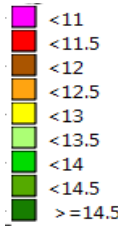


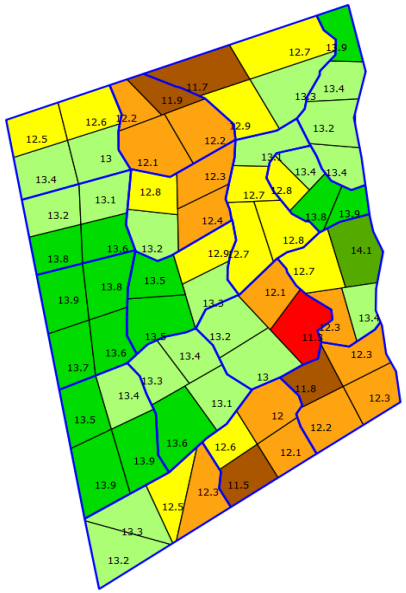
COSIMA, 2015, maize

Comparison between the precicion combine and satellite based yield measurements in cultivation zones







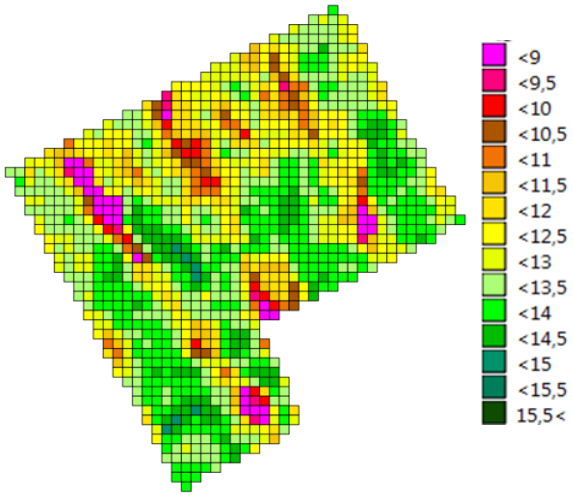


A) Avg. difference between COSIMA's yield prediction (-3-4 weeks) and the precision yield map of the harvester **~±2%**

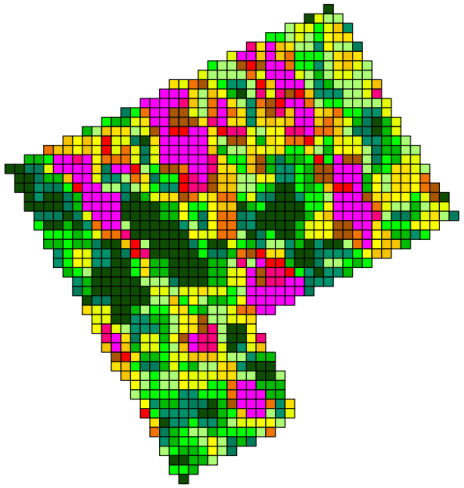
B) Avg. difference at subdivided zones (0,7 ha avg.) is less than **~±2,5%**

The measurement can substitute the properly calibrated precision combines' data reliably!
THIS METHOD IS A GREAT ASSET IN THE QUICK AND RELIABLE ANALYSIS OF THE YIELD/PRODUCTION PATTERN OF THE PARCEL IN THE PREVIOUS YEARS

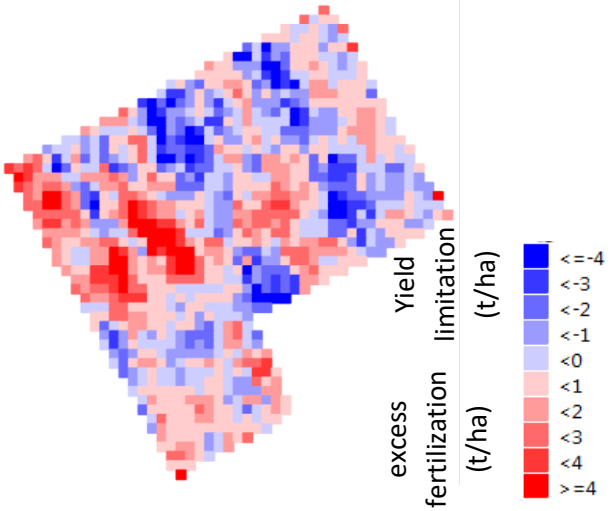
MEASUREMENT ACCURACY ↔ OPTIMAL ENVIRONMENT IMPACT



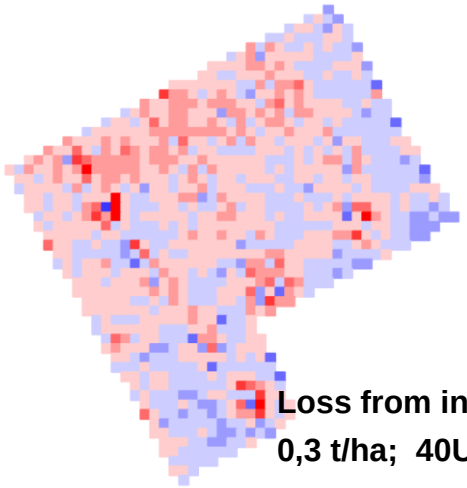
Yield values/ Cosima



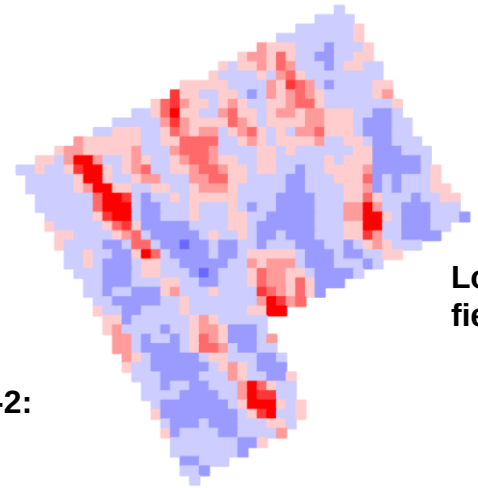
Inaccurate yield measurement-1



Loss from measurement 1:
0,8t/ha ~120USD/ha

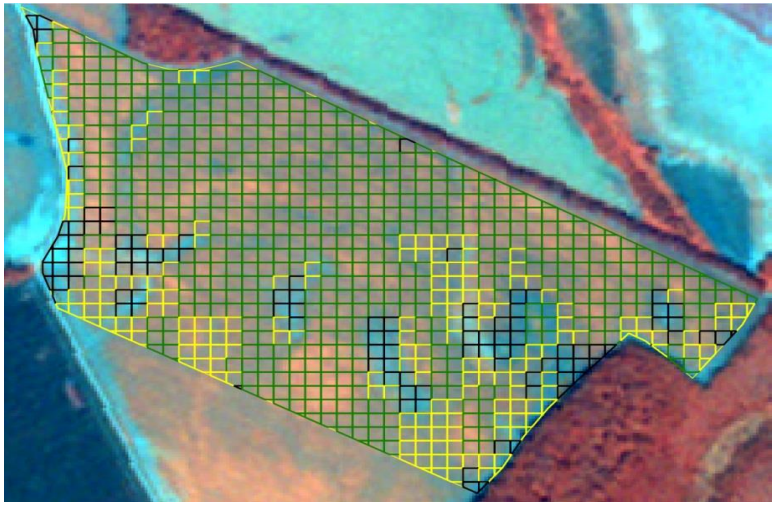


Loss from inaccurate-2:
0,3 t/ha; 40USD/ha



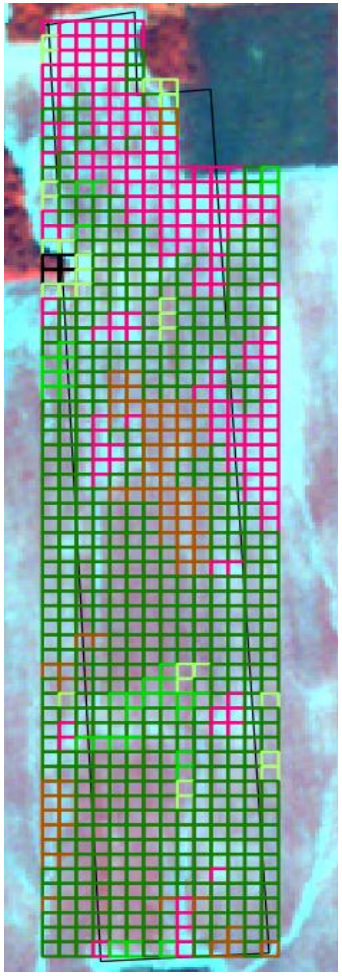
Loss along the traditional cultivation/ field average: 0,5 t/ha 80USD/ha

OTHER EXAMPLE: TOP/SIDE DRESSING

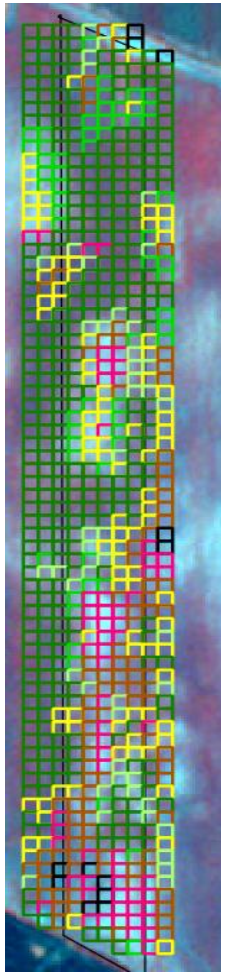


A novel technique was developed and being introduced for farms that is more efficient in terms of financial benefit and load the environment.

It assess processes rather than incident stage and combines historic yield profile of the field (cell)



Optimal top dressing, N recommendations to the farms



CONCLUSION

- ***LCLUC programs monitor the main driving forces and derive parameters of the vital global cycles of concern***
- ***It is to improve our chance through some feedback actions, policies implementation at states, regional, global level***
- ***The shown developed tool should similarly contribute to the self-control of farming at a local scale and basic level***
- ***These techniques provide a better, more efficient and still less harmful way to cropping***
- ***Moreover, similar approaches can hopefully be applied in LCLUC***

THANK YOU FOR YOUR INTEREST

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