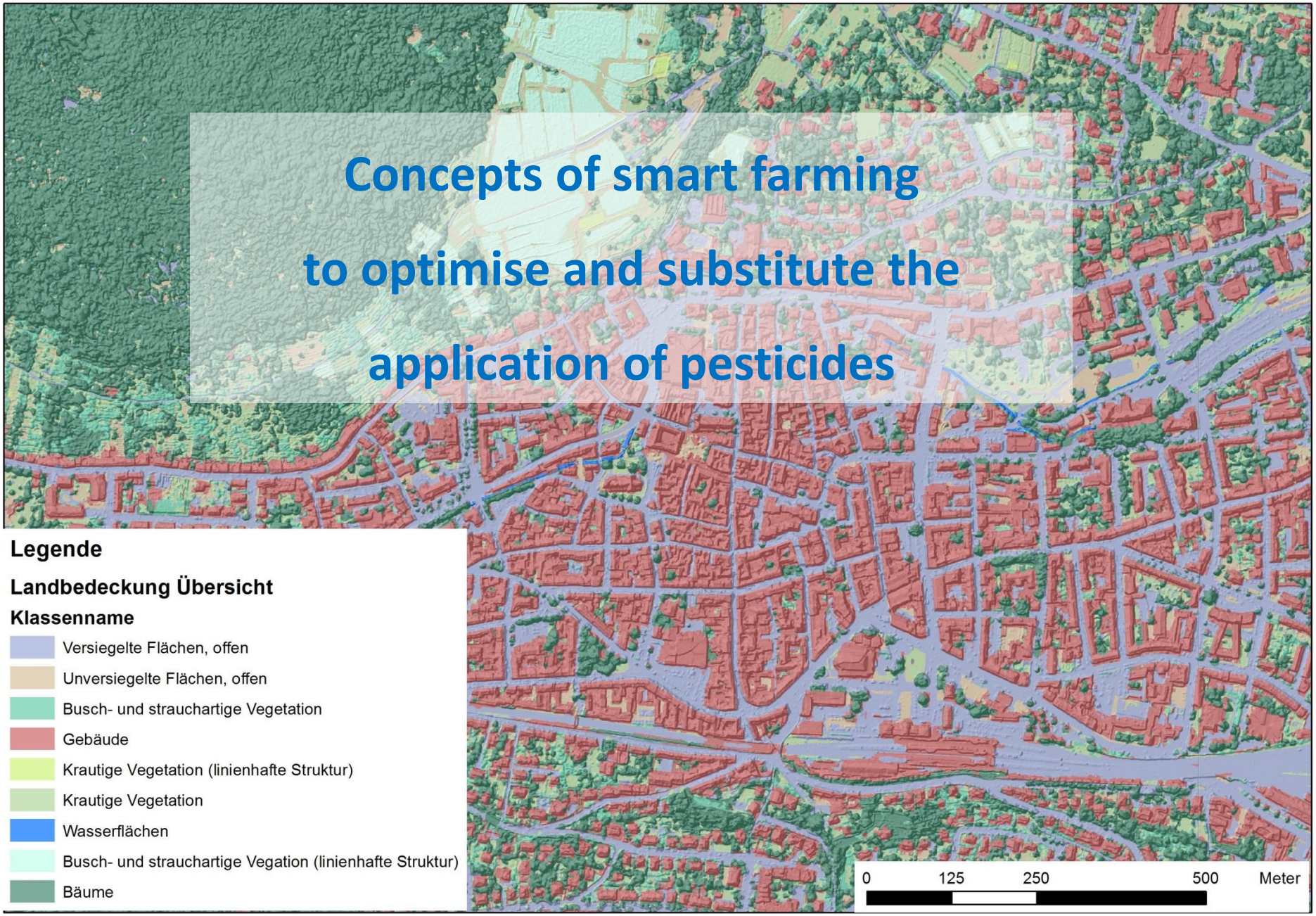
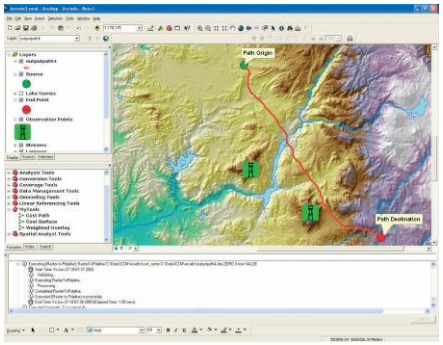
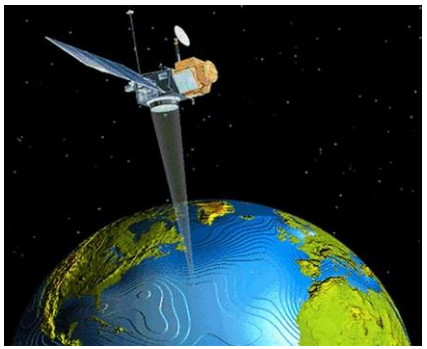
Concepts of smart farming to optimise and substitute the application of pesticides

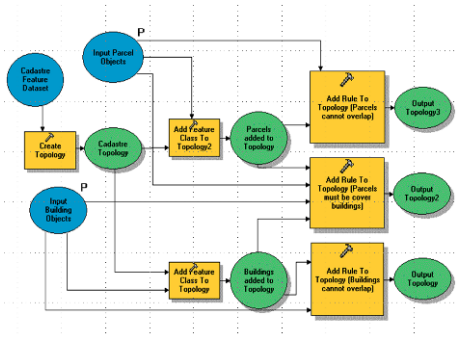


Environmental Systems

We think georeferenced ;-)







Fields of activity

- **Remote sensing** - Object based image analysis (OBIA) – Satellite time series - Copernicus
- **Geodata analysis**: **Risk and potential assessment**, change detection, monitoring,
- **Programming** (R, .NET, Python, C++)
- Automated **large scale geoprocessing**
- **AI** based data analysis (**machine learning**)
- Geosemantics
- Terrain analysis
- Climate data analysis
- Landscape development
- Visualisation
- Communication (**Apps**, WebMaps)

Concepts of smart farming

to optimise and substitute the application of pesticides

Smart farming for

- **optimising the application (pattern) of pesticides**
- substitute pesticides

nature
International journal of science

Outlook | Published: 26 April 2017

Technology: The Future of Agriculture

Anthony King

Nature **544**, S21–S23 (27 April 2017) | Download Citation

A technological revolution in farming led by advances in robotics and sensing technologies looks set to disrupt modern practice.

Made for minds.

THEMEN MEDIA CENTER TV DEUTSCH LERNEN

DEUTSCHLAND BREXIT WELT WIRTSCHAFT KULTUR WISSEN & UMWELT SPORT

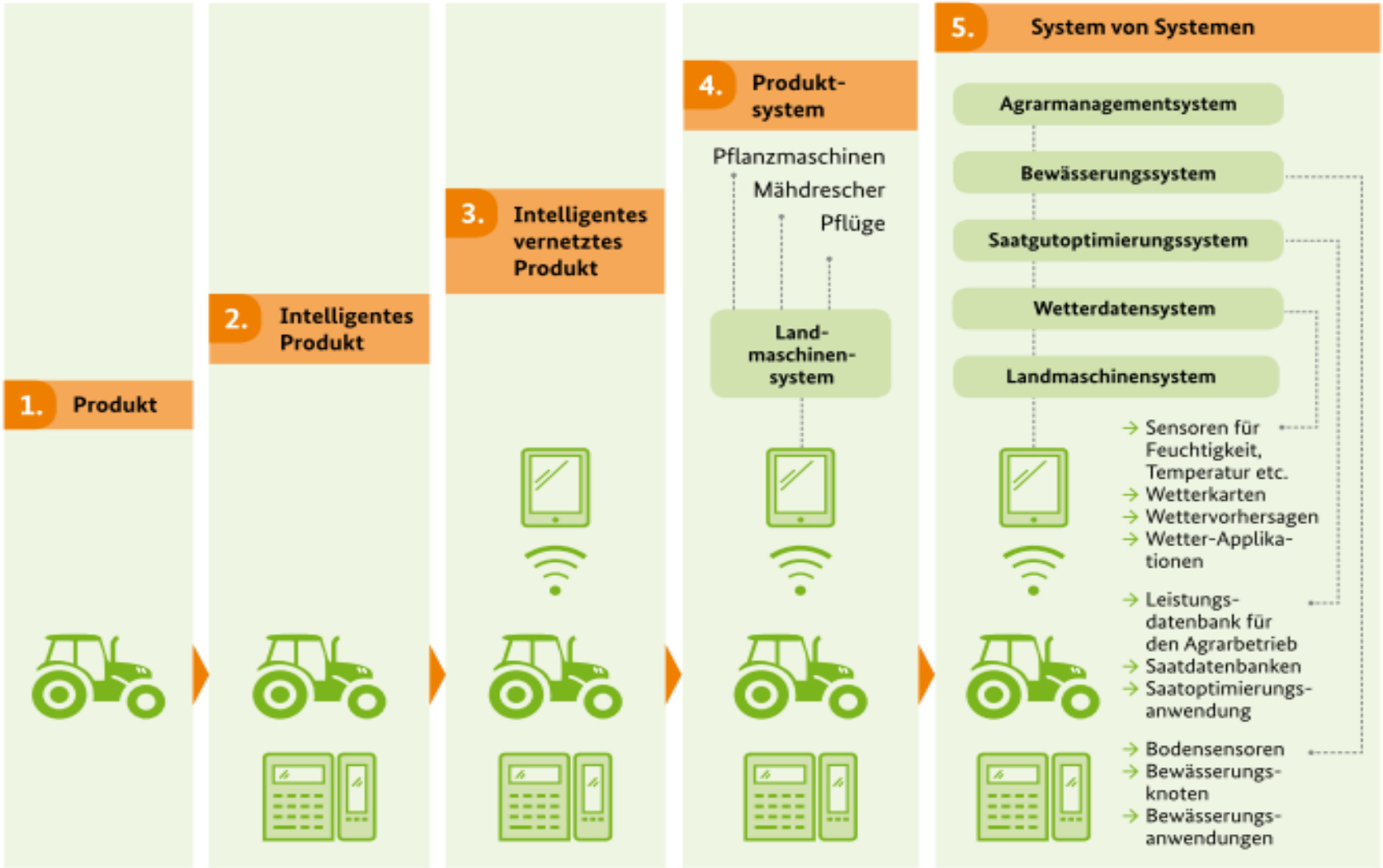
THEMEN / WIRTSCHAFT

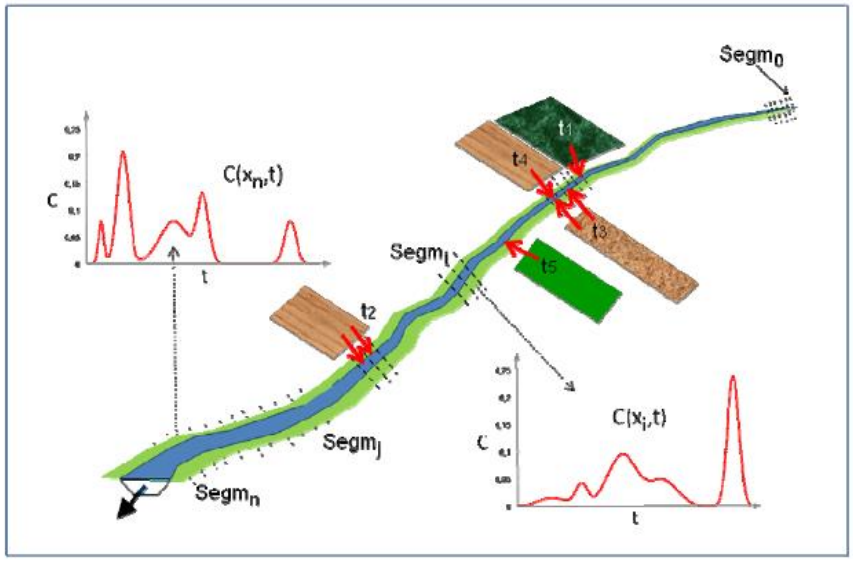
PRÄZISIONSLANDWIRTSCHAFT

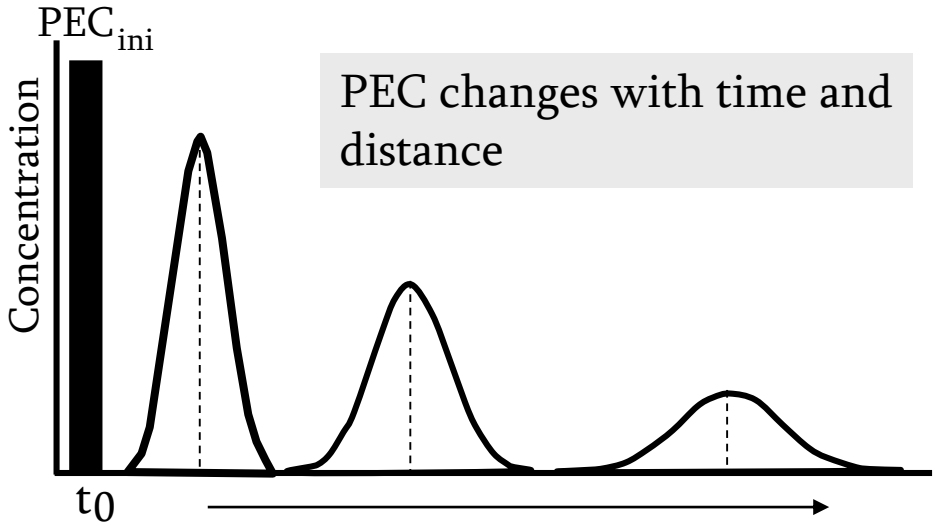
Roboter statt Glyphosat

Es ist so einfach, mit Glyphosat Unkraut zu beseitigen - wenn es nur nicht den Ruf hätte, schädlich für Mensch und Umwelt zu sein. Mal angenommen, es gäbe Roboter, die Unkraut jäten. Wer bräuchte dann noch Glyphosat?

From precision farming to smart farming and Internet of Things



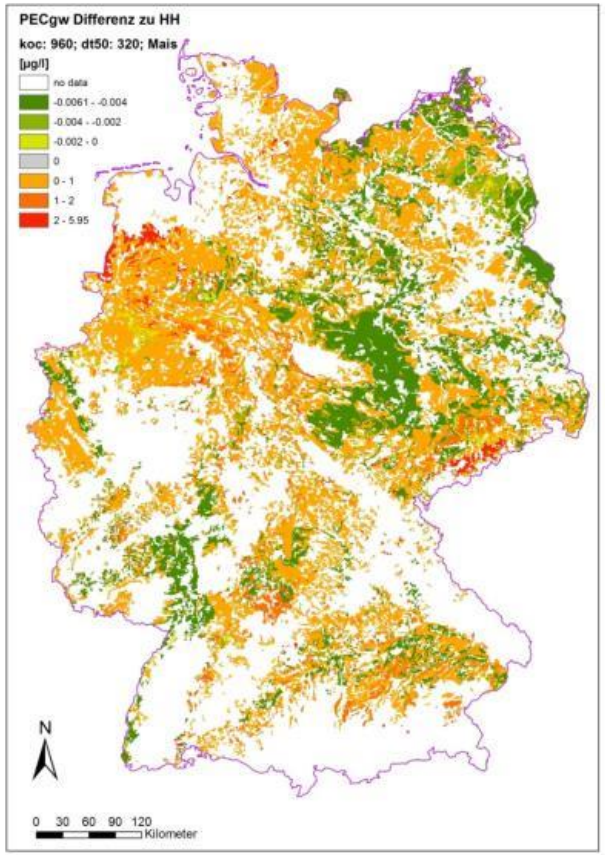




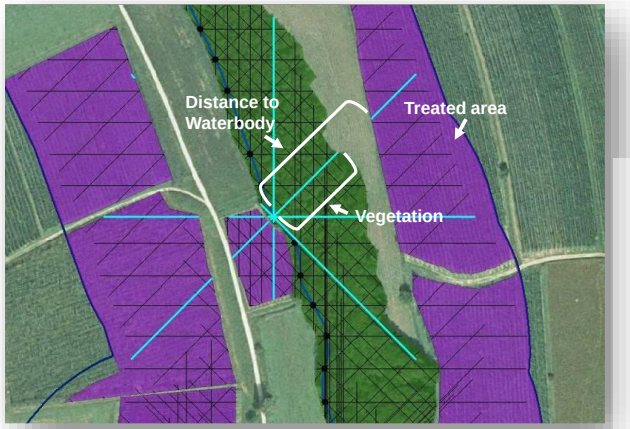
PEC changes with time and distance

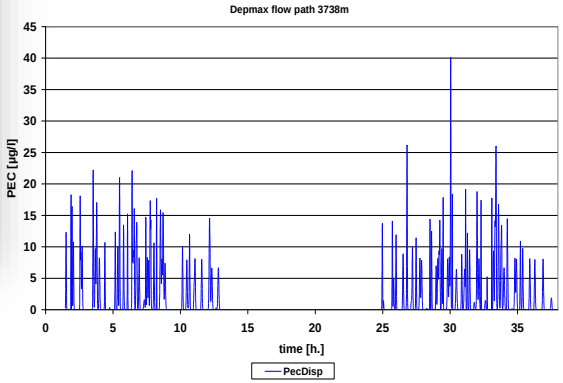
Exposure and Risk Assessment of Pesticides on landscape level

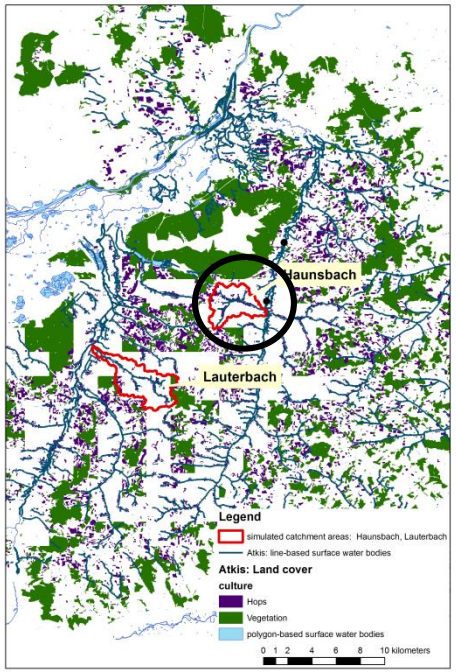
to optimise the use and application of pesticides

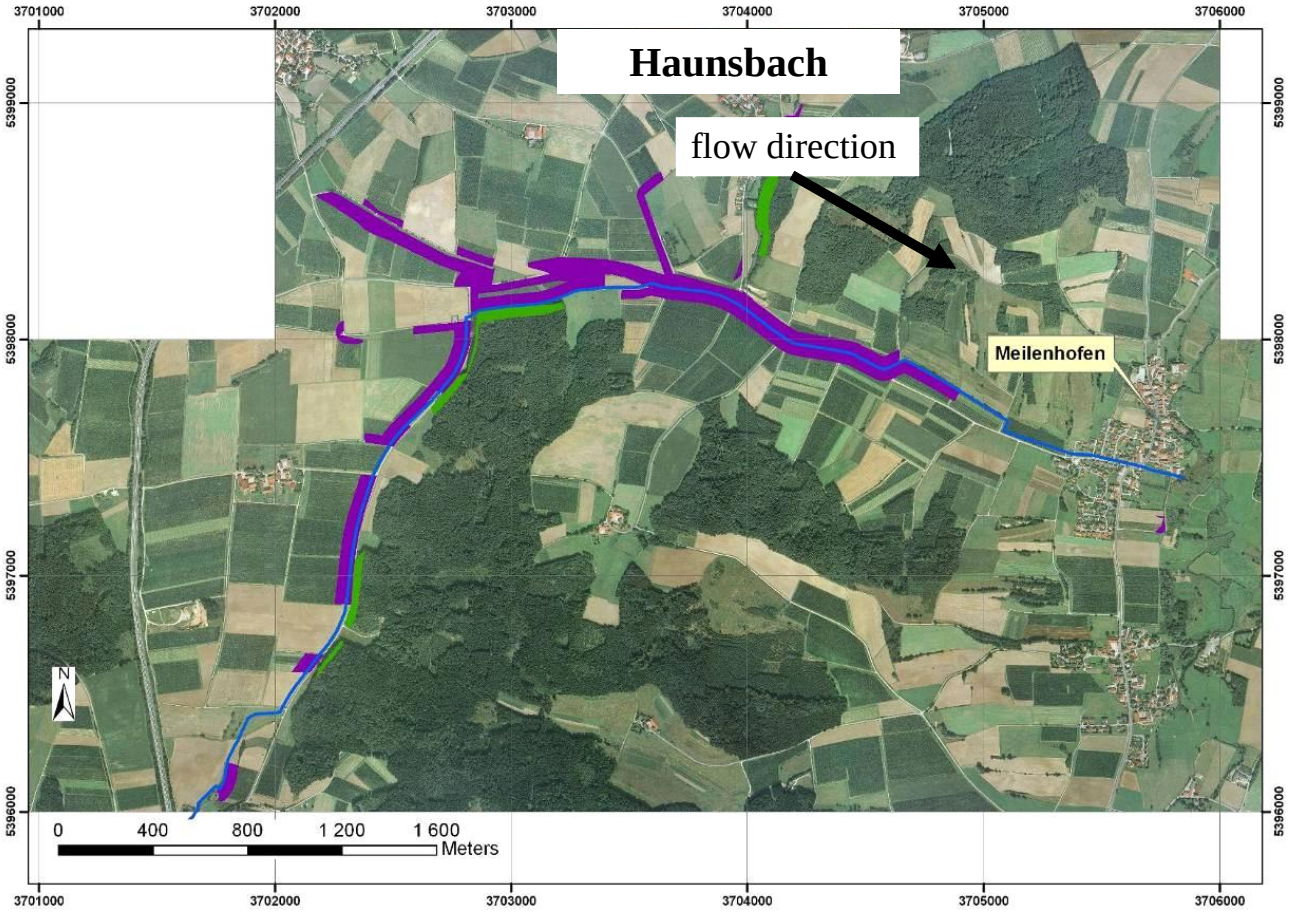


- GeoPERA (IVA: sw, drift- related)
- GeoRISK (UBA: sw, holistic approach)
- GERDA (UBA: sw)
- RiskMIN (BVL: terrestrial mitigation measures)
- GISPelmo (UBA: gw)
- GW Monitoring (UBA: gw)







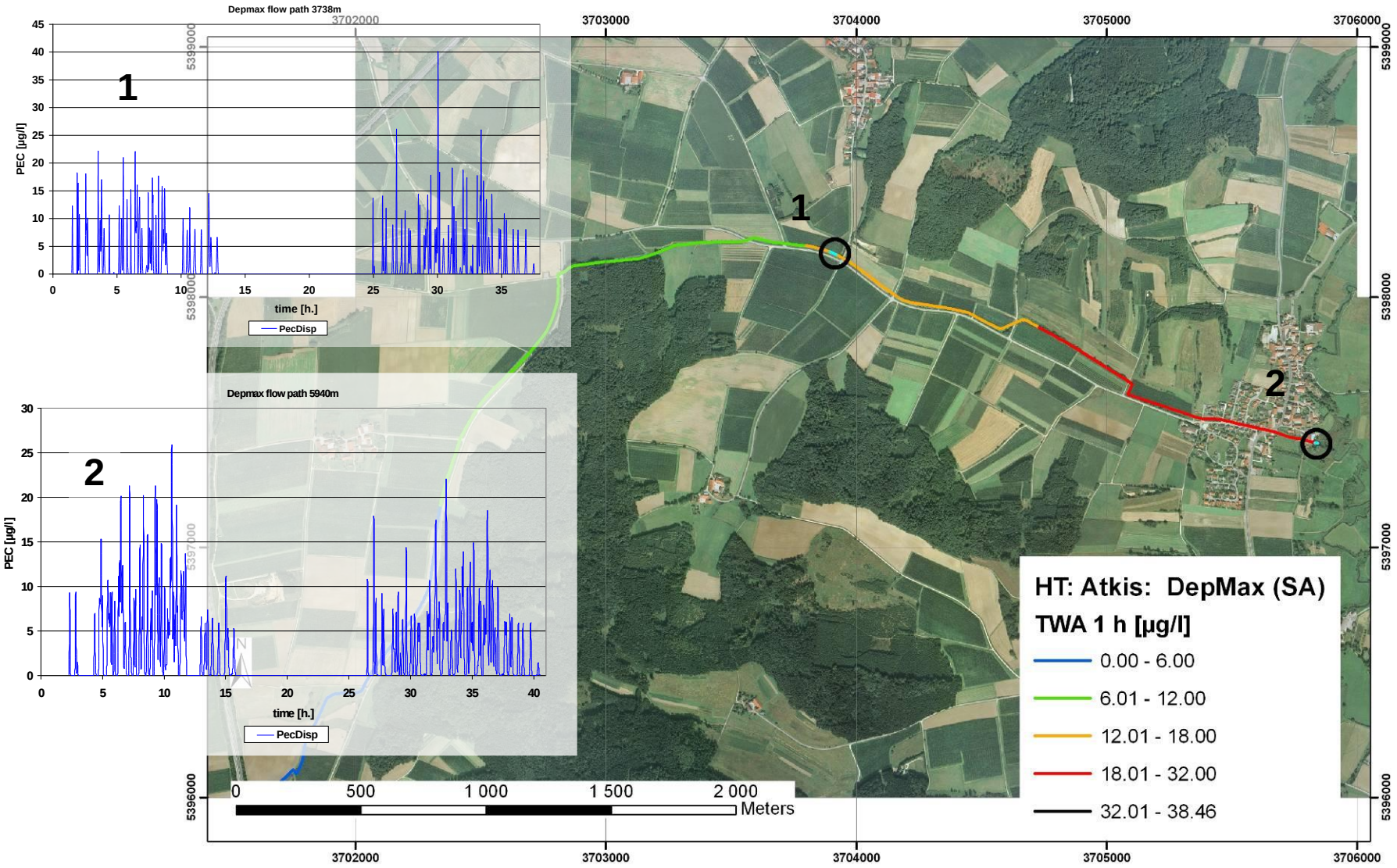


Hydrological parameters surveyed in 3 ground truthing campaigns

- length of simulated flow path: nearly 6 km
- mean flow velocity: 0.22 m/s (ca. 7.5 hours from start to end)
- mean water depth: 0.10 m
- mean water body width: 0.66 m

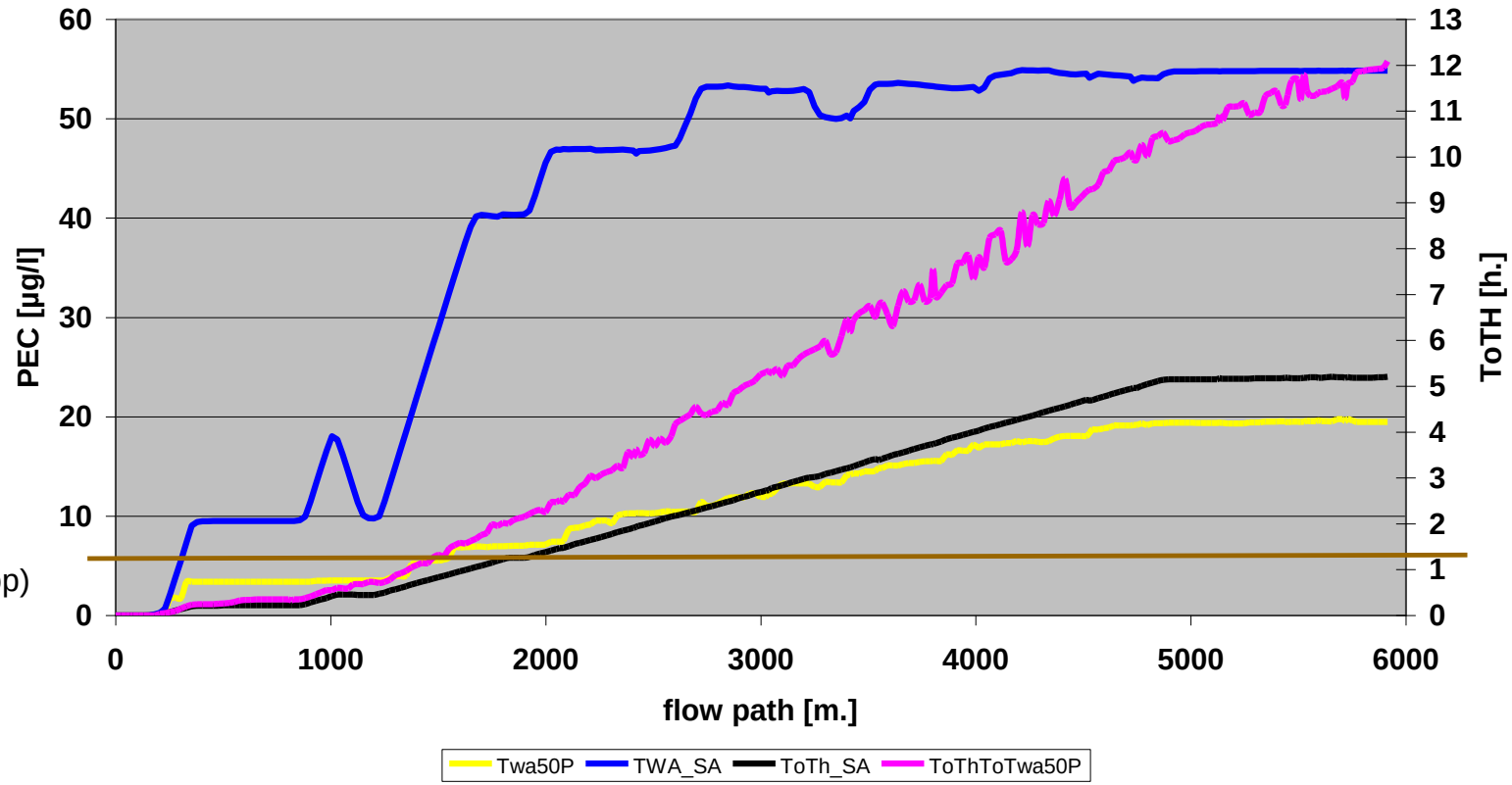
Hops within a 150 m buffer zone around the water body: 69 ha

Visualization of simultaneous application pattern



➔ **Differentiated spatio-temporal deposition patterns**

25 simulations:
PEC_TWA and ToTh of SA and the 50. Percentiles



RACsta:
(6 µg/l for hop)

! Flow time 7.5 hours, app time 10 hours per day

➔ **short-time exposure pattern (i.e 5 hours ToTh)**

➔ **simultaneous application pattern is worst case**

Most efficient for drift related impacts on flowing surface water:

Optimise time pattern of the application

➔ **Communication (Geotalk) between farmers, consultants and authorities**

Needs:

Communication infrastructure, combination of open and private data

„**honest broker**“ : data security using local networks

„**honest notary**“: data security using blockchain technology

Concepts of smart farming

to optimise and substitute the application of pesticides

Smart farming for

- optimising the application (pattern) of pesticides
- **substitute pesticides**

Anwendungsfeld
Digitalisierung in der Landwirtschaft

- **Wissenschaftlicher Experten-Workshop**
  „Digitalisierung ökologisch nachhaltig nutzbar machen“ **am Freitag, 29. Juni 2018**
  Fraunhofer Forum Berlin

In future digitalisation will provide a full capturing of all relevant process steps of the food chain from the production including logistic issues to the customer:

„ From furrow to the plate“

(Cited: Minister of Agriculture, Germany, Julia Klöckner, Berlin, 31.05.2018).

In Zukunft kann mit Hilfe der Digitalisierung ein lückenloses Erfassen aller Arbeitsprozesse entlang der Lebensmittelkette, von der Produktion einschließlich der Logistik bis zum Konsumenten erfolgen (Rückverfolgbarkeit von der „Furche bis zum Teller“, Zitat Bundeslandwirtschaftsministerin Klöckner, Berlin, 31.05.2018).

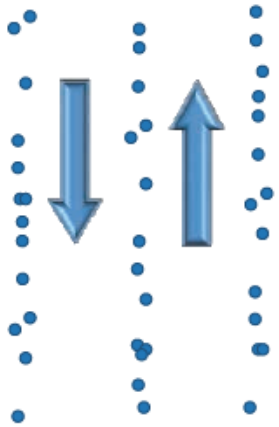
Today,

Often the **technical conditions determine the way crops are cultivated**, i.e. distance between the rows…

Using these new technologies the point of view can be changed to:

What is the best for cultivating the crop, i.e. the concept of spot farming:

Normal sowing



Cross compound sowing

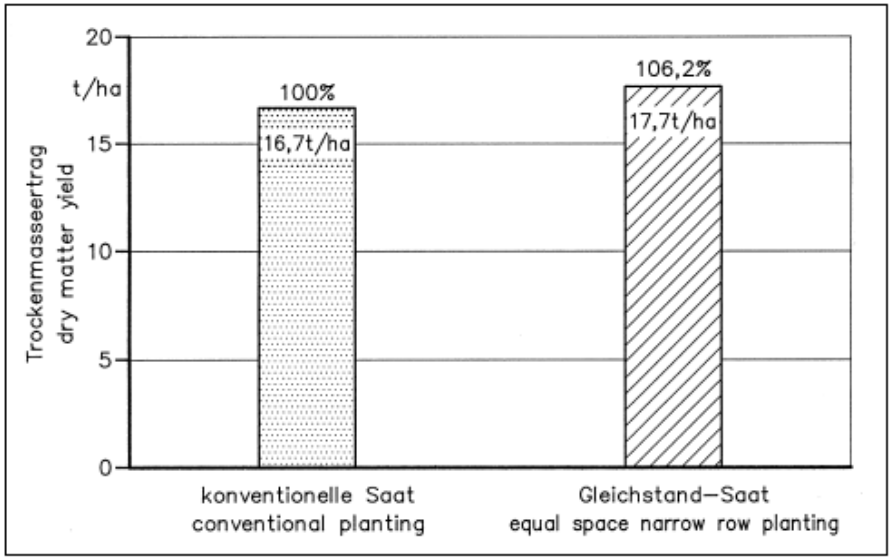


Fig. 3: Absolute and relative silage maize DM-yield of conventional and of equal space narrow row planted maize

Spot farming and agrosystems in future

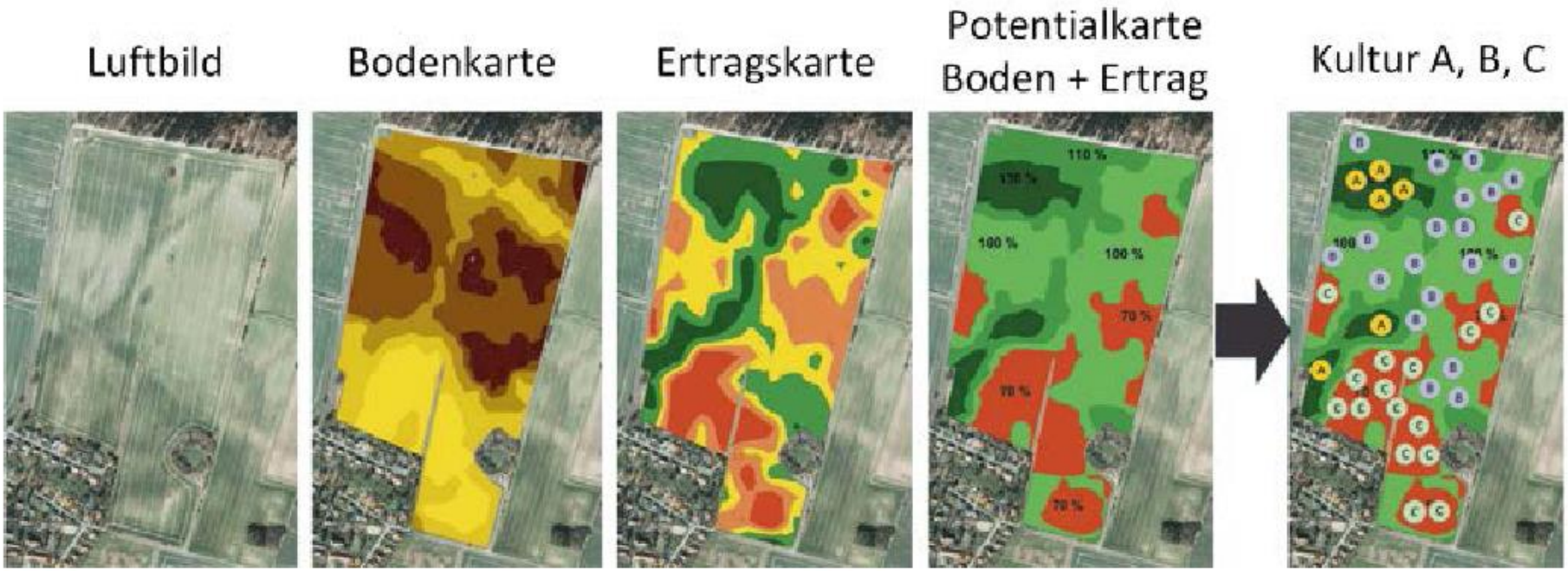


Abb. 1 Einfaches Beispiel zur Ableitung von unterschiedlichen Spots durch Informationsüberlagerung (WEGENER et al., 2017).

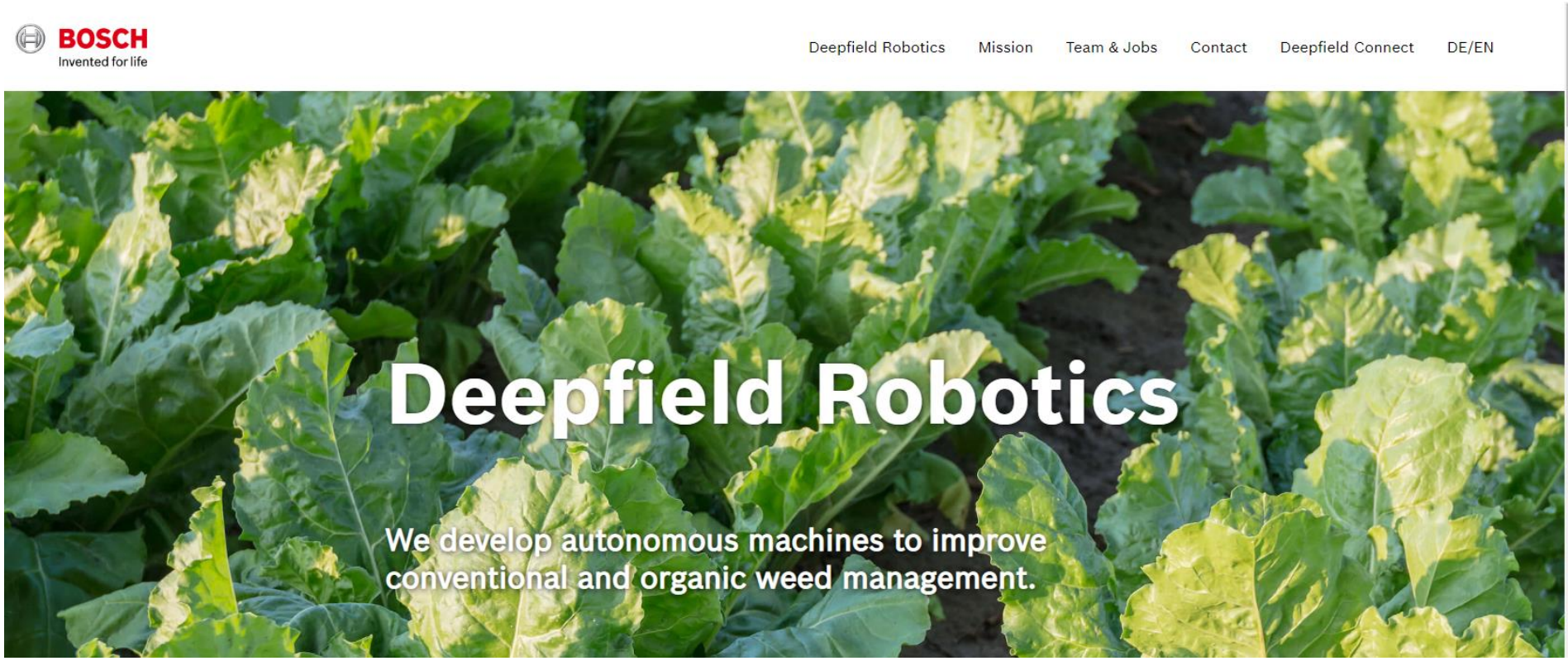
Bonirob

— a **car-sized robot** originally developed by a team of scientists including those at **Osnabrück University of Applied Sciences in Germany** —
can measure other indicators of soil quality using various sensors and modules, including a moisture sensor and a penetrometer, which is used to assess soil compaction. According to Arno Ruckelshausen, an agricultural technologist at Osnabrück, **Bonirob can take a sample of soil, liquidize it and analyse it to precisely map in real time characteristics such as pH and phosphorous levels.** The University of Sydney's smaller RIPPA robot can also detect soil characteristics that affect crop production, by measuring soil conductivity.

…
But if there is no need for the farmer to drive the machine, then one large vehicle that covers as much area as possible is no longer needed.

“As soon as you remove the human component, size is irrelevant,”
says van Henten.

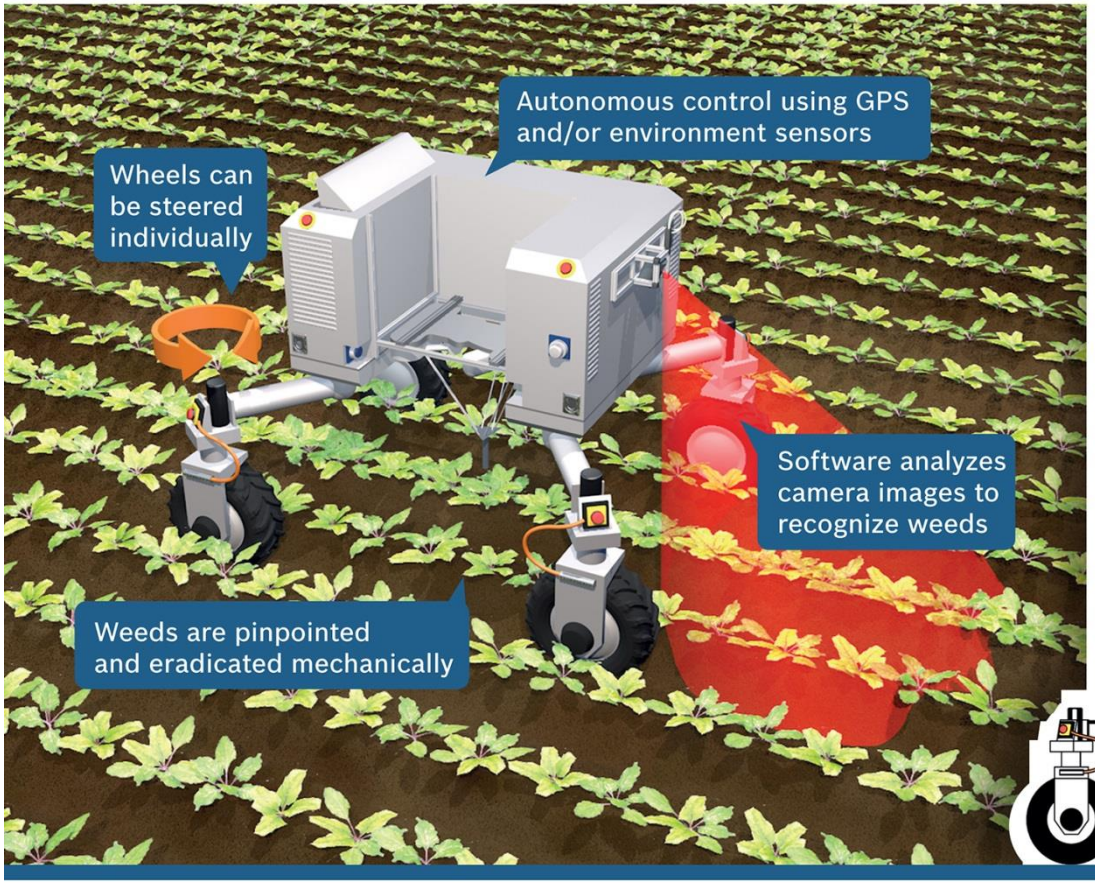
Small, autonomous robots make mixed planting feasible and would not crush the soil.


BOSCH
Invented for life
Deepfield Robotics
Mission
Team & Jobs
Contact
Deepfield Connect
DE/EN
Deepfield Robotics
We develop autonomous machines to improve
conventional and organic weed management.

On the beet field of the future

Bosch agricultural robot Bonirob gets rid of weeds automatically.
Sustainable green revolution in plant cultivation.

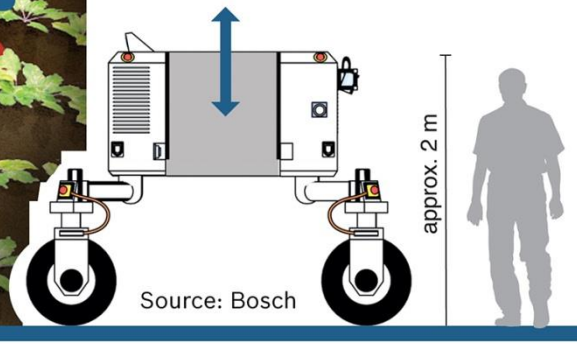
BOSCH
Invented for life



Other tools can be fitted for different applications

Measuring soil density
Soil can be examined to a depth of 80 cm

Field trials
Automatic plant analysis



Source: Bosch

Example Pesticides:

Using small scaled swarm intelligent (smart) micro robots

- Herbicide application can be fully substituded for some crops (sugar beans…)
- Fungicides and insecticides can be reduced up to 40 %
- Yield can be optimised up to 10 % by digital farmin

Implementing concepts of spot farming and cascade using concepts combined with small scaled strip cropping economical and ecological effects will be much higher (Thünen- Institute)

Bioeconomy and regionalised value chains

- Cascade using concepts: Niche plants, i.e oats with aventhramides…
- Processing and merchandising where the plants grow:

  „re“regionalisation of value chains

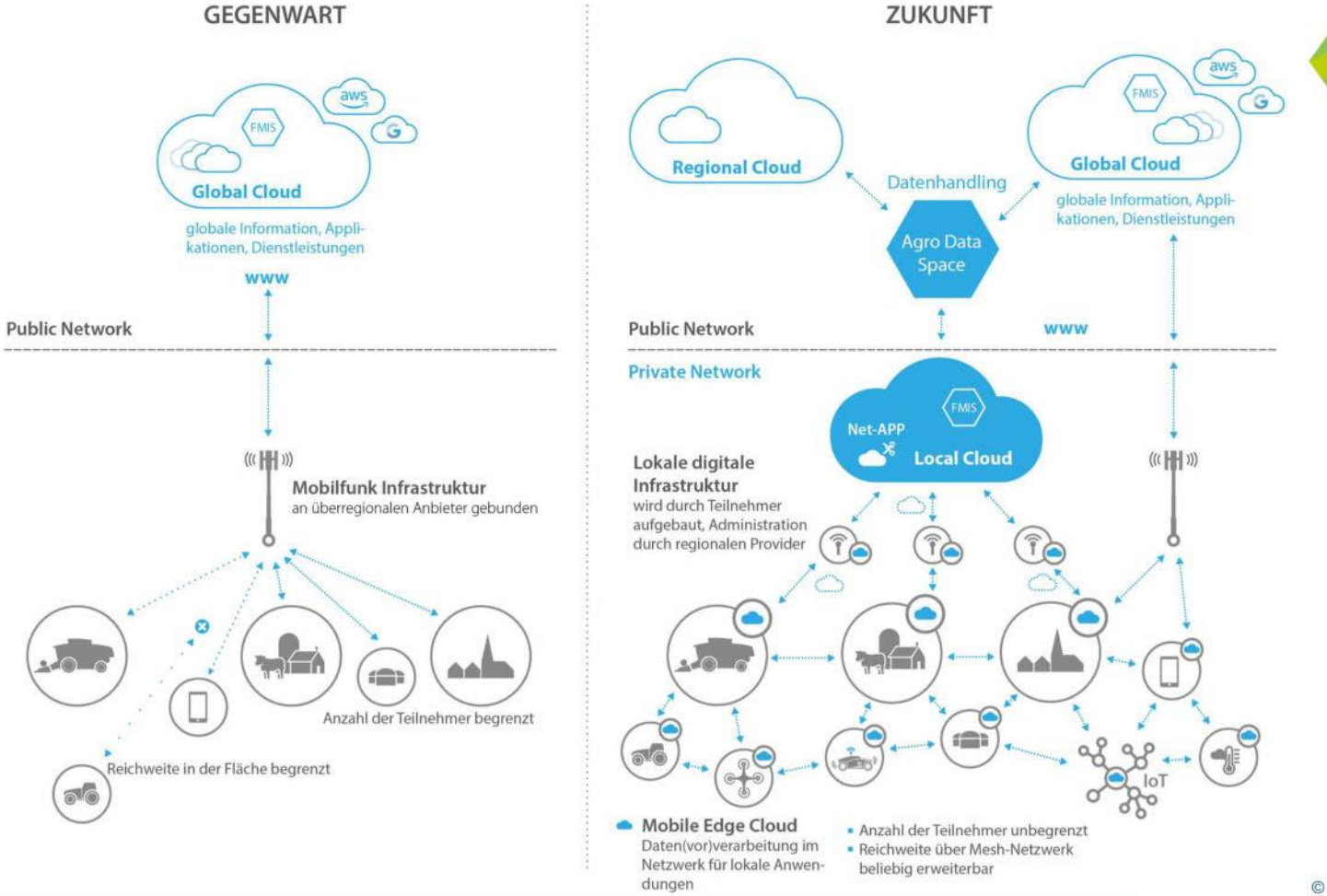
➔ **Communication (Geotalk) between farmers, consultants and administration**

Needs:

Communication infrastructure, combination of open and private data,

„honest broker“ : data security using local networks

„honest notary“: data security using blockchain technology



5G LAB GERMANY

© Dr. Franchi & Prof. Herlitzius

RLP AgroScience

Institut für Agrarökologie

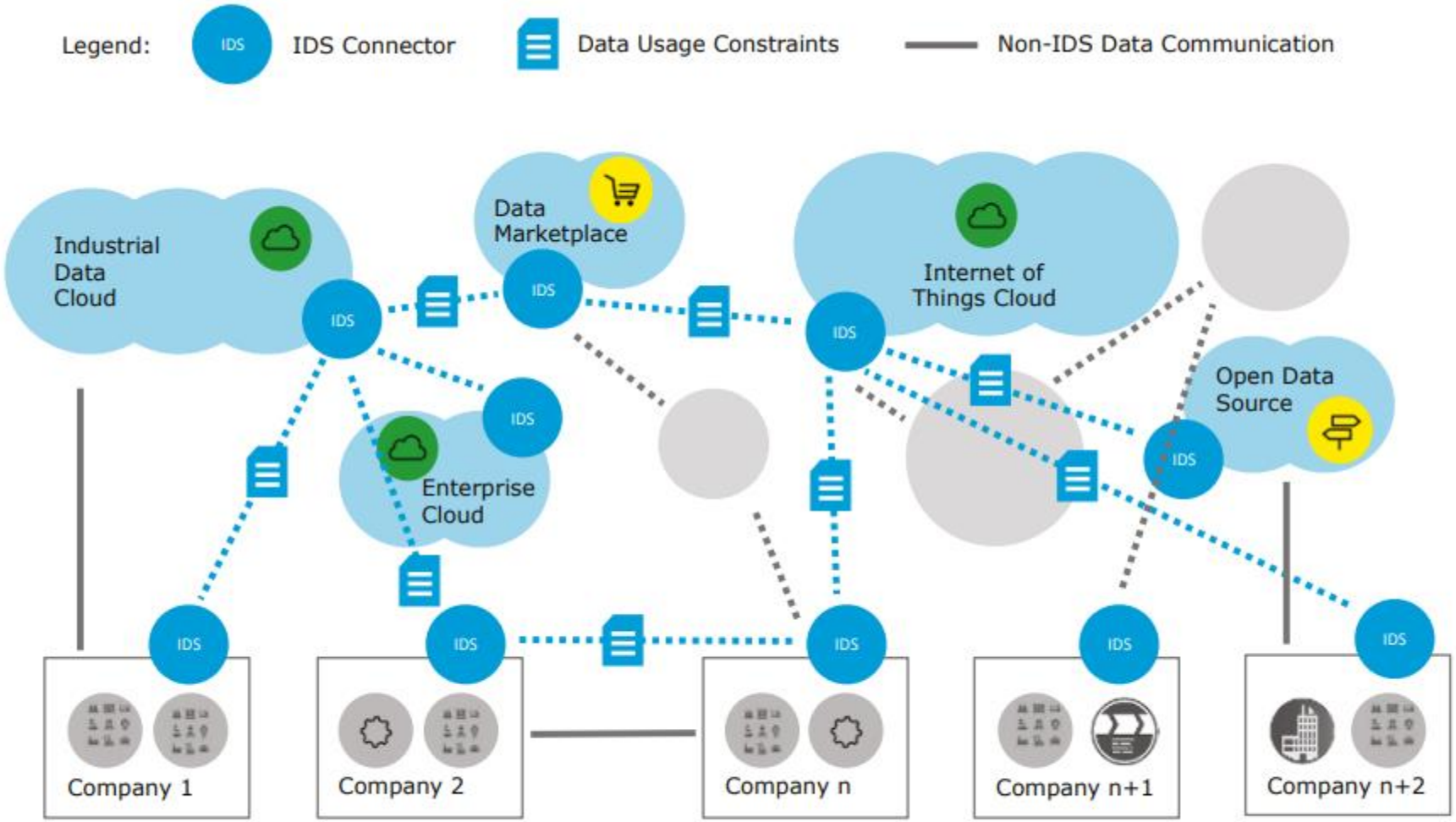
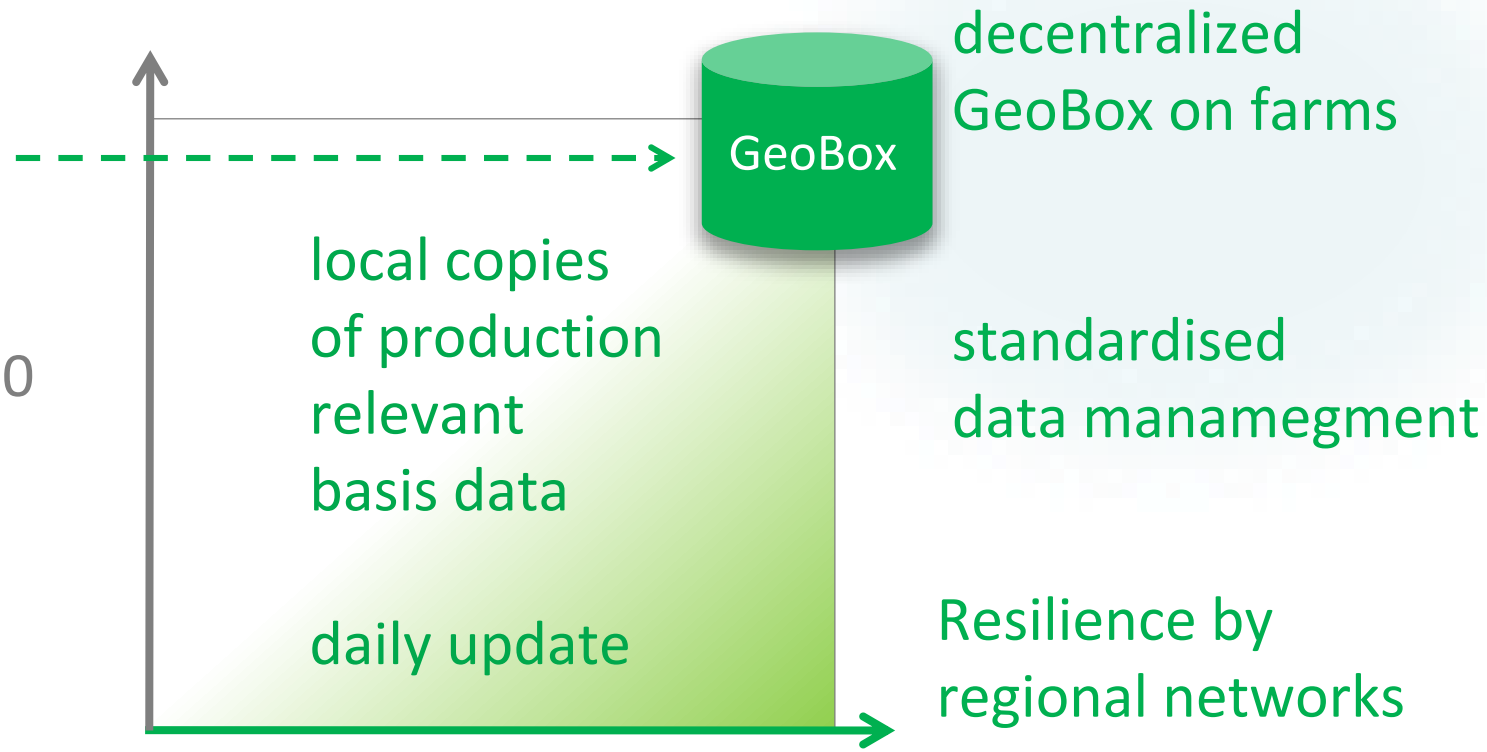


Figure 2.4: Industrial Data Space and Cloud Platforms

Data security: decentralized data storage with regional networks

Internet based contingency

Crisis management plans
Ernährungssicherstellungs- und -vorsorgegesetz (ESVG)



Public responsibilities

Crisis management plans
Ernährungssicherstellungs- und -vorsorgegesetz (ESVG)

GeoBox

Reduce bureaucracy

eGovernment

RLP Agroscience „Standortpass“

Precision and smart Farming

establishing geodata based services information and consulting

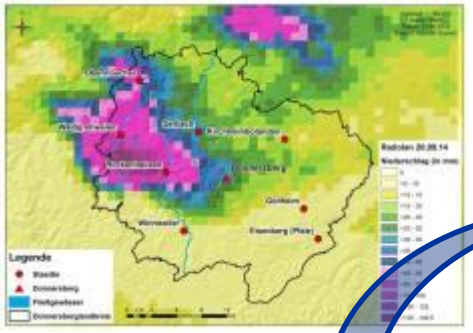
resilient regional and cross linked smart Farming

value added services for farmers and rural regions

Direct and indirect effects

additional

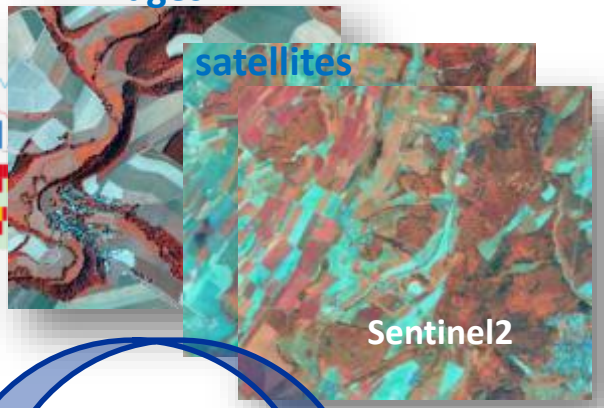
Weather data and forecasts



Trachtnet (DLR)

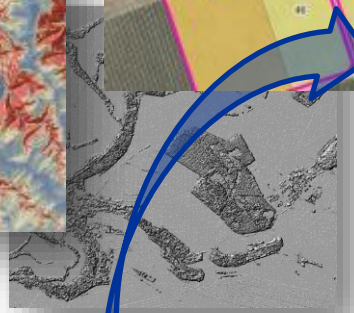
modelling (ISIP)

Images

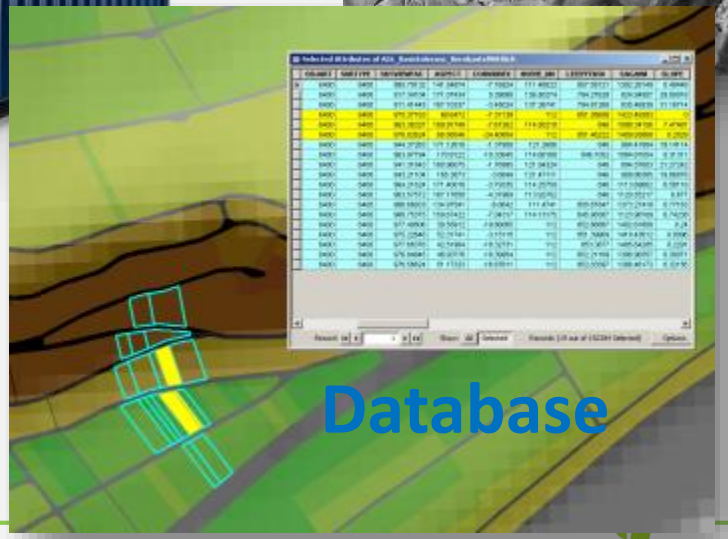


Soil data (LGB)

Terrain and surface models



Radar Satelliten

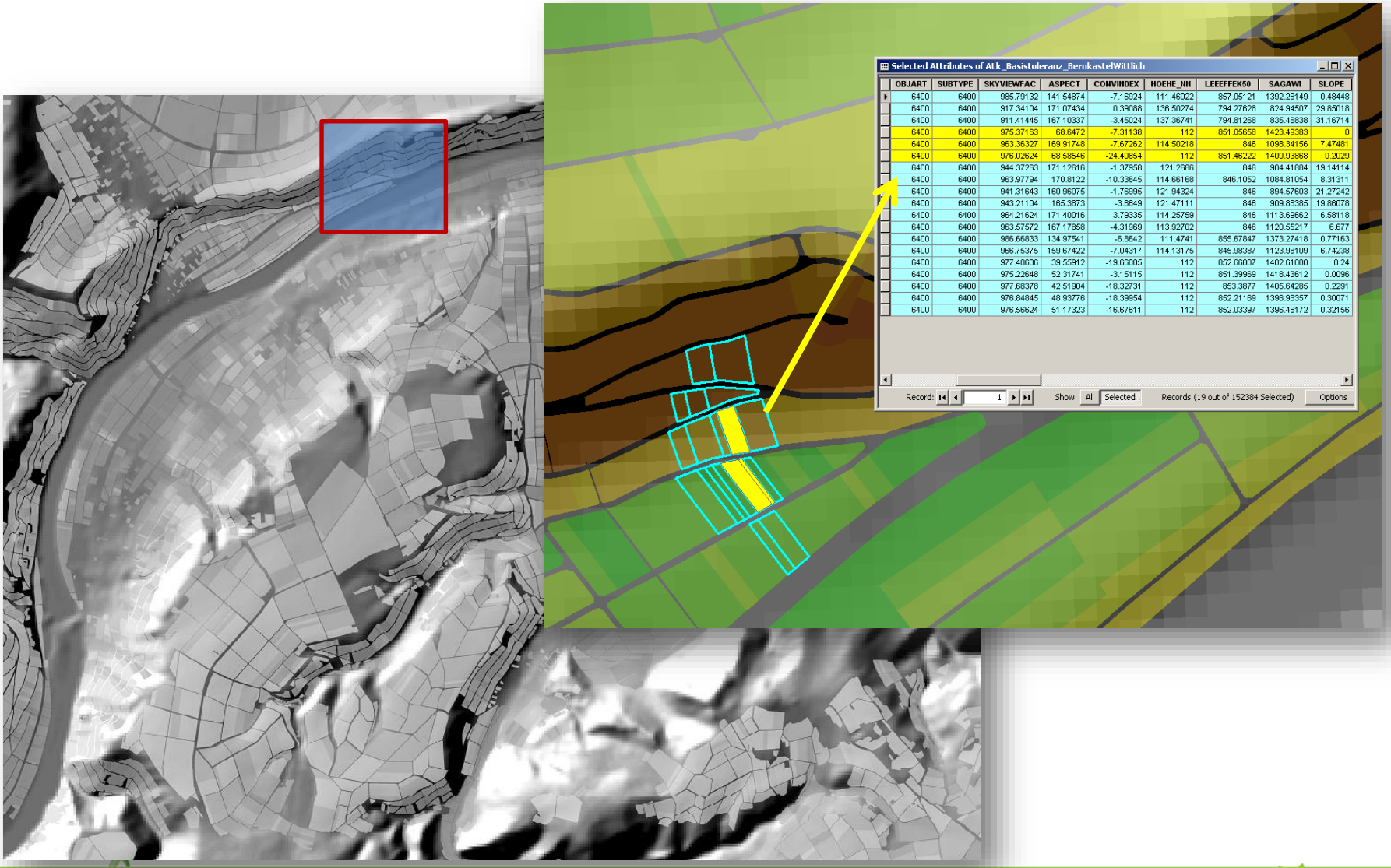


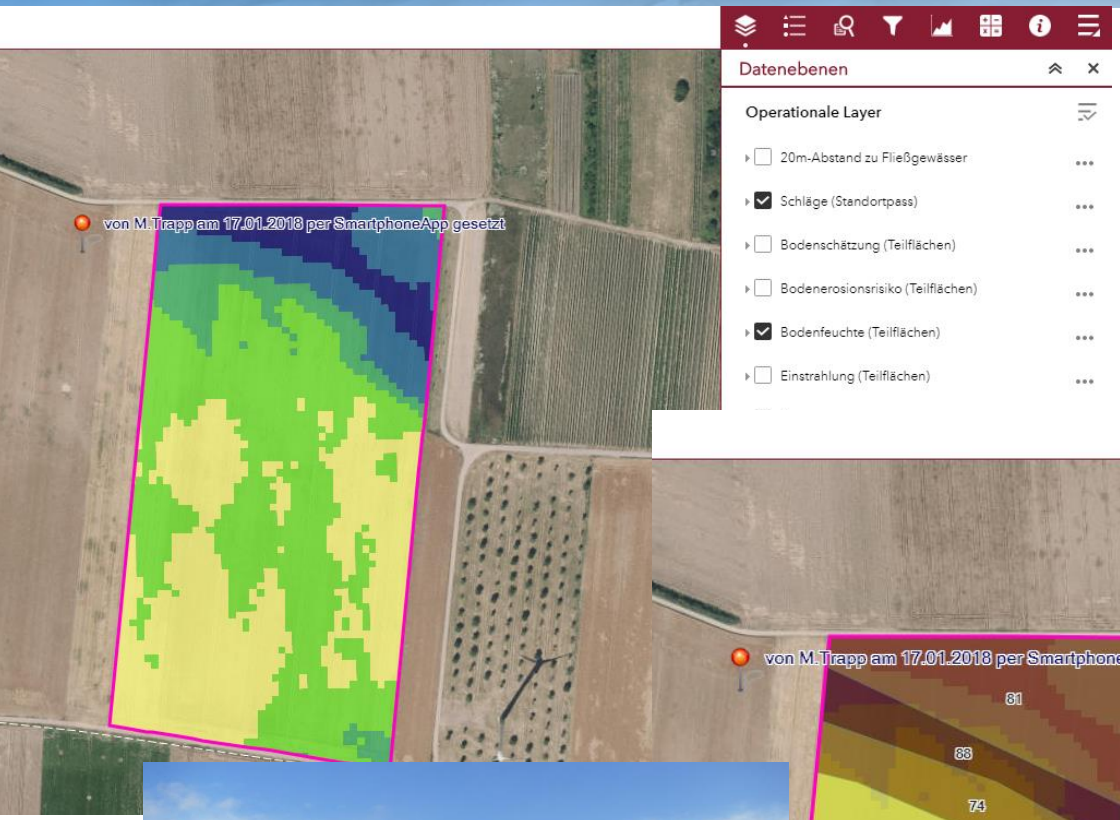
Land cover (IfA)

Administrative data
Open data
Atkis,
ALKIS

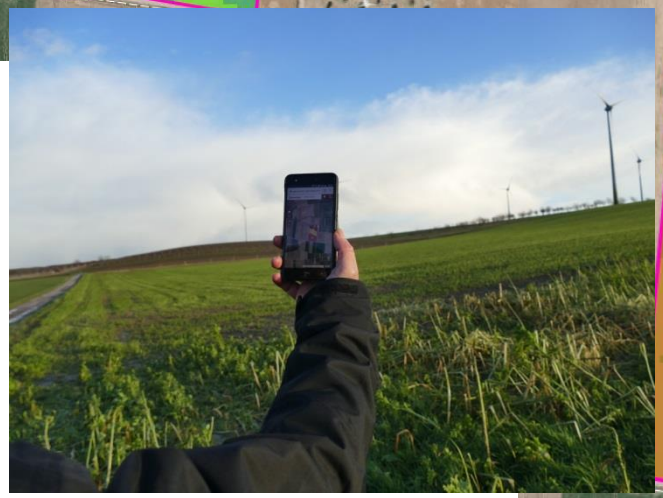
Site specific geodata analysis

Characterisation of agricultural sites




von M.Trapp am 17.01.2018 per SmartphoneApp gesetzt

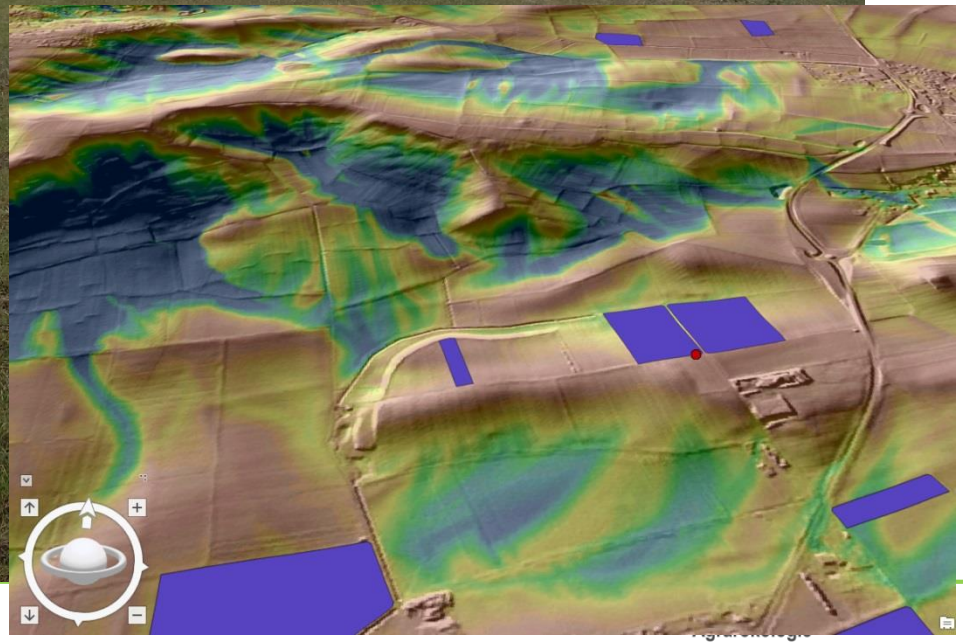
Datenebenen
Operationale Layer
20m-Abstand zu Fließgewässer
Schläge (Standortpass)
Bodenschätzung (Teilflächen)
Bodenerosionsrisiko (Teilflächen)
Bodenfeuchte (Teilflächen)
Einstrahlung (Teilflächen)




von M.Trapp am 17.01.2018 per SmartphoneApp gesetzt
81
65
88
74
62
60
74
Selze
Köngern


Legende
Schläge (Standortpass)
Bodenschätzung (Teilflächen)
Ackerzahl
84 - 95
74 - 83
64 - 73
53 - 63
41 - 52
Bodenfeuchte (Teilflächen)
gridcode
sehr hohe potenzielle Bodenfeuchte
hohe potenzielle Bodenfeuchte
mittlere potenzielle Bodenfeuchte
geringe potenzielle Bodenfeuchte
keine Neigung zur Vernässung


https://agroscience.maps.arcgis.com/apps/webappviewer/index.htm
DemoApp
MWVLW RLP
esri



Standortpass – site specific geodata available on state level

- **Site specific informationen:**

  soil information (Bodenschätzung: mittlere Ackerzahl), height, slope, erosion, landscape features, protected areas, requirements of EU (nitrate, buffers……)

- **Remote Sensing :**

  biomass and yield, soil moisture …

- **dynamic modelling data**:

  weather and weather forecasts (agrarmeteorologie), simulation modells (ISIP)…

- User can editing, downloadable, offline

Current research projects

SoFI: Smart soil information for farmers (BLE)
Combination of in situ field data, sensor data and remote sensing to generate soim moisture maps

Time Stamp: (Nationale Copernicus Nutzung, BMVI)
The project timeStamp utilizes remote sensing-based land-use changes to provide tailor-made solutions for addressing administrative tasks, for example, to make on-site inspections more efficient

Cognac: Cognitive Agriculture (Leitprojekt FhG)

➔ **Combining open data with local sensor data**

Youtube movie, if it works

https://www.youtube.com/watch?v=NO8PmqEI0cc

Many thanks for your kind attention