Agenda

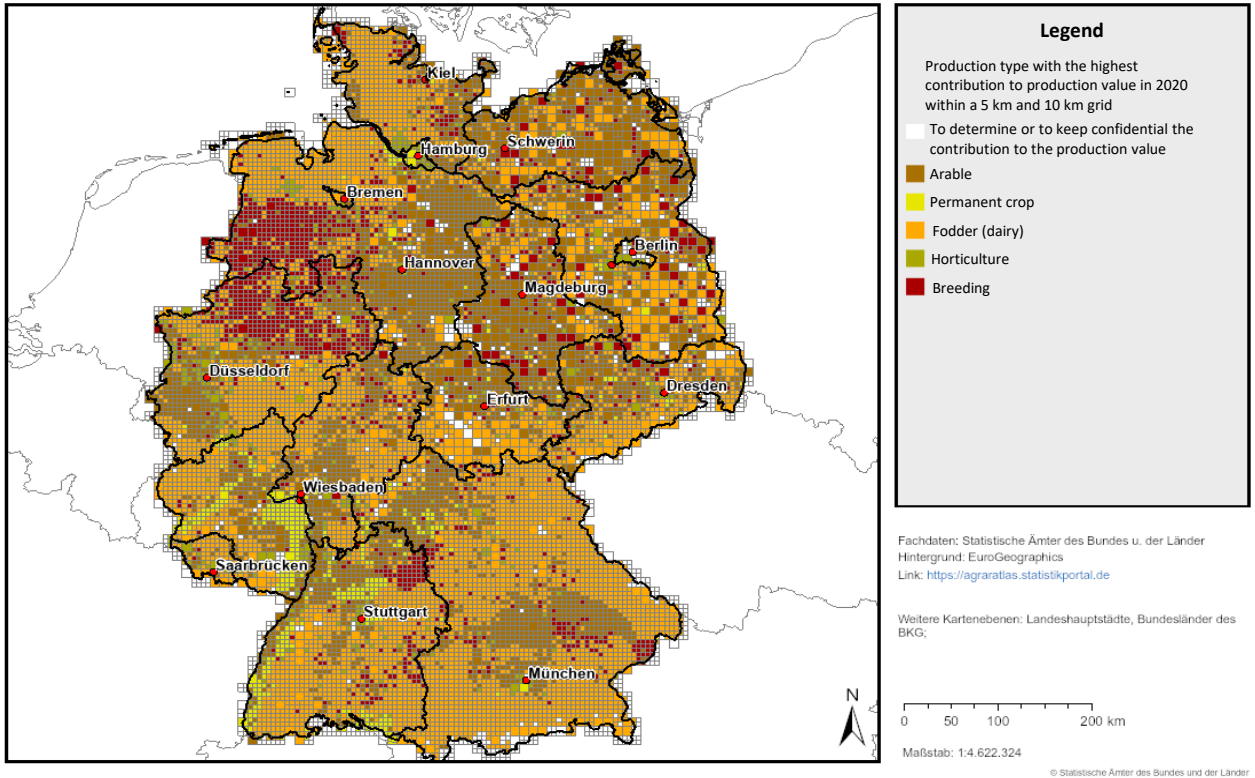
- Agriculture in Germany – an overview
- Ag-Drone usage in Germany
- Hurdles and restrictictions of drone-use in EU
- Outlook

Agriculture in Germany – an overview

- amount of farms: 255,000
- Farm-sizes: 2 - 8,500 ha
- Farm-types: arable, mixed, dairy, pigs, breeding, permanent crops

Agriculture in Germany – an overview

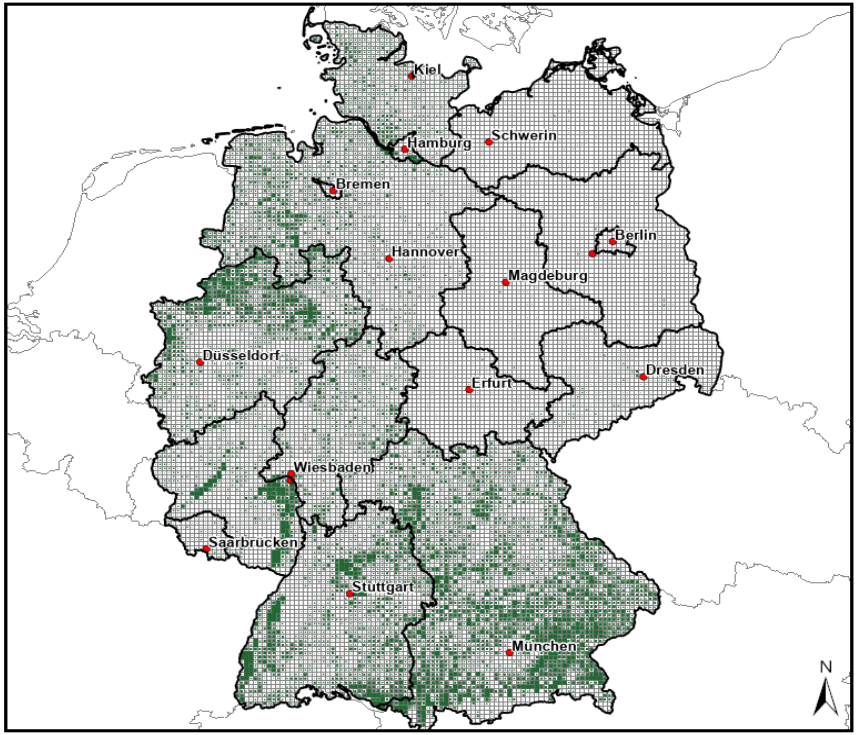
Production type 2020



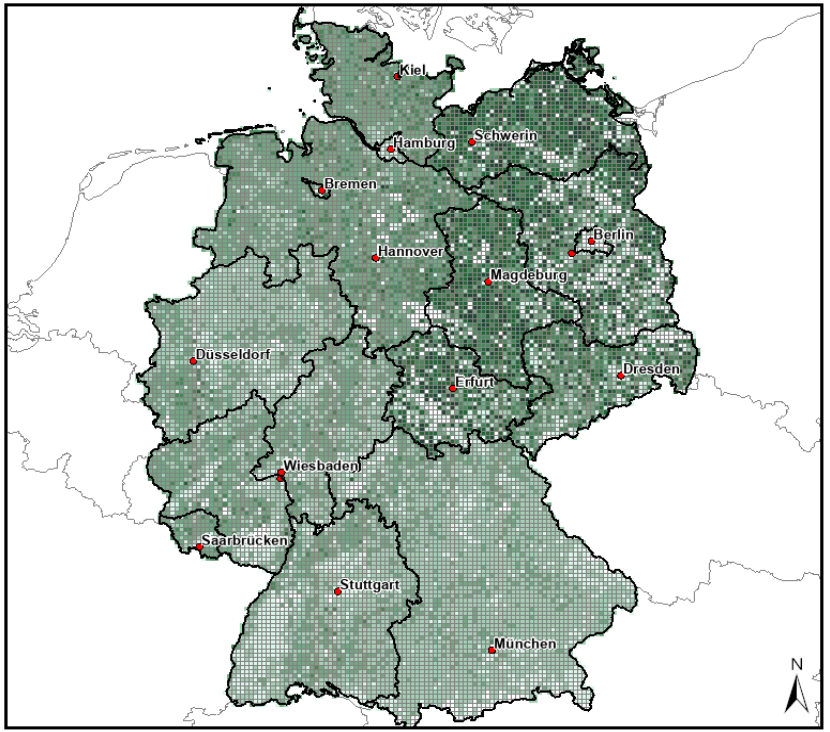
https://agraratlas.statistikportal.de/

Agriculture in Germany – an overview

Amount of farms in 2020



average farm size in 2020



https://agraratlas.statistikportal.de/

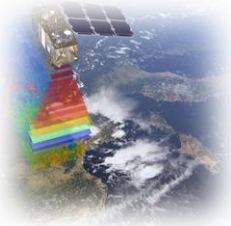
Use of technology in agriculture - today

- How to manage fields on big farms?

Harbort (2025)

Use of technology in agriculture - today

(ESA: 2024)



(Weier: 2021)

(dji.com/)

Remote-sensing system	Sentinel-2 satellite	manned aircraft	Drones
Availability	• Weekly flown, available under https://dataspace.copernicus.eu/ • Immediately available	• Charterplane with Pilot • Avilability depending on airport, normally a couple of days planning mandatory	• Contractor or own drone (from 2.000 EUR) • Avilability of the service upon consultation
Hardware	• Modern PC	• Reflex-camera with GPS • Modern PC + powerful graphics card	• If neccessary own drone with multispectralcamera, spare-batteries, charger, transportationbox, SD-cards • Modern PC + powerful graphicscard
Software	• Quantum GIS (GIS: Geoinformationsystem)	• Quantum GIS	• Software for Orthomosaic calculation (fee-based) • UAV forecast (weater) • Flight planning app • Quantum GIS
Coverage	• Size of one Image-Tile 100 x 100 km (1 Mio. ha)	• Around 1,000 ha per flighthour and 250 images (Ø 0,25 images/ha)	• 25-100 ha per flighthour (Ø 400 images/ha)
Resolution	• 10 m x 10 m	• 80 cm x 80 cm	• 3 cm x 3 cm (storage footprint: ~0,34 GB/ha)
Costs	• GIS-training, Data-analysis	• GIS-training, Chartercosts, datacollection, -processing and -analysis	• GIS-trainig,tech. features, UAV-license, insurance, datacollection, -processing and -analysis

Use of drones in agriculture - today

Wide spread	Rising market	Still rare
Trichogramma spreading (maize/corn)	Fieldmapping (weed-detection, AI-segmentation of weeds/crops, tiling-system mapping)	Spraying, spreading
fawn-detection in grassland before mowing	Health monitoring	Green-house shading

https://www.bauernzeitung.ch/

Harbort (2024)

https://www.sueddeutsche.de/wirtschaft/weinbau-und-hightech-wie-eine-neue-drohne-bedrohten-wein-steillagen-helfen-kann-dpa.urn-newsml-dpa-com-

Use of drones in agriculture - today

- RTK-ready drones are getting more popular
  - Open RTK or SAPOS-corrections are often available for a very low price (sometimes for free)
  - Data-acquisition is getting much more precise

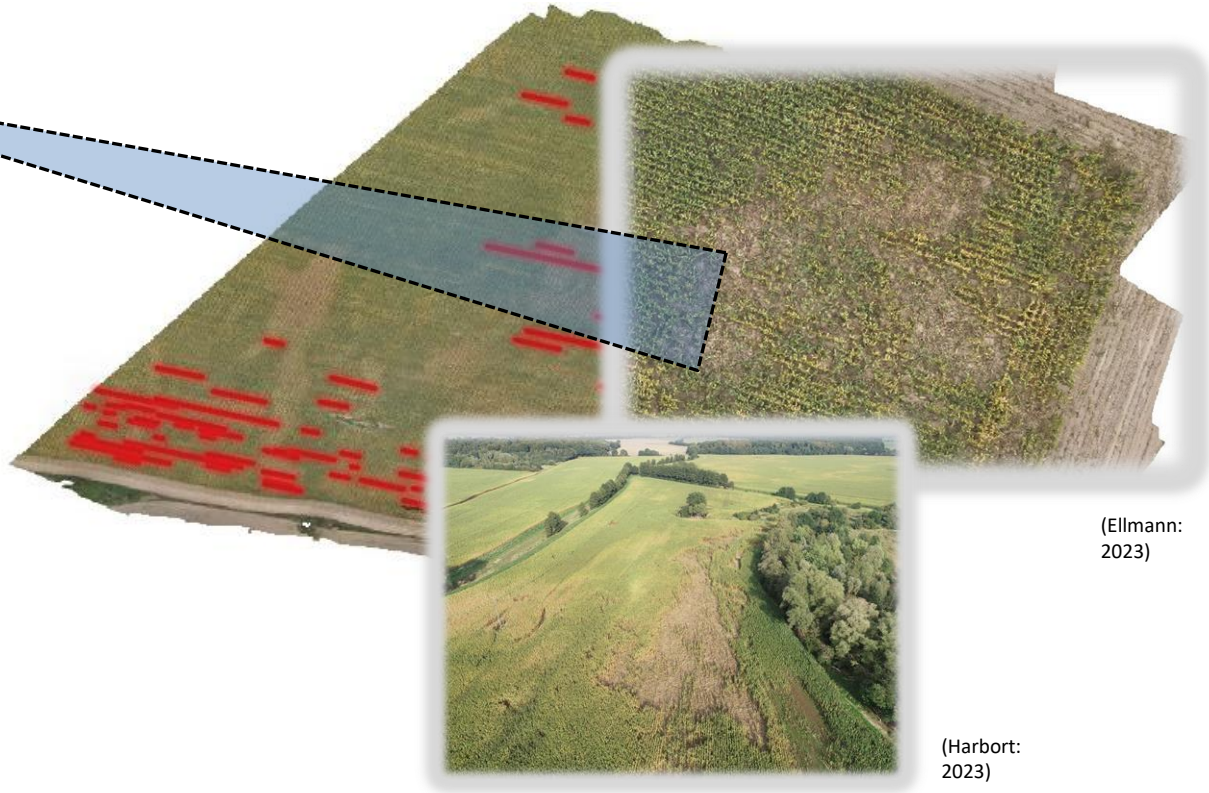
Mobile RTK-Station

(Harbort: 2025)

Use of drones in agriculture - today

- Detection and mapping of wild damage

(Gütschow: 2023)



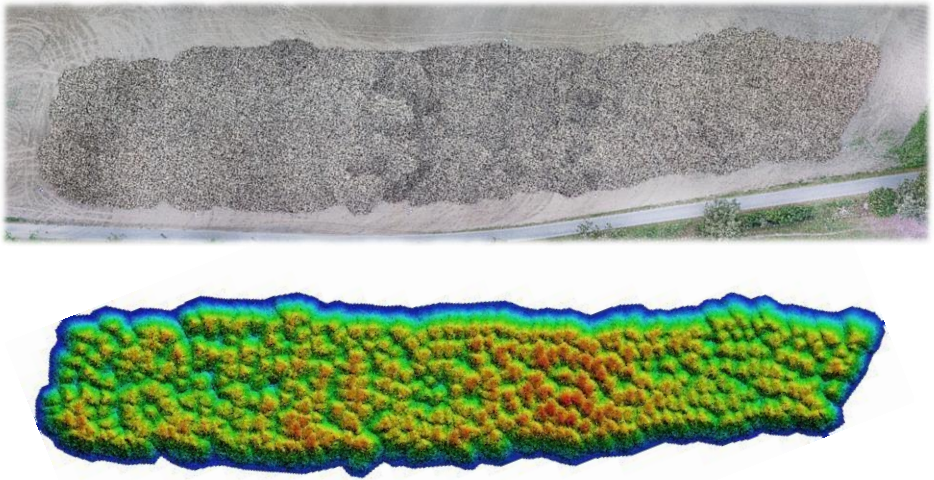
(Ellmann: 2023)

(Harbort: 2023)

Use of drones in agriculture - today

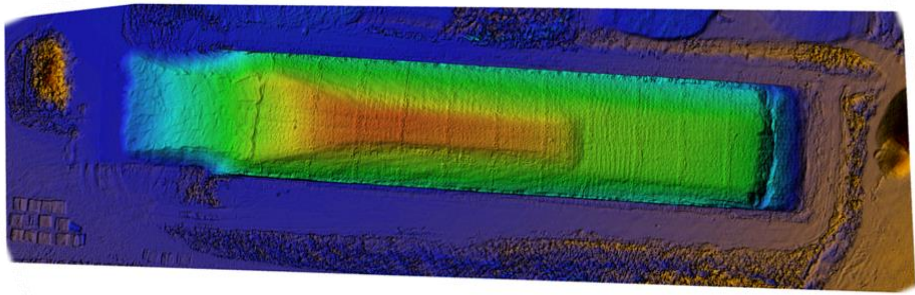
- Stockpile measuring

Yieldmass of sugar beets



(Harbort: 2023)

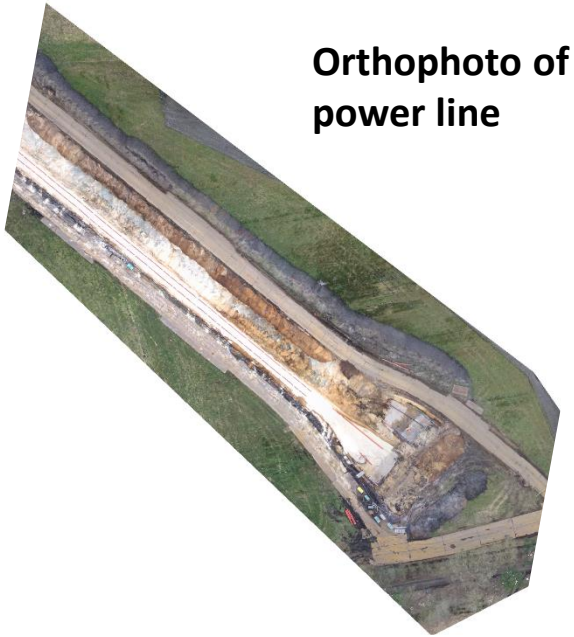
Maize silage



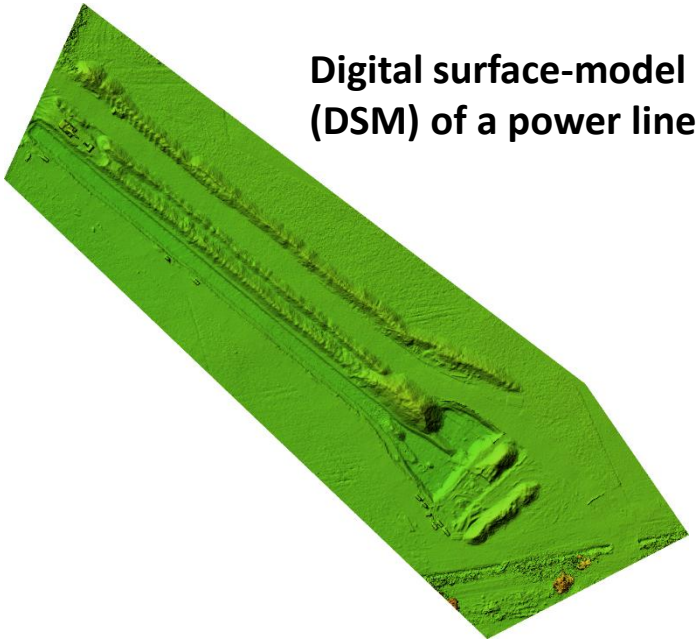
(Harbort: 2023)

Use of drones in agriculture - today

- Modern drones have high precision cameras
- Deliver high quality 2D and 3D data



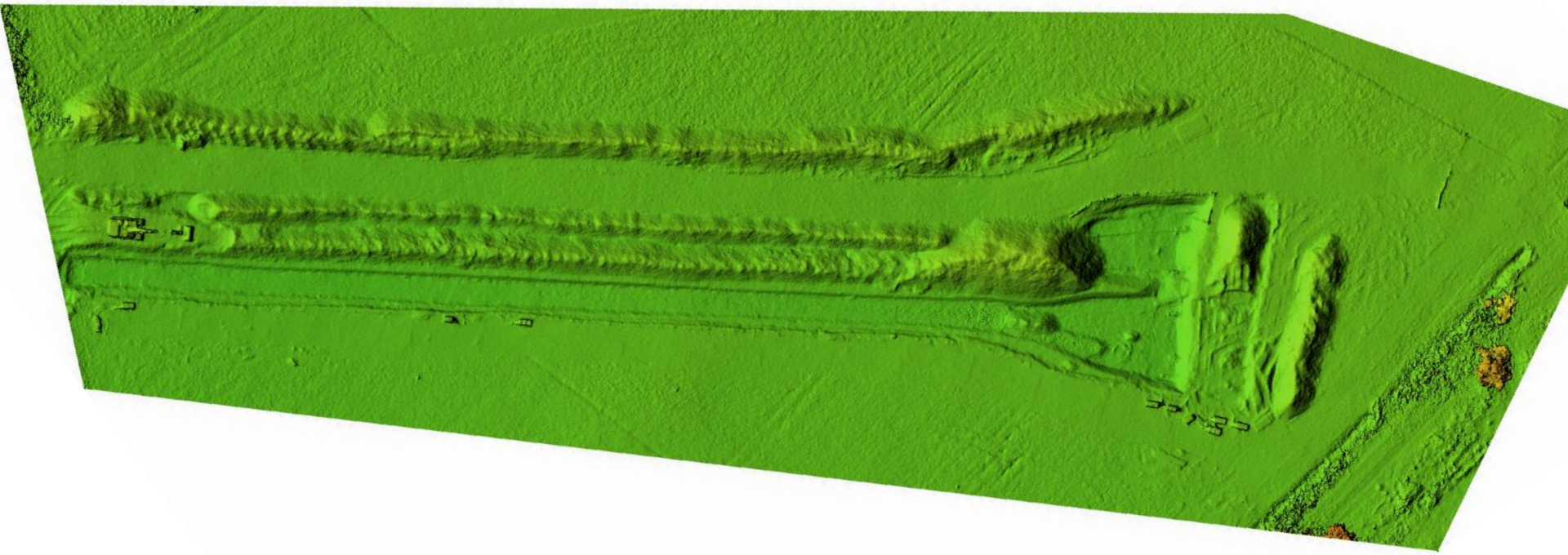
Orthophoto of a power line



Digital surface-model (DSM) of a power line

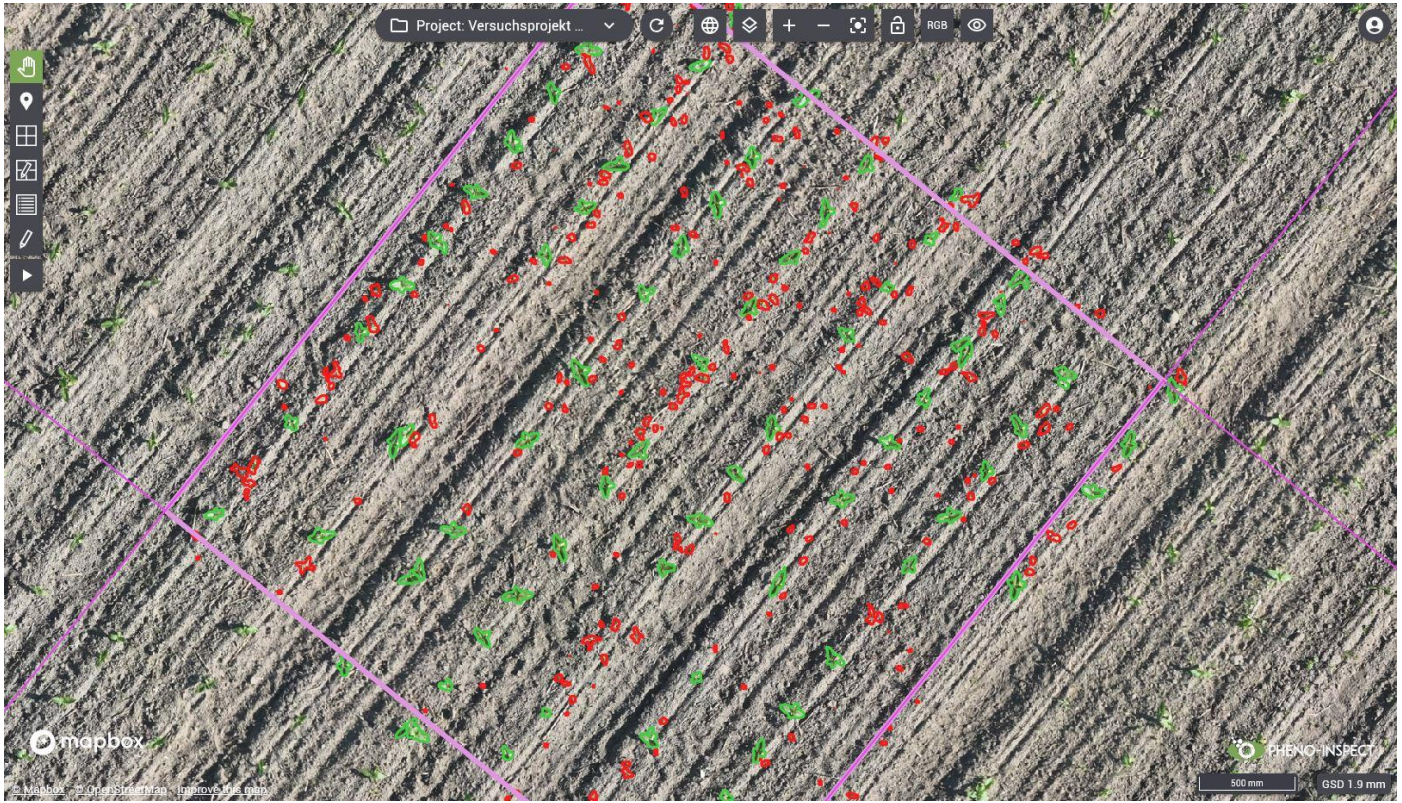
Use of drones in agriculture - today

Digital surface-model (DSM) of a power line



Use of drones in agriculture - today

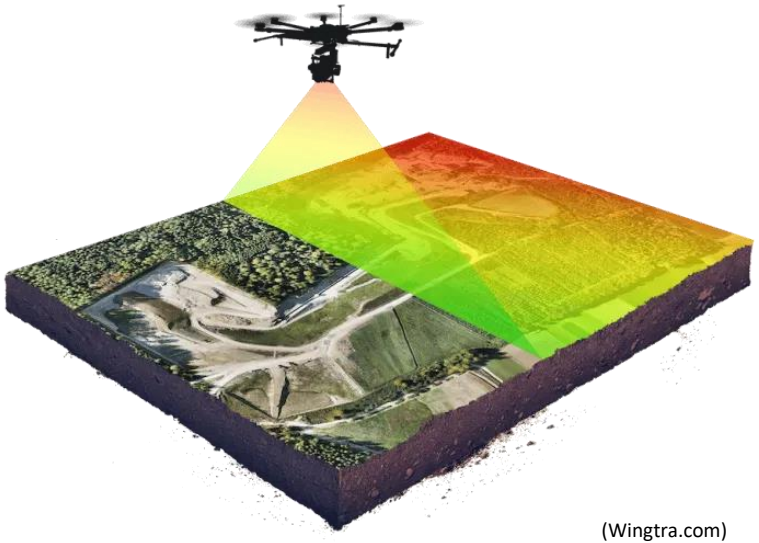
- Field mapping and AI-segmentation



(https://phenoinspect.com

Use of drones in agriculture - today

- LIDAR-Systems getting into smaller, affordable drones
  - LIDAR: Light Detection and Ranging
  - Good for creating surface models
  - Great for measuring volumes (stockpiles)
  - Very high accuracy
  - very complex to process data



(Wingtra.com)

Use of drones in agriculture - today

- To fly a drone in Germany, you need to get a license
  - Remote-pilot license (EU-Competence proof)
    - drone-category (A1/A3), online

(https://www.lba.de)

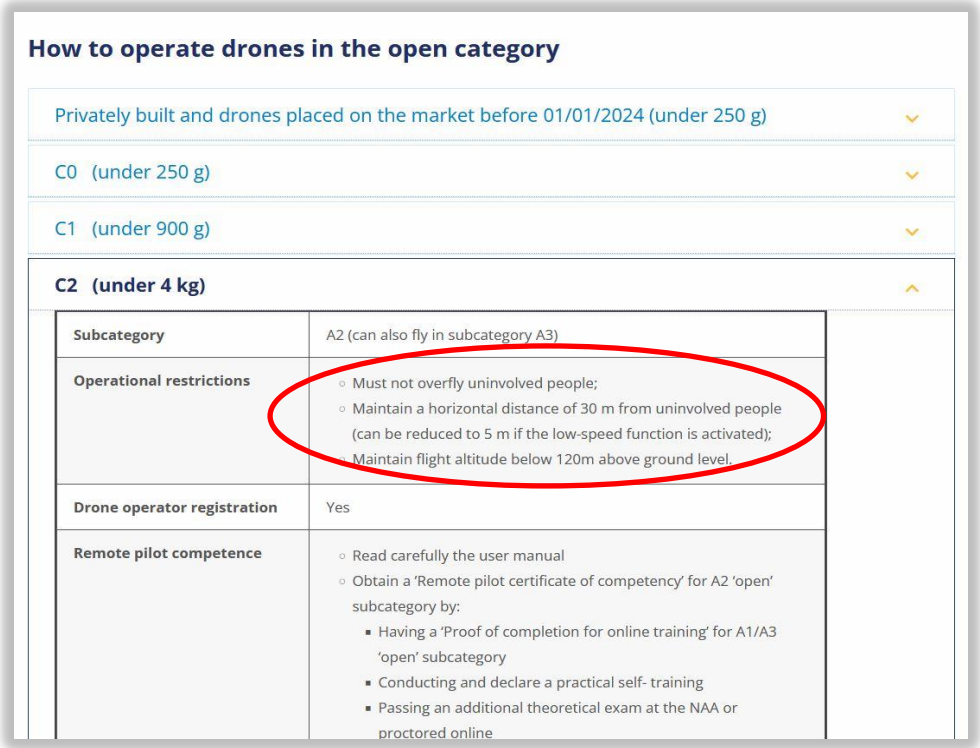
  - EU-Remote-pilot certificate (drone-category A2)
    - Extension of the A1/A3 license
    - Self study and declaration of practical flying skills

(https://www.lba.de)

- Both licenses are valid for 5 years

Use of drones in agriculture - today

- Drones are classified in different (open) categories, but only to a MTOM (maximum take-off mass) of <25 kg
- For more info, google „EASA C-Classification Drones“



How to operate drones in the open category

Privately built and drones placed on the market before 01/01/2024 (under 250 g)

C0 (under 250 g)

C1 (under 900 g)

C2 (under 4 kg)

Subcategory	A2 (can also fly in subcategory A3)
Operational restrictions	◦ Must not overfly uninvolved people; ◦ Maintain a horizontal distance of 30 m from uninvolved people (can be reduced to 5 m if the low-speed function is activated); ◦ Maintain flight altitude below 120m above ground level.
Drone operator registration	Yes
Remote pilot competence	◦ Read carefully the user manual ◦ Obtain a 'Remote pilot certificate of competency' for A2 'open' subcategory by: ▪ Having a 'Proof of completion for online training' for A1/A3 'open' subcategory ▪ Conducting and declare a practical self- training ▪ Passing an additional theoretical exam at the NAA or proctored online

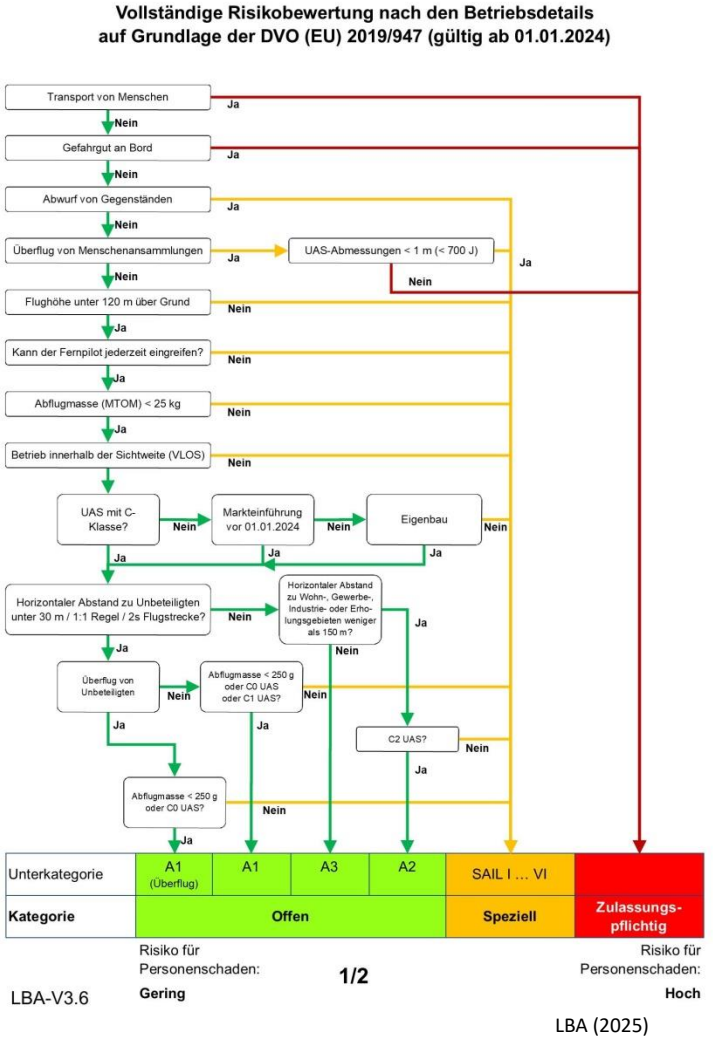
(https://www.easa.europa.eu: 2025)

Hurdles of big ag-drone usage in GER

https://www.sueddeutsche.de (2025)

Hurdles of big ag-drone usage in GER

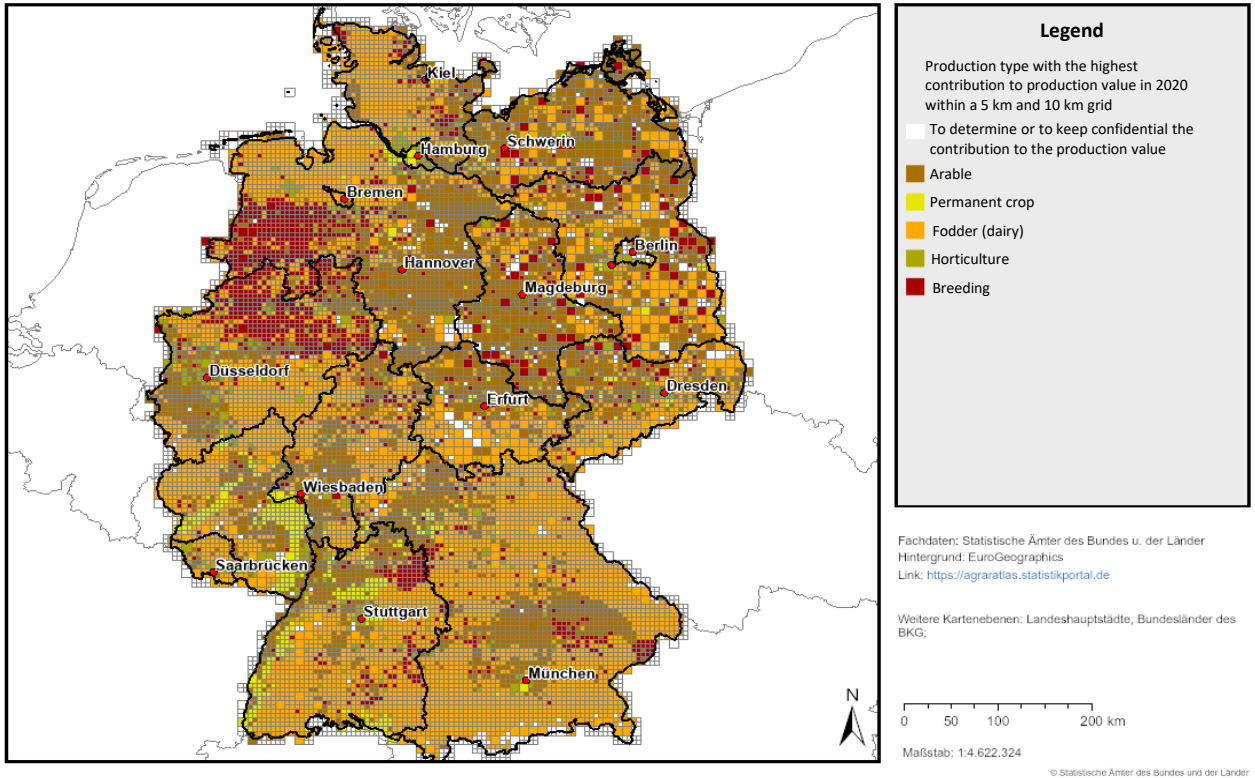
- Drones with a MTOM of >25 kg need special certification
- The use of chemicals in a spray drone is not allowed (only allowed in steep-slope vineyards with special permit)
- Efficiency: tractor vs. drone



LBA (2025)

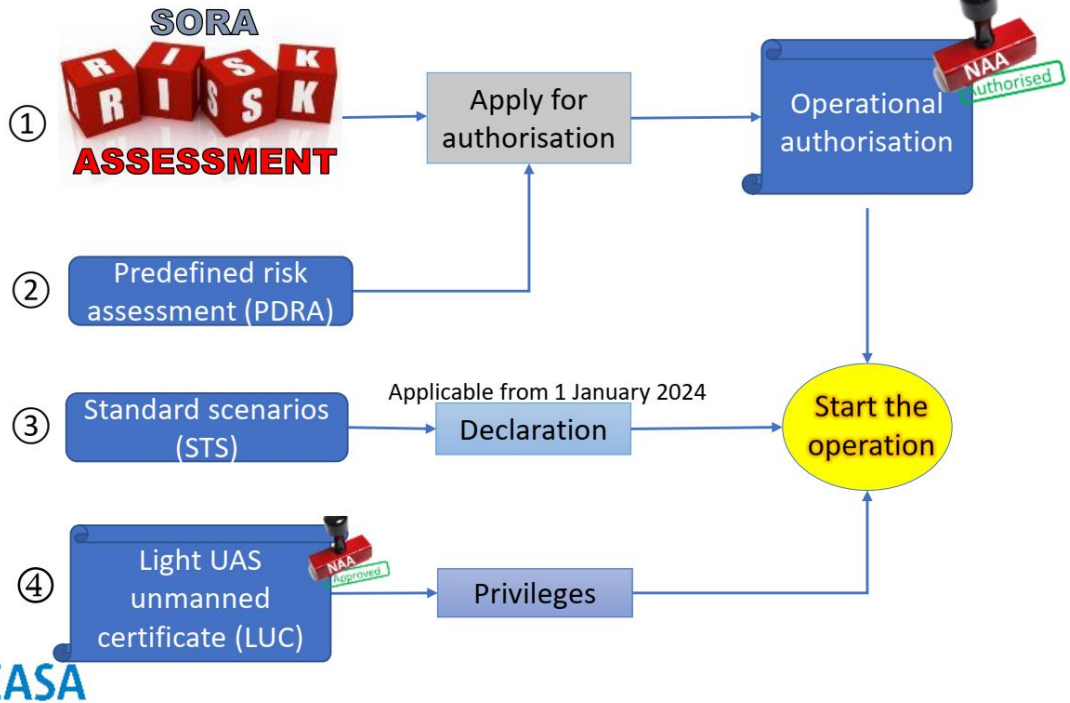
Agriculture in Germany – an overview

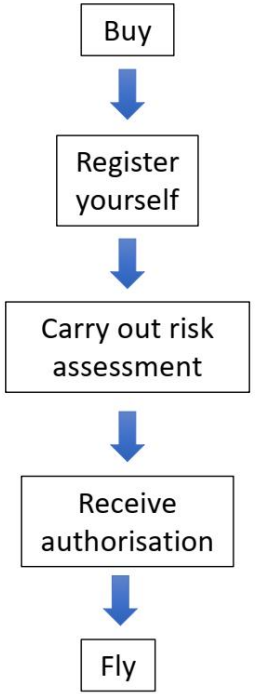
Production type 2020



https://agraratlas.statistikportal.de/

Risk Assesment





Source: EASA (2025)

Risk Assesment

Source: EASA (2025)

Outlook

- Spreading catch-crops during vegetation
- The market of drones is rising – big ag-drones are still a niche in Germany
- Spot-spraying with drones?

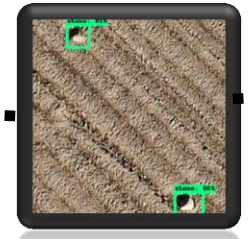
VS

Outlook – Rock-detection

MARTIN-LUTHER UNIVERSITÄT HALLE-WITTENBERG
HOCHSCHULE NEUBRANDENBURG
University of Applied Sciences

(Gütschow: 2024)

AI-Model



Information position and size of the rock

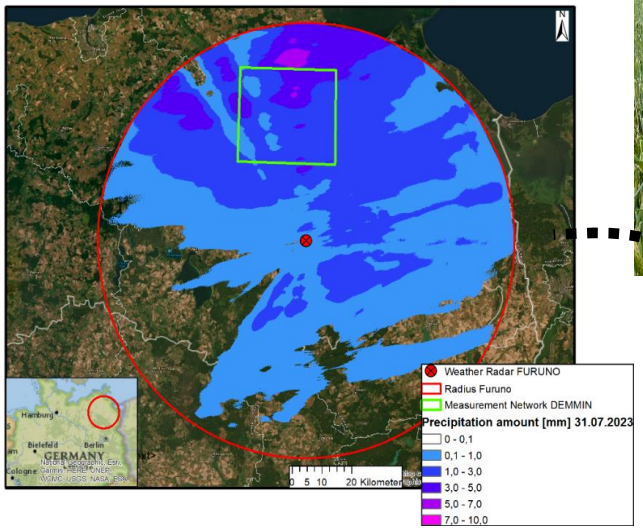
(MLU, Teucher: 2024)

(https://www.innovationfarm.at)

(MLU, Teucher: 2019)

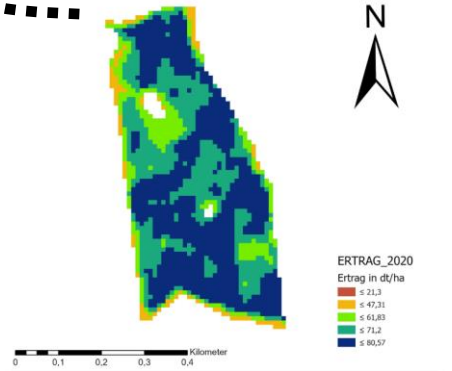
Outlook – precise crop protection, Haildamage

https://rz-vm103.gfz-potsdam.de/xregnet/signin
Datenportal Xregnet



https://astro23936.jalbum.net/Landfotos.de/Getreide/hagelschaeden/index.html

Hail-damage in wheat



Location: Hochschule Neubrandenburg
Radius ~70 km

? Mabe possible in the future ?

High-res severe weather events in combination with yieldmaps for a better prediction of yield damage

We thank the German Federal Ministry of Food and Agriculture for the support.

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AgriSens
DEMMIN 4.0

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