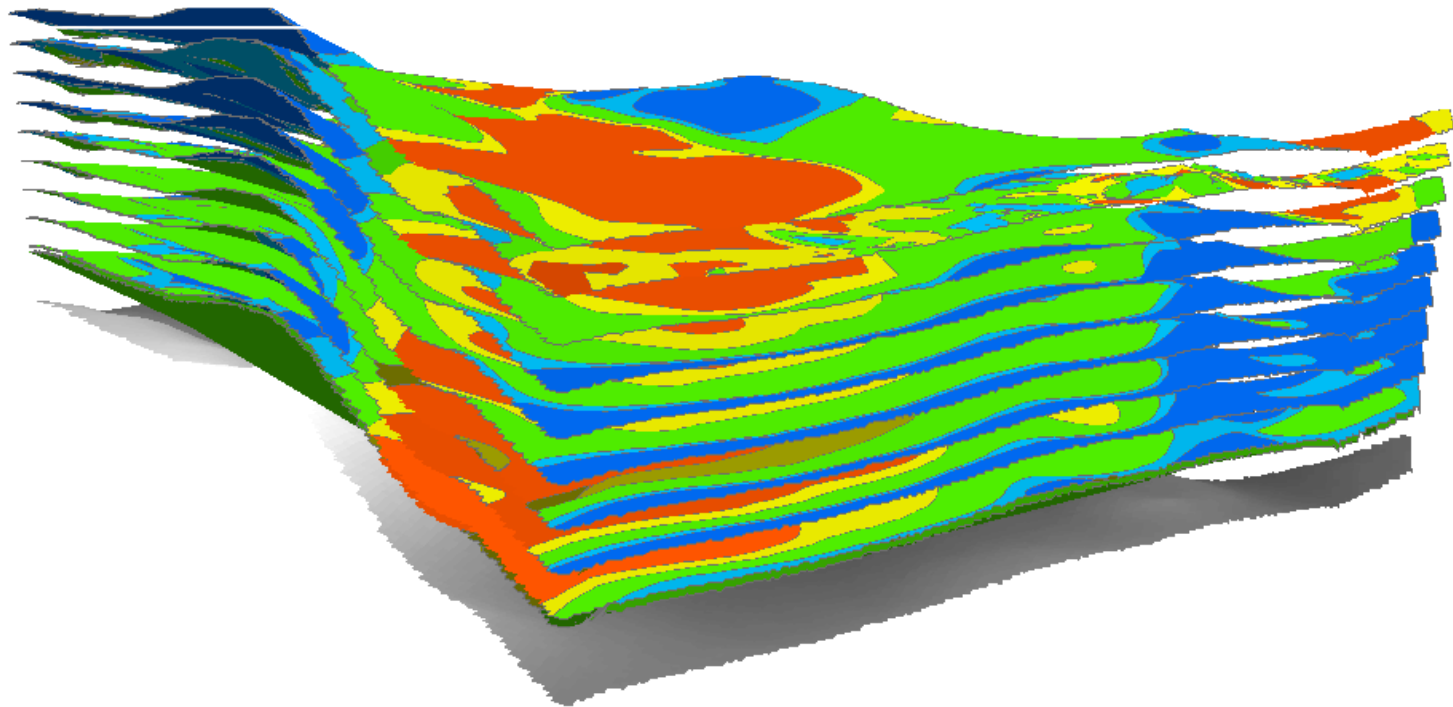
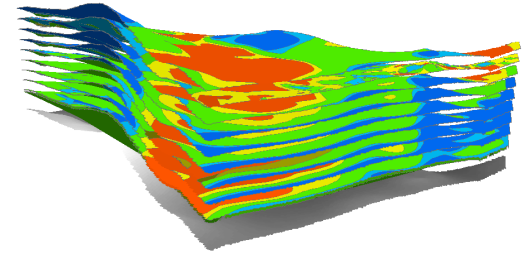


# Precision Farming im Ackerbau: Erfahrungen und Ausblick



# Precision Farming im Ackerbau: Erfahrungen und Ausblick



## Inhalt

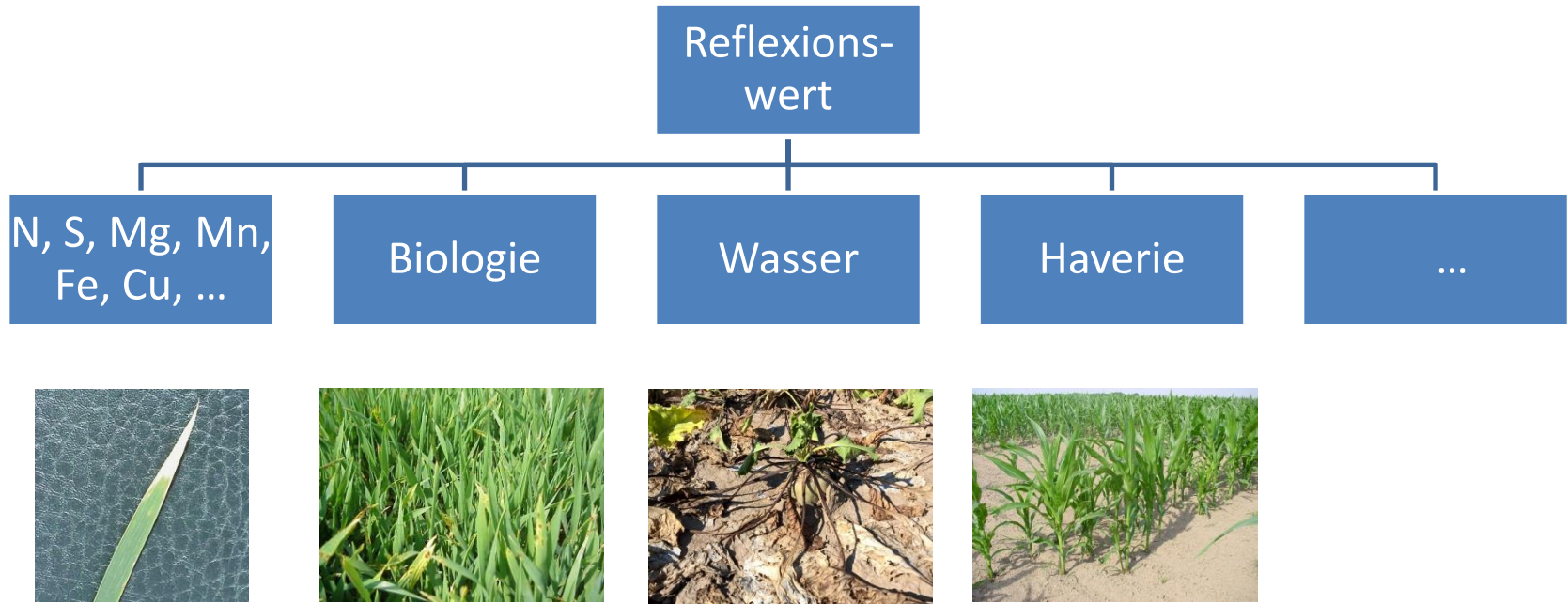
### Anwendungsbeispiele zu vegetationsbeschreibenden Parametern

#### **ESA / Copernicus / Sentinel**

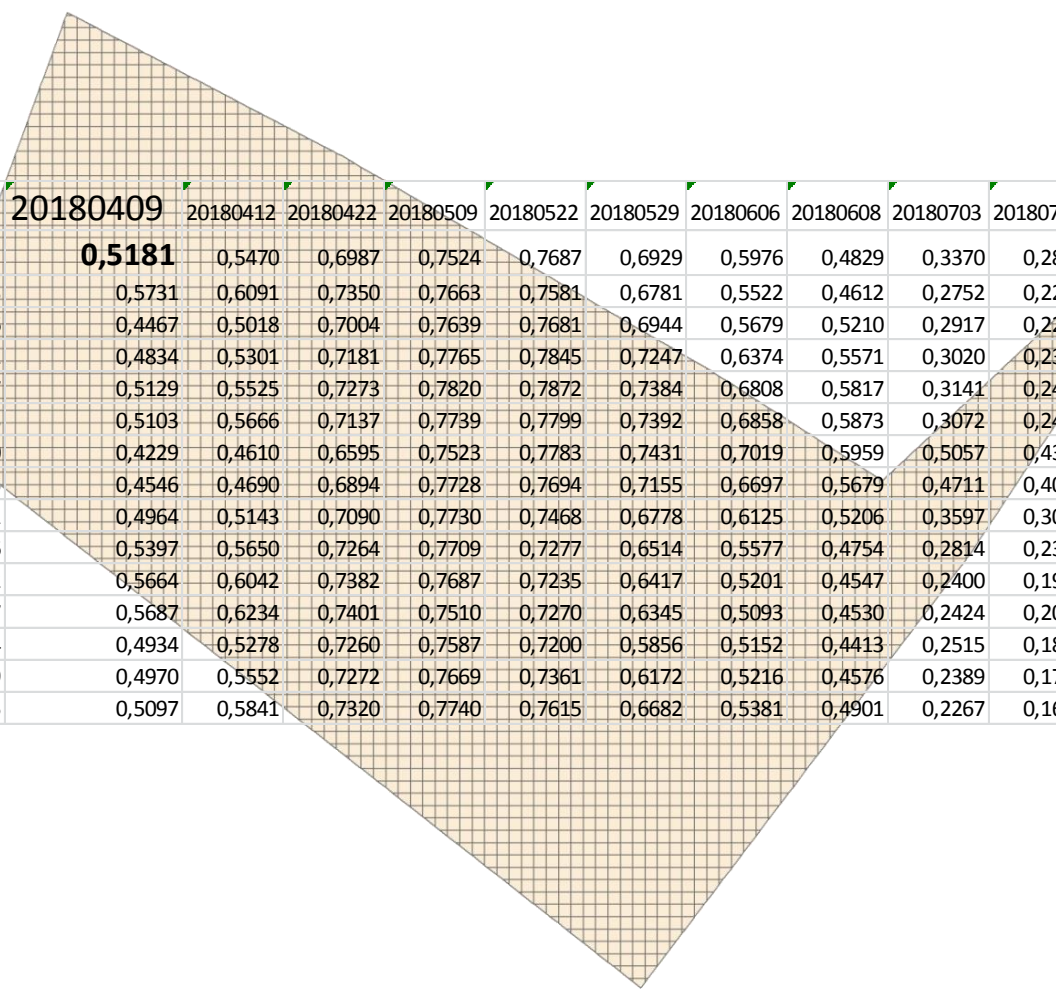
- mehrere Spektralkanäle
- 490 - 2200 nm
- 10 - 60 m Auflösung

#### **UAV / MSK**

# vegetationsbeschreibende Parameter

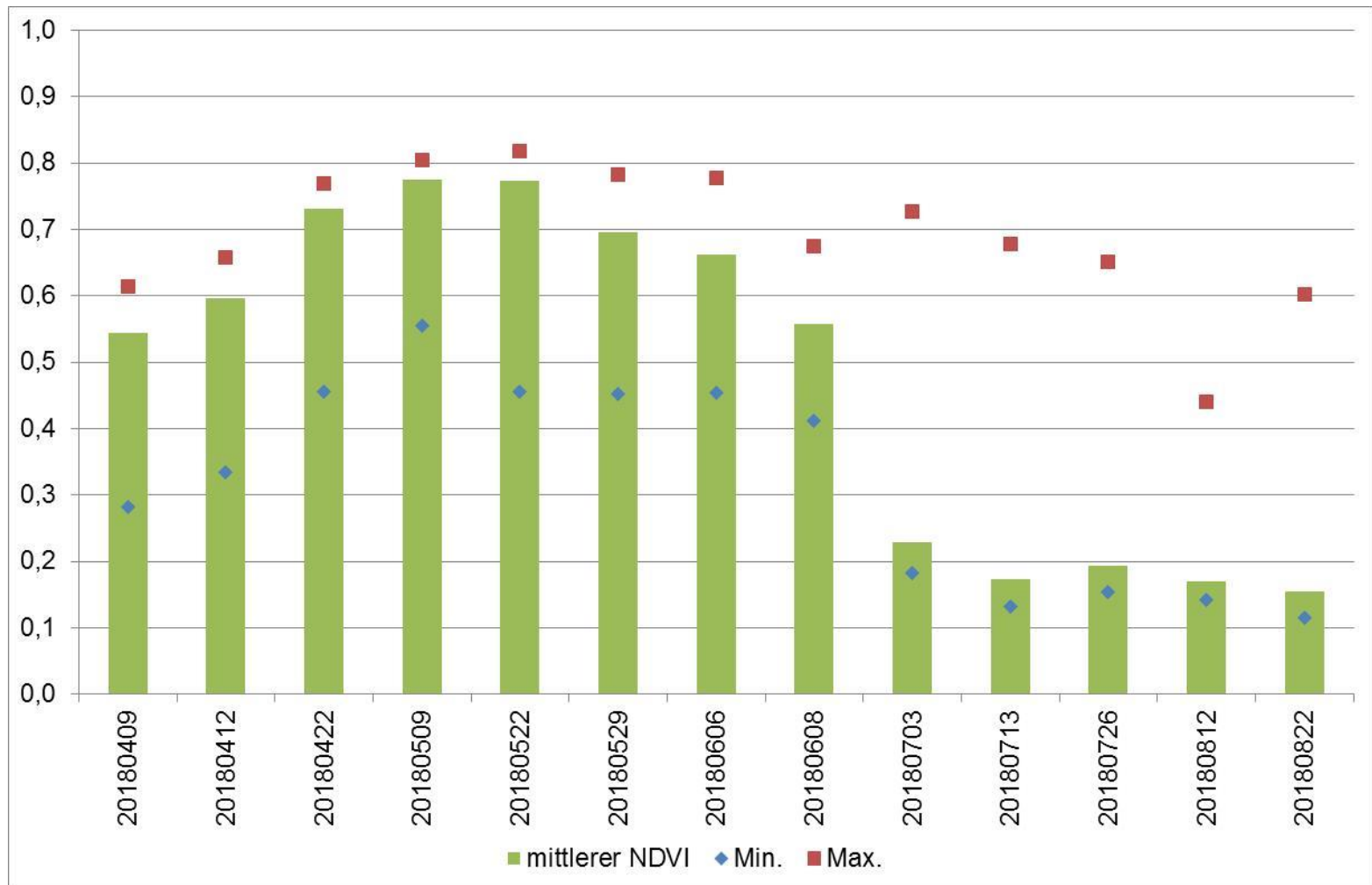


# satellitenbasierte vegetationsbeschreibende Parameter, z.B. NDVI<sub>Sentinal</sub>

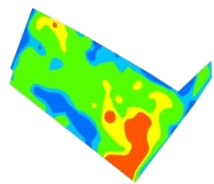


| X                  | Y                  | 20180409      | 20180412 | 20180422 | 20180509 | 20180522 | 20180529 | 20180606 | 20180608 | 20180703 | 20180713 | 20180726 | 20180812 | 20180822 |
|--------------------|--------------------|---------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| <b>12,64349826</b> | <b>51,26051578</b> | <b>0,5181</b> | 0,5470   | 0,6987   | 0,7524   | 0,7687   | 0,6929   | 0,5976   | 0,4829   | 0,3370   | 0,2845   | 0,3284   | 0,2319   | 0,2131   |
| 12,64350285        | 51,26042593        | 0,5731        | 0,6091   | 0,7350   | 0,7663   | 0,7581   | 0,6781   | 0,5522   | 0,4612   | 0,2752   | 0,2282   | 0,2438   | 0,1914   | 0,1791   |
| 12,64360009        | 51,26132726        | 0,4467        | 0,5018   | 0,7004   | 0,7639   | 0,7681   | 0,6944   | 0,5679   | 0,5210   | 0,2917   | 0,2217   | 0,2086   | 0,1793   | 0,1703   |
| 12,64360468        | 51,26123742        | 0,4834        | 0,5301   | 0,7181   | 0,7765   | 0,7845   | 0,7247   | 0,6374   | 0,5571   | 0,3020   | 0,2349   | 0,2179   | 0,1840   | 0,1776   |
| 12,64360928        | 51,26114757        | 0,5129        | 0,5525   | 0,7273   | 0,7820   | 0,7872   | 0,7384   | 0,6808   | 0,5817   | 0,3141   | 0,2497   | 0,2193   | 0,1845   | 0,1902   |
| 12,64361388        | 51,26105773        | 0,5103        | 0,5666   | 0,7137   | 0,7739   | 0,7799   | 0,7392   | 0,6858   | 0,5873   | 0,3072   | 0,2479   | 0,2112   | 0,1814   | 0,1889   |
| 12,64362766        | 51,26078820        | 0,4229        | 0,4610   | 0,6595   | 0,7523   | 0,7783   | 0,7431   | 0,7019   | 0,5959   | 0,5057   | 0,4310   | 0,3472   | 0,2384   | 0,3031   |
| 12,64363226        | 51,26069835        | 0,4546        | 0,4690   | 0,6894   | 0,7728   | 0,7694   | 0,7155   | 0,6697   | 0,5679   | 0,4711   | 0,4025   | 0,3484   | 0,2358   | 0,2950   |
| 12,64363686        | 51,26060851        | 0,4964        | 0,5143   | 0,7090   | 0,7730   | 0,7468   | 0,6778   | 0,6125   | 0,5206   | 0,3597   | 0,3046   | 0,2710   | 0,2039   | 0,2323   |
| 12,64364145        | 51,26051866        | 0,5397        | 0,5650   | 0,7264   | 0,7709   | 0,7277   | 0,6514   | 0,5577   | 0,4754   | 0,2814   | 0,2329   | 0,2171   | 0,1791   | 0,1843   |
| 12,64364605        | 51,26042882        | 0,5664        | 0,6042   | 0,7382   | 0,7687   | 0,7235   | 0,6417   | 0,5201   | 0,4547   | 0,2400   | 0,1975   | 0,1885   | 0,1656   | 0,1605   |
| 12,64365064        | 51,26033897        | 0,5687        | 0,6234   | 0,7401   | 0,7510   | 0,7270   | 0,6345   | 0,5093   | 0,4530   | 0,2424   | 0,2010   | 0,1822   | 0,1627   | 0,1510   |
| 12,64373409        | 51,26150984        | 0,4934        | 0,5278   | 0,7260   | 0,7587   | 0,7200   | 0,5856   | 0,5152   | 0,4413   | 0,2515   | 0,1870   | 0,1783   | 0,1712   | 0,1551   |
| 12,64373869        | 51,26141999        | 0,4970        | 0,5552   | 0,7272   | 0,7669   | 0,7361   | 0,6172   | 0,5216   | 0,4576   | 0,2389   | 0,1751   | 0,1704   | 0,1678   | 0,1506   |
| 12,64374328        | 51,26133015        | 0,5097        | 0,5841   | 0,7320   | 0,7740   | 0,7615   | 0,6682   | 0,5381   | 0,4901   | 0,2267   | 0,1672   | 0,1675   | 0,1650   | 0,1501   |

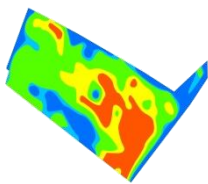
# NDVI<sub>Sentinal</sub>



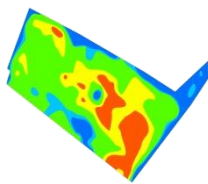
# DGM, NDVI<sub>Sentinal</sub>, VI, Geophysik, Bodenanalyse



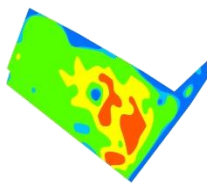
30.03.18



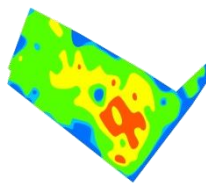
09.04.18



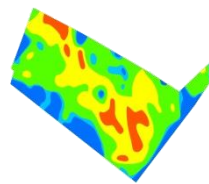
12.04.18



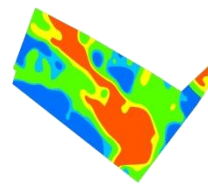
22.04.18



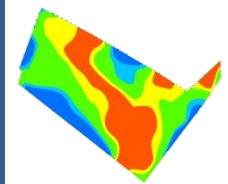
09.05.18



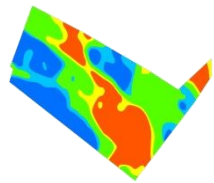
22.05.18



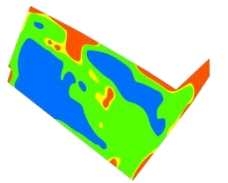
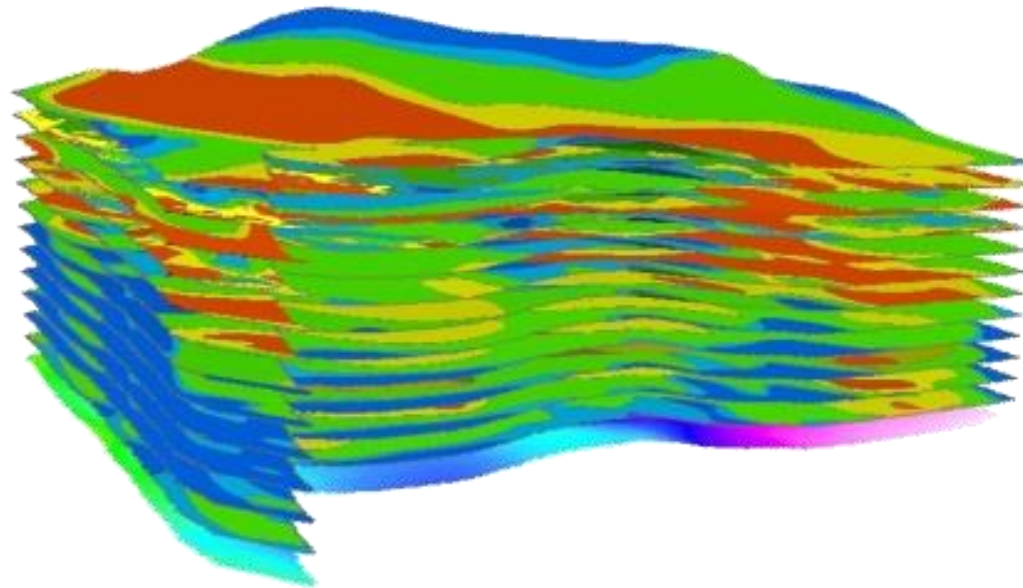
29.05.18



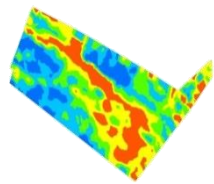
5 Zonen



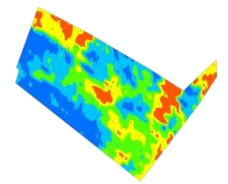
08.06.18



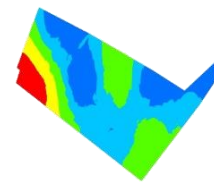
03.07.18



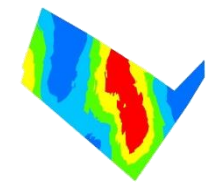
08.06.18  
Pflanze Scan



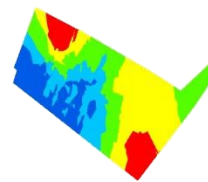
09.18  
Boden Scan



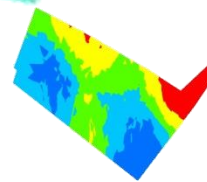
09.18  
Boden P



09.18  
Boden K



09.18  
Boden pH



09.18  
Boden Mg

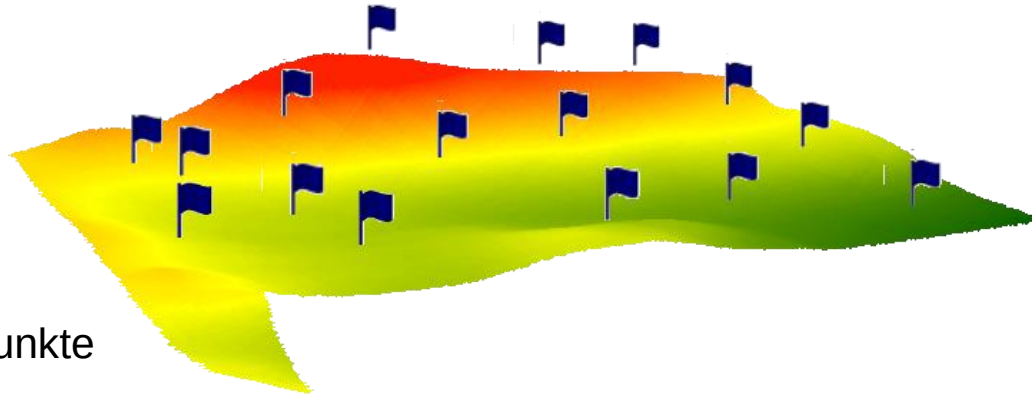
22.02.2019

| Farbe    |          | Bedeutung    |
|----------|----------|--------------|
| rot      | rot      | sehr hoch    |
| gelb     | gelb     | hoch         |
| grün     | grün     | mittel       |
| hellblau | hellblau | niedrig      |
| blau     | blau     | sehr niedrig |



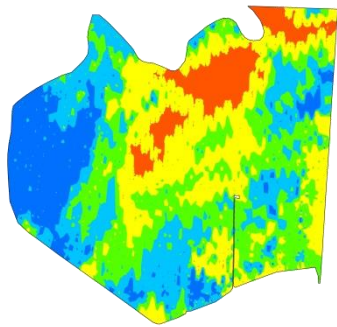
# 2018-2019

- vegetationsbeschreibende Parameter (fortlaufend)
- $N_{\min}$  (nach Weizen 2018, im Herbst 2018, Frühjahr 2019, Herbst 2019)
- N-Aufnahme von Mais (Juni/Juli 2019, September 2019)
- Maisertrag (Handernte/Feldhäcksler)

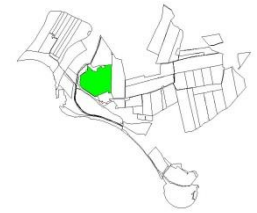
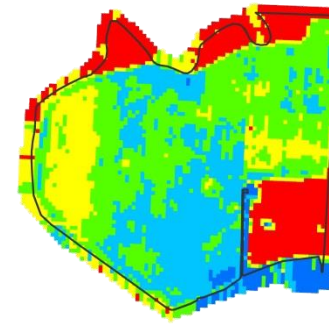
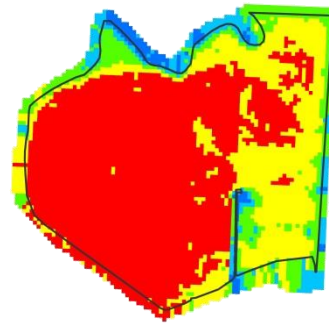


- 16 Punkte

DGM2 (143-177 m über NN)



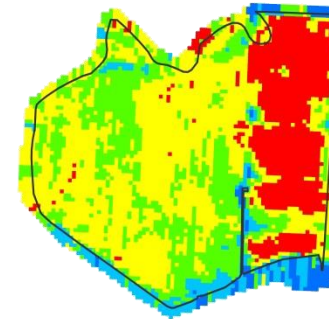
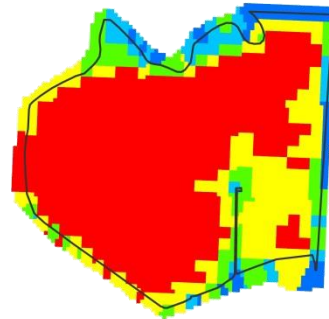
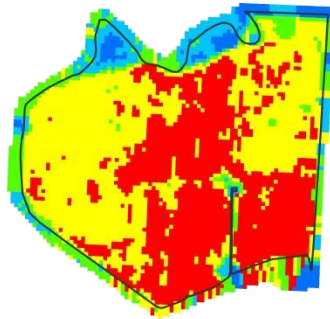
# Bewirt- schaftung



geophysikalische  
Bodenerkundung  
01/2016

VI Satellit  
22.04.2016

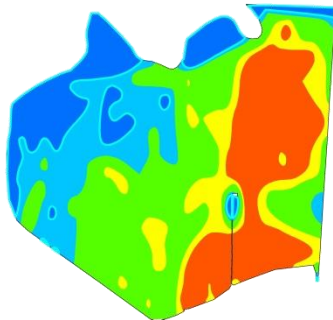
VI Satellit  
09. 05.2016



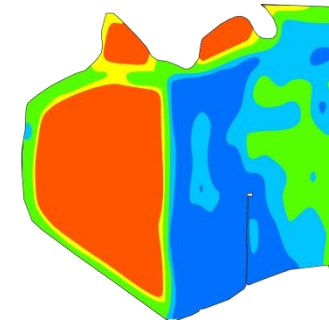
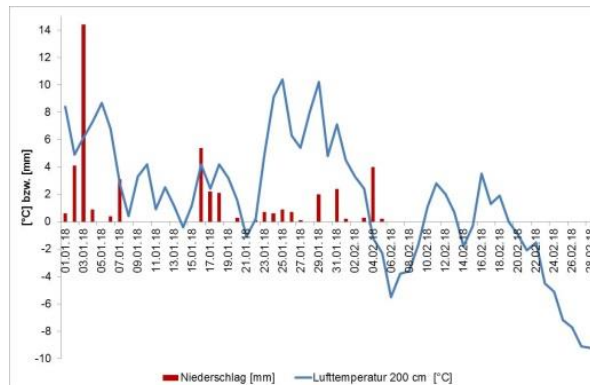
VI Satellit  
28.03.2017

VI Satellit  
24. 04.2017

VI Satellit  
17. 05.2017

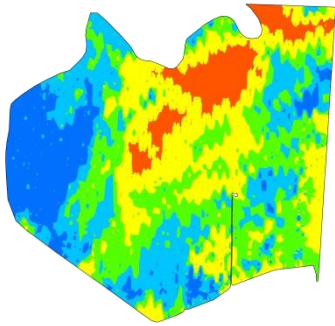


VI Satellit  
13.02.2018



VI Satellit  
14.05.2018



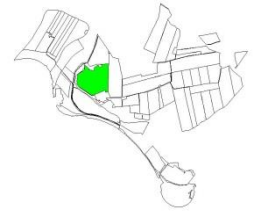


# Düngung

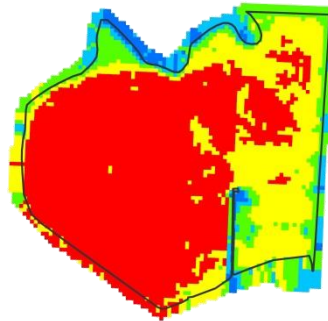
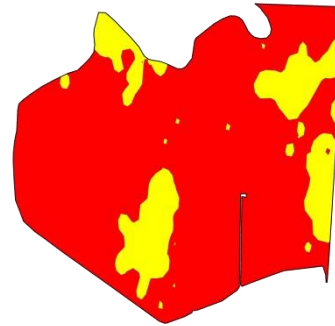
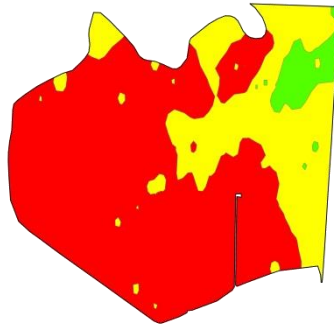
Boden P, 2015

Boden K, 2015

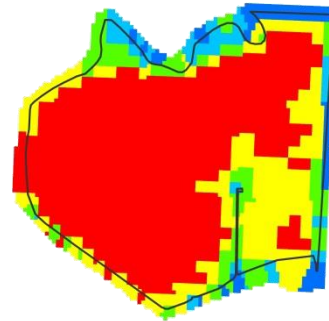
landwirtschaftliche Klassifizierung (Gehaltsklassen)



geophysikalische  
Bodenerkundung  
01/2016



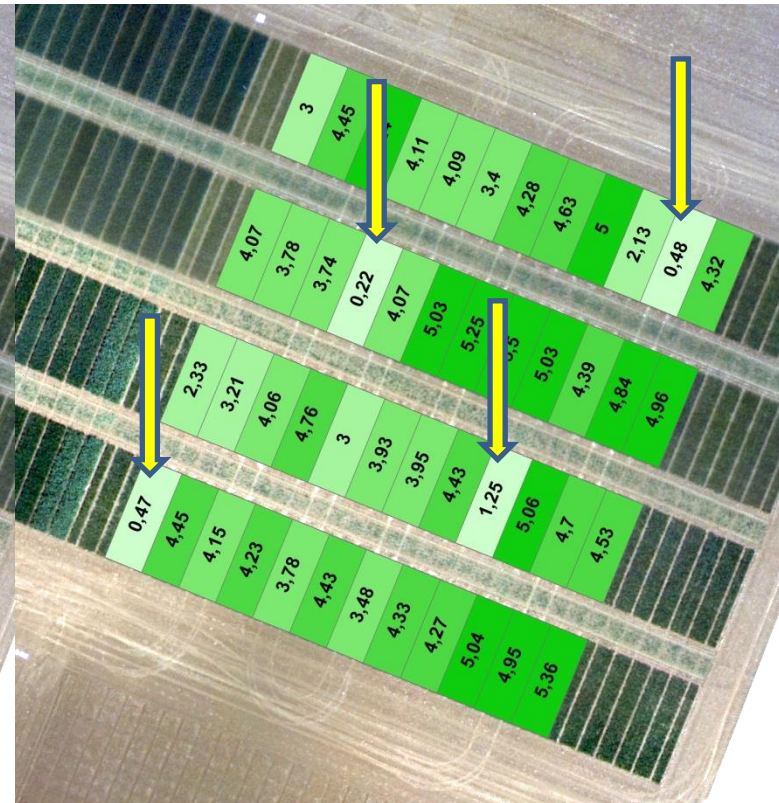
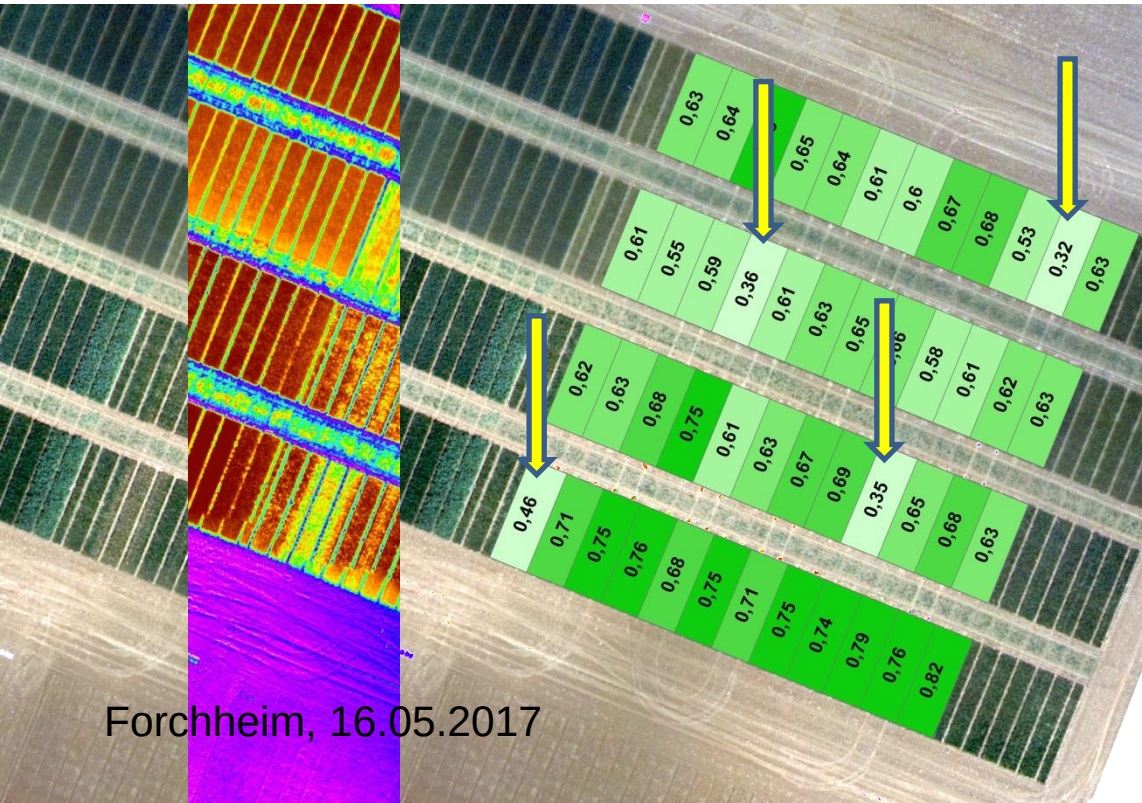
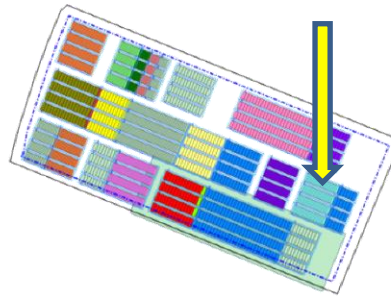
VI Satellit  
22.04.2016



VI Satellit  
24. 04.2017

| Farbe |          | Bedeutung    |
|-------|----------|--------------|
|       | rot      | sehr hoch    |
|       | gelb     | hoch         |
|       | grün     | mittel       |
|       | hellblau | niedrig      |
|       | blau     | sehr niedrig |

# vegetationsbeschreibende Parameter im Feldversuch



Forchheim, 16.05.2017

22.02.2019

MSK am UAV

Sensor am Dreipunkt

# vegetationsbeschreibende Parameter

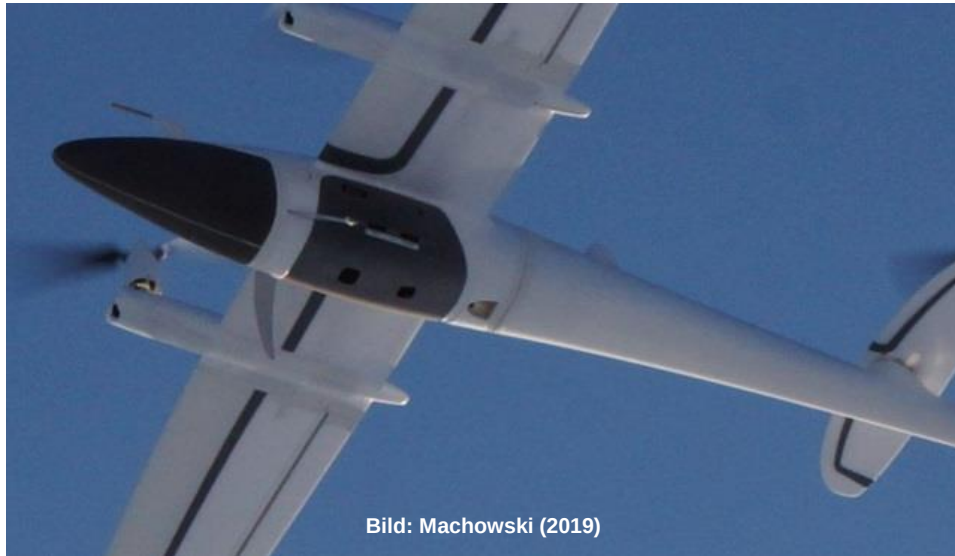
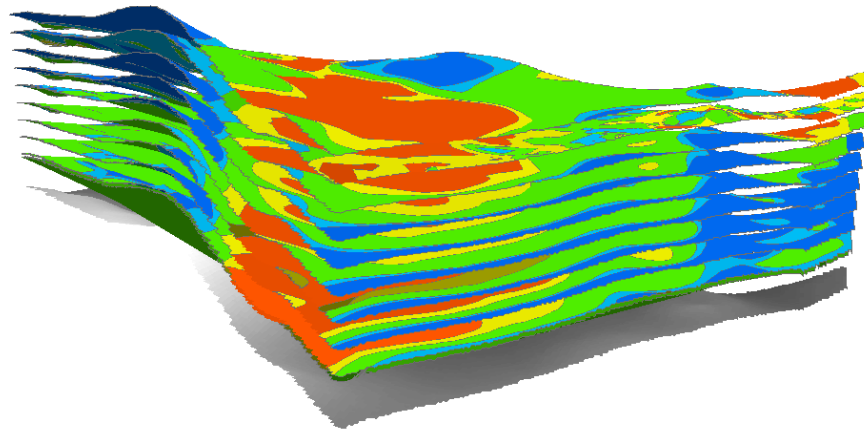


Bild: Machowski (2019)



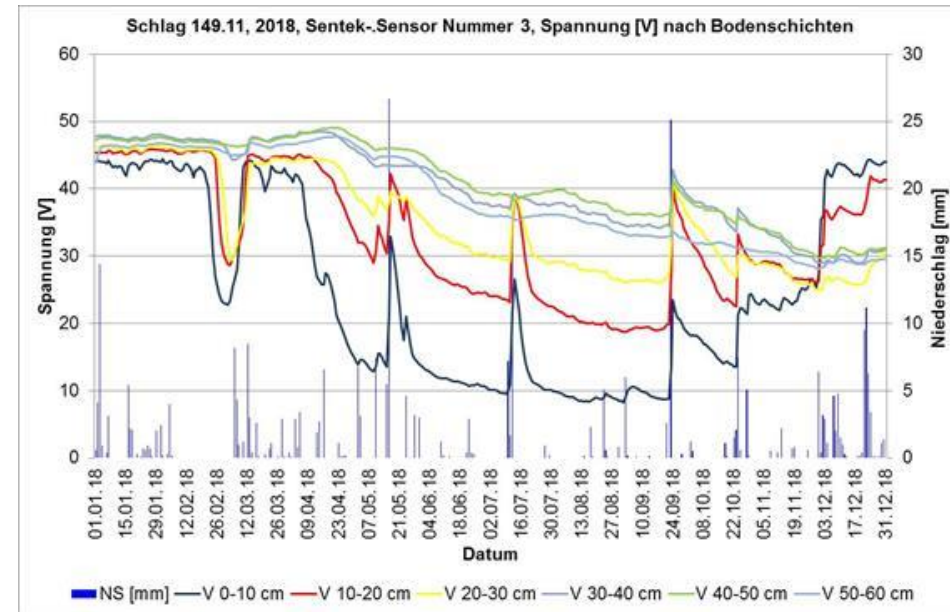
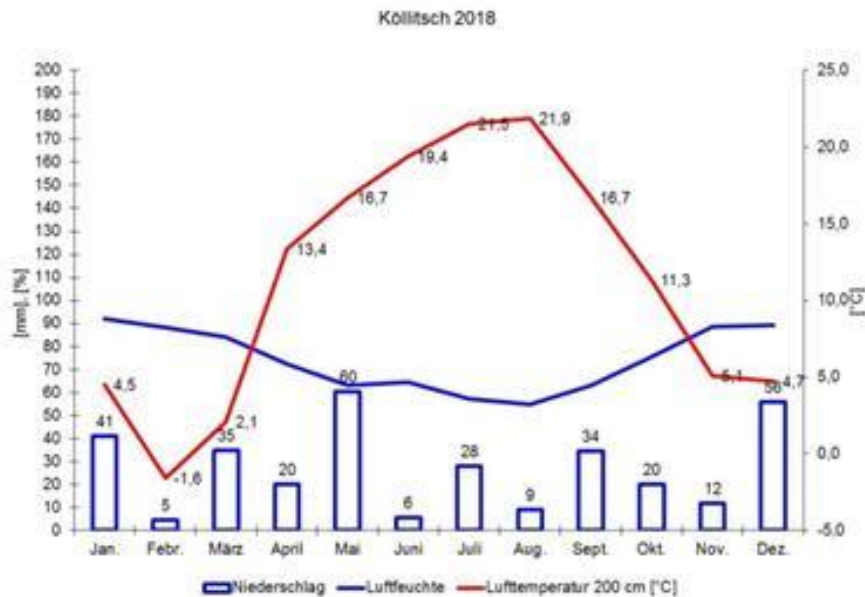
# vegetationsbeschreibende Parameter

Die Wahl des vegetationsbeschreibenden Parameters  
und  
die Ableitung einer pflanzenbaulichen Maßnahme  
aus diesem vegetationsbeschreibenden Parameter  
ist Sache des Agronomen vor Ort.





# vegetationsbeschreibende Parameter



2019      Niederschlag

Januar      45 mm  
Februar      14 mm

Bodenschicht

0 - 10 cm  
10 - 20 cm  
20 - 30 cm  
30 - 40 cm  
40 - 50 cm  
50 - 60 cm

Spannung [V] am  
31.12.18 wie am 1.1.18

ja  
ja  
nein  
nein  
nein  
nein

22.02.2019

# **Danksagung an unmittelbar am Vortrag Beteiligte**

AgGUmenda GmbH

Agrargenossenschaft e. G.

Agricon GmbH

AGRO-SAT Consulting GmbH

geo-konzept GmbH

LfULG Versuchsstation Forchheim

Staatliche Betriebsgesellschaft für Umwelt und Landwirtschaft (BfUL)

Staatsbetrieb Geobasisinformation und Vermessung Sachsen (GeoSN)