Klimalandschaft

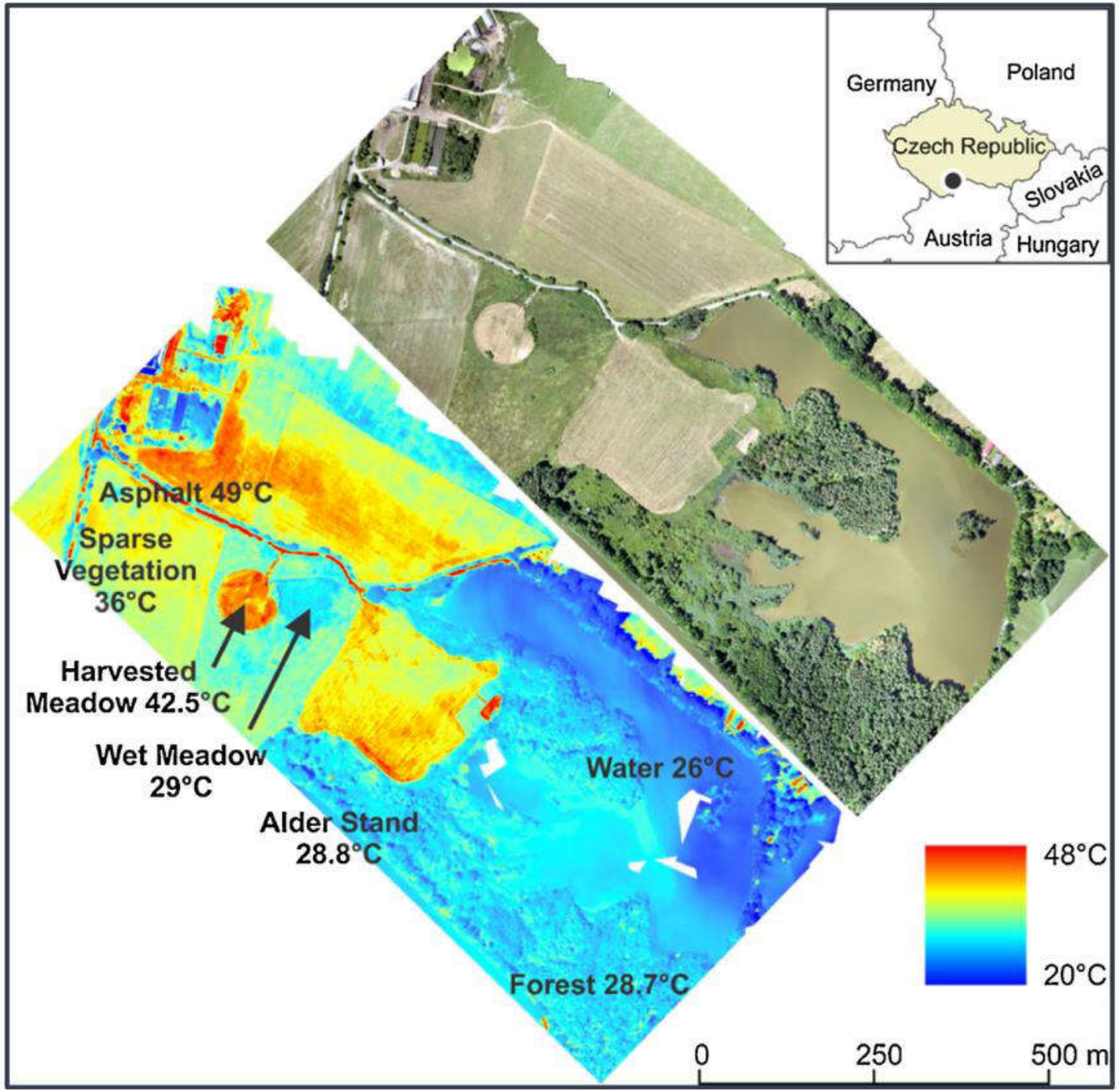
Mit Agroforst und Keyline Design den Klimawandel eindämmen?

NABU-Talk Bioökonomie in den Planetaren Grenzen, Berlin, 11. Dezember 2023

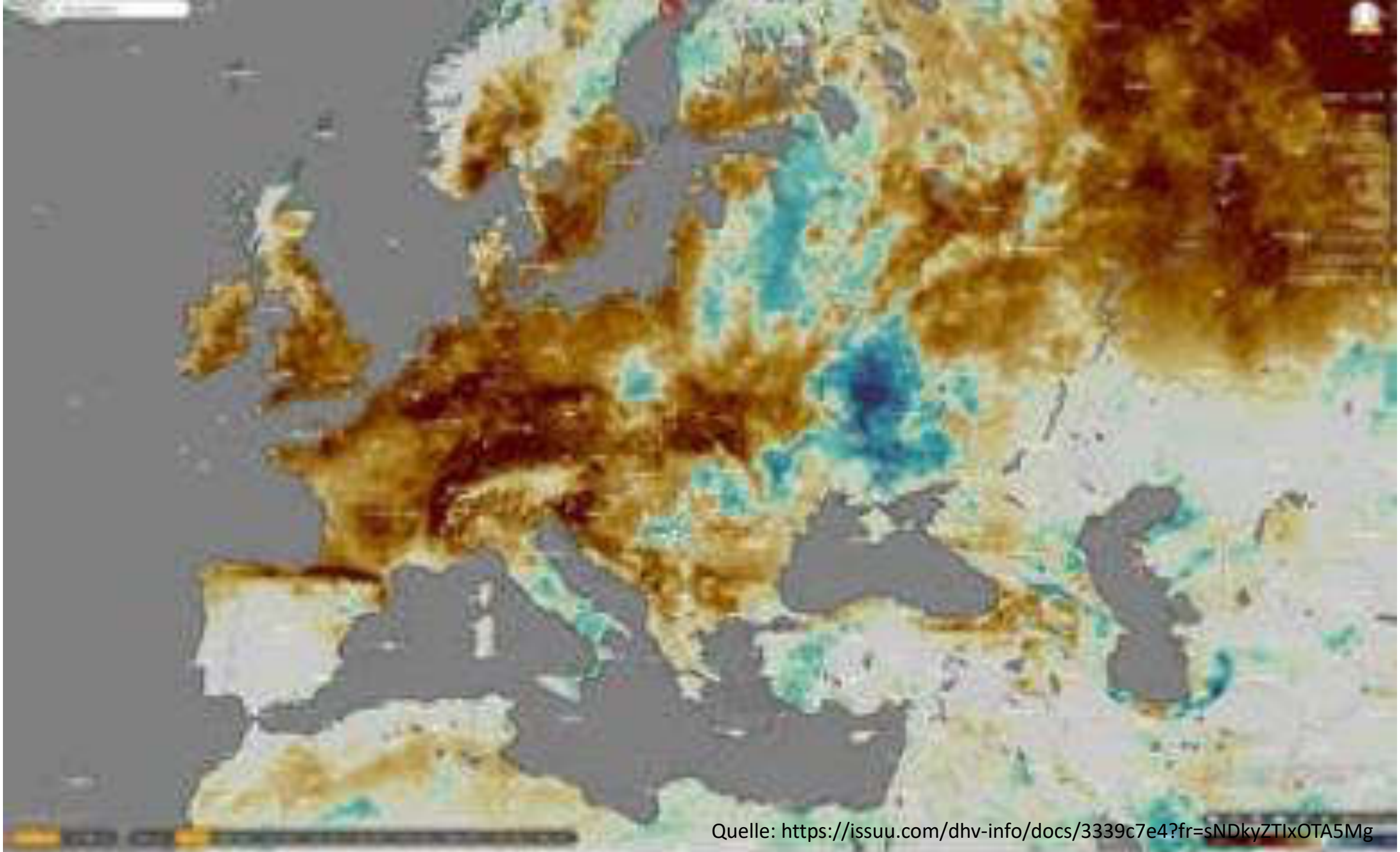
Dipl.-Forstw. Dr.nat.techn. Philipp Gerhardt

baumfeldwirtschaft.de

Teil 1: **Land(wirt)schaft und Klima**

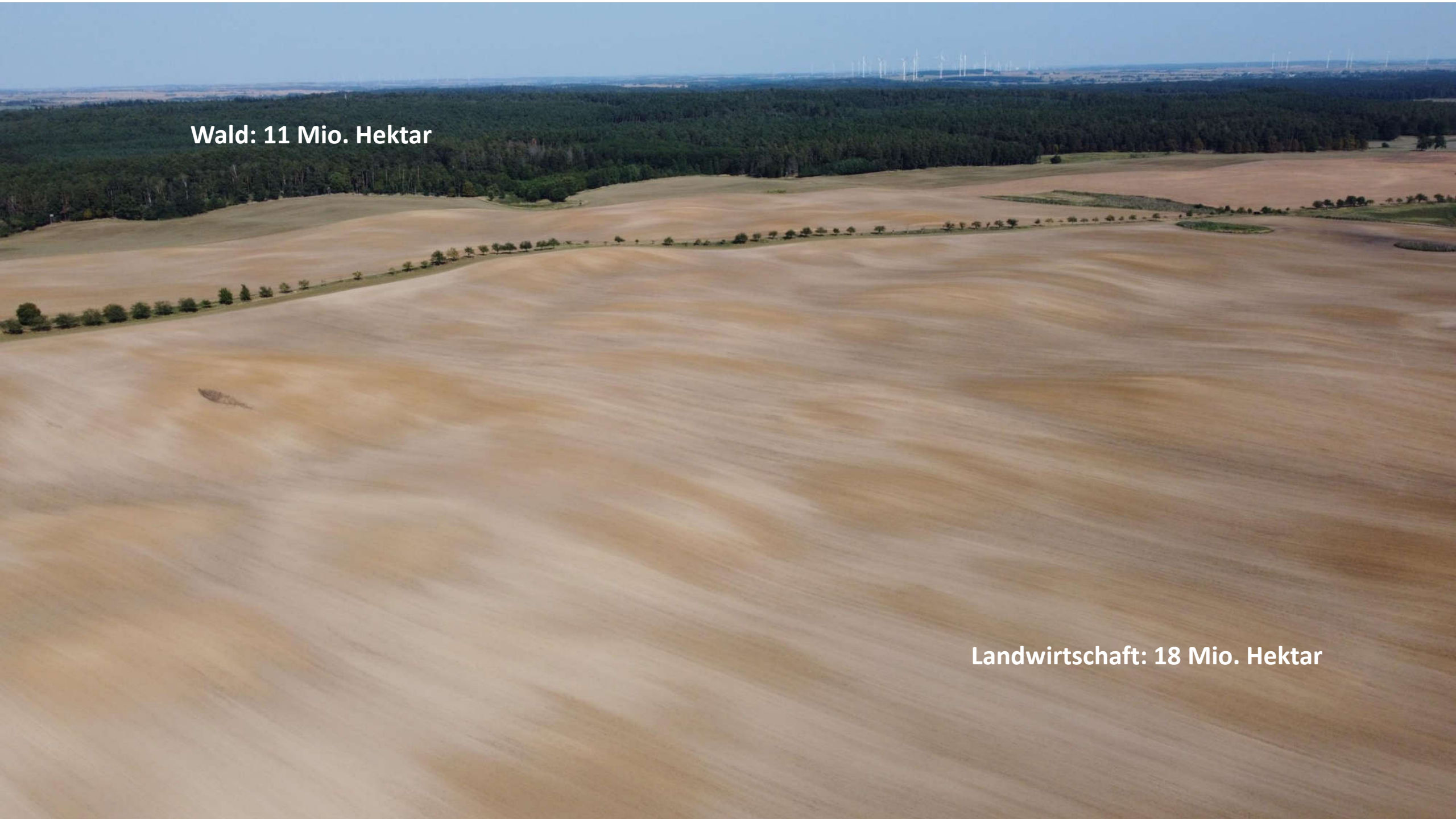


Ellison et al. 2017

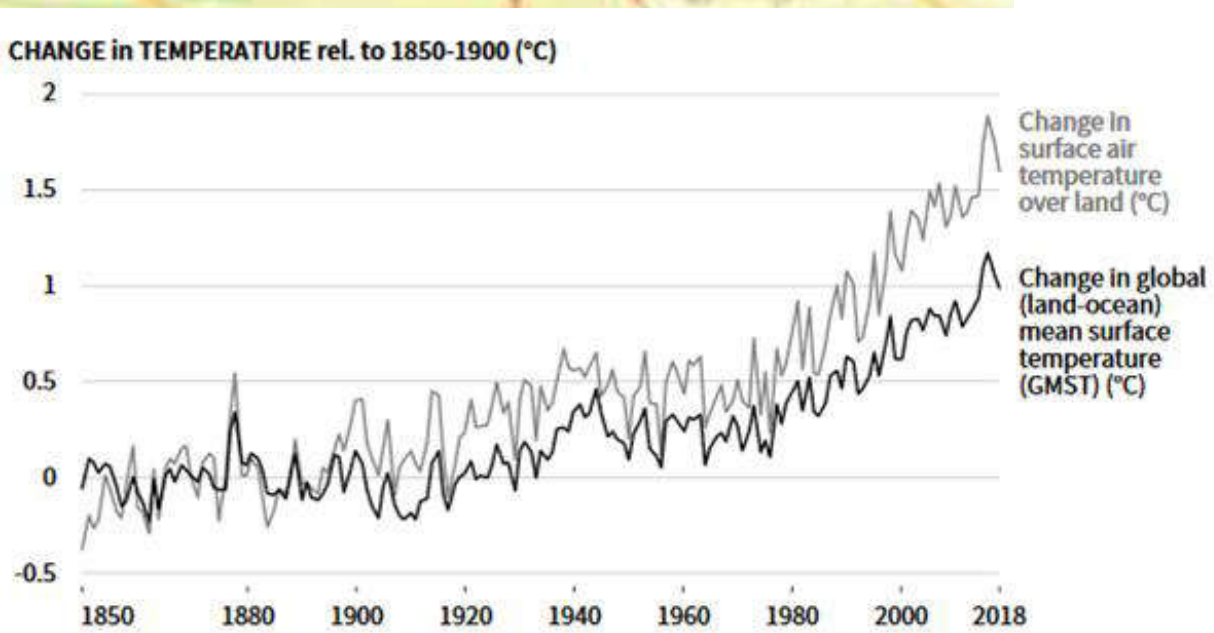


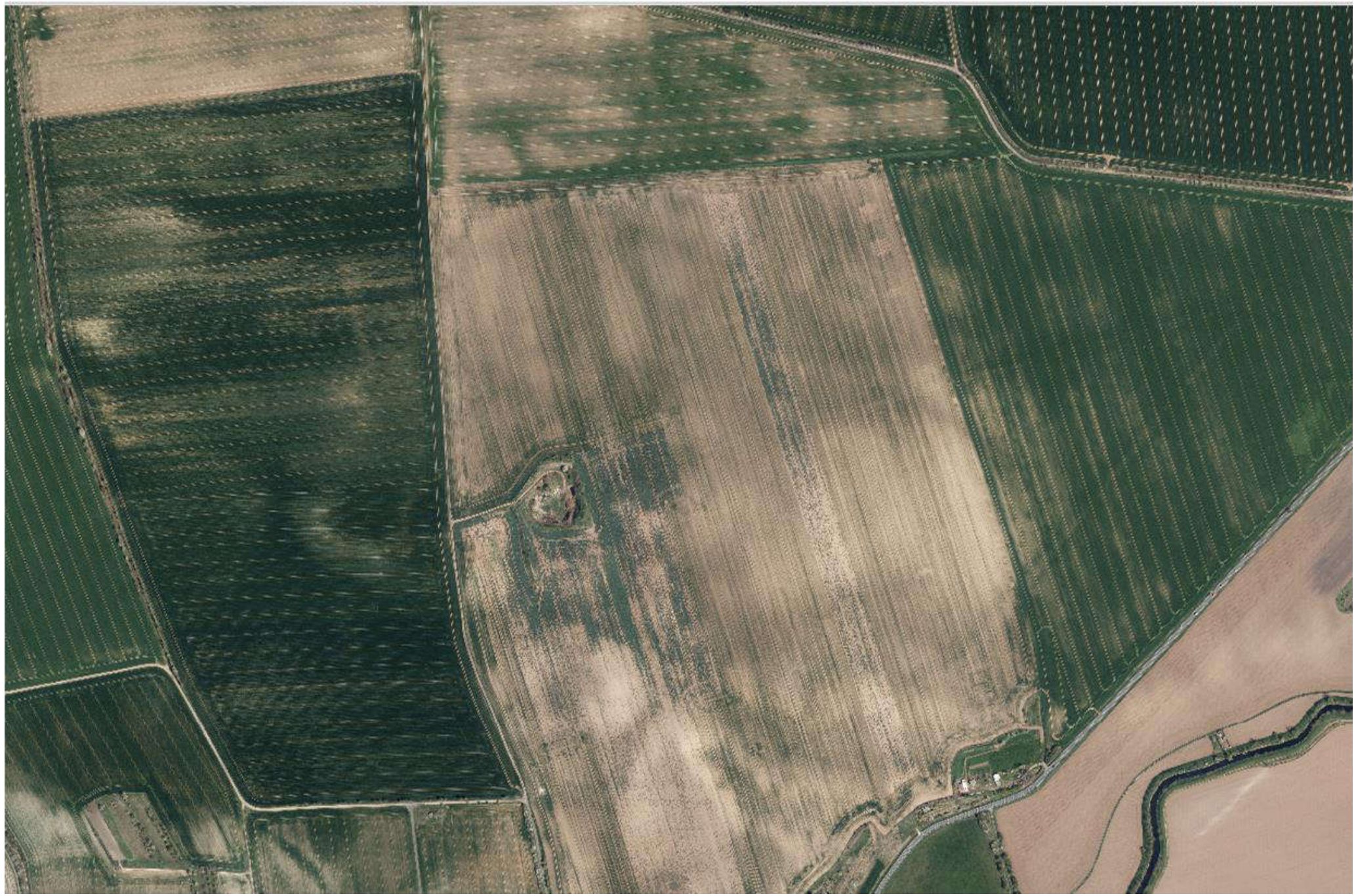
Quelle: https://issuu.com/dhv-info/docs/3339c7e4?fr=sNDkyZTIxOTA5Mg

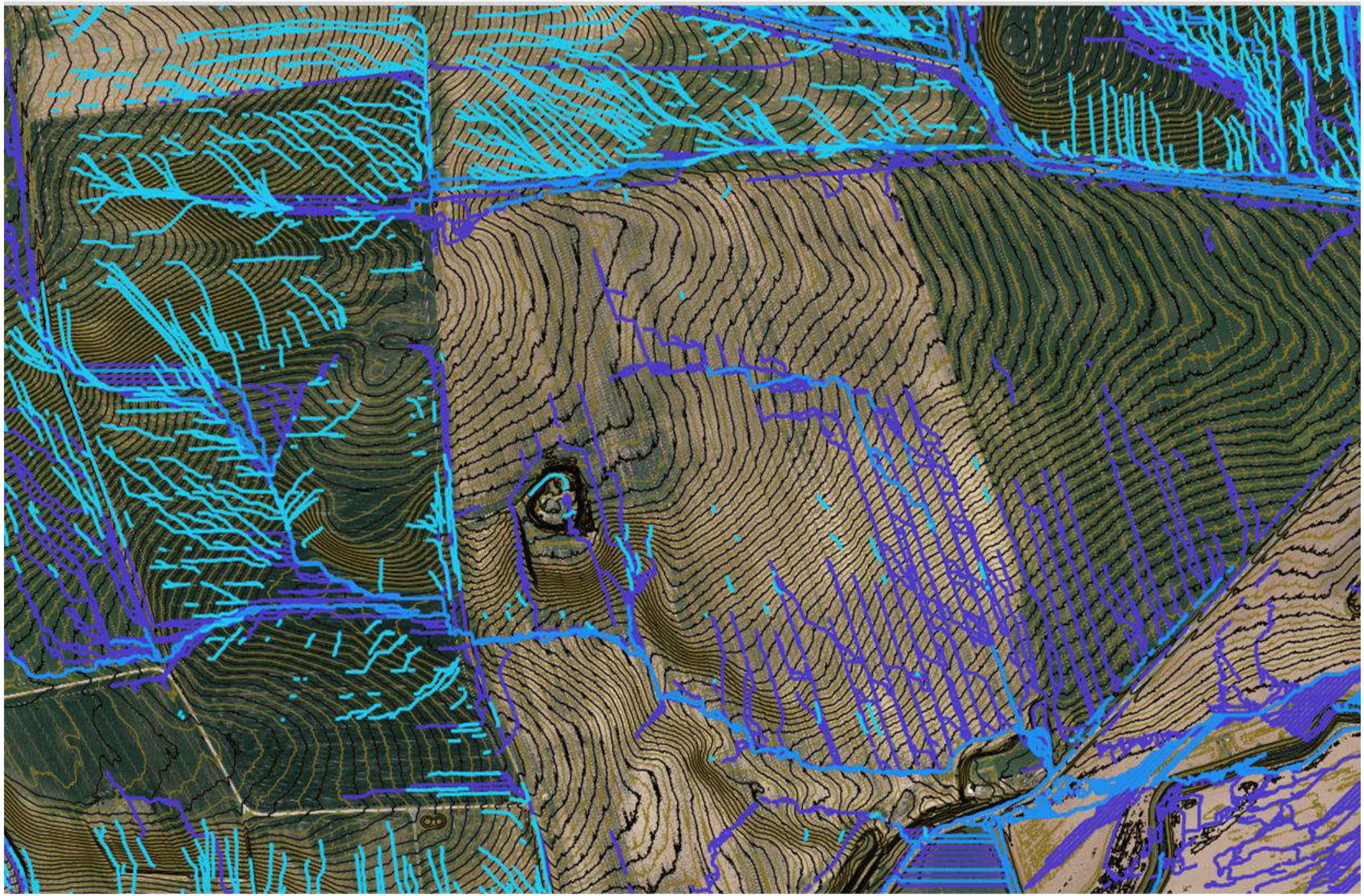

vi.
vii.
ii.
i.
v.
iii.
iv.


Wald: 11 Mio. Hektar
Landwirtschaft: 18 Mio. Hektar

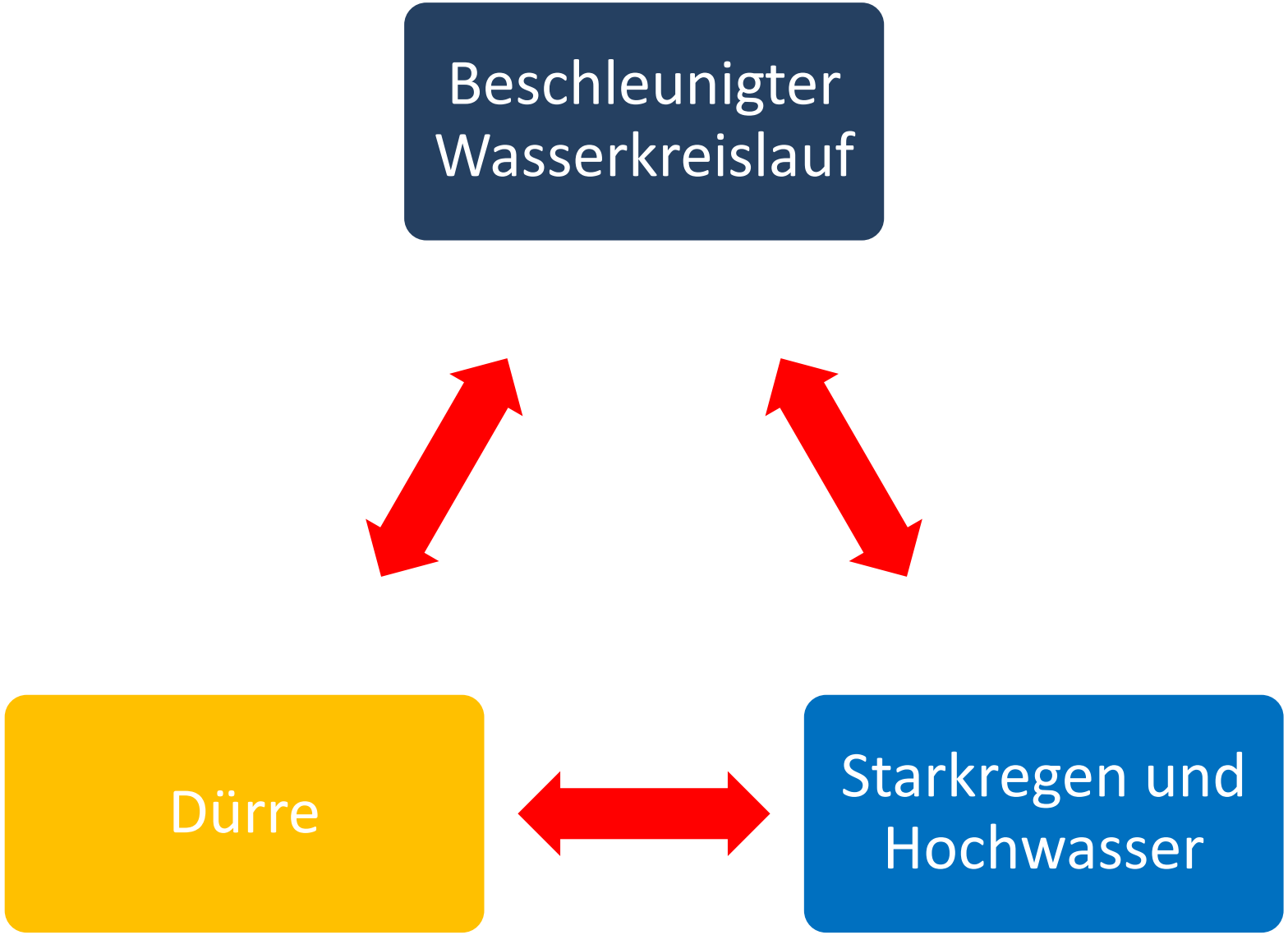

vi.
vii.


CHANGE in TEMPERATURE rel. to 1850-1900 (°C)
2
1.5
1
0.5
0
-0.5
1850
1880
1900
1920
1940
1960
1980
2000
2018
Change in surface air temperature over land (°C)
Change in global (land-ocean) mean surface temperature (GMST) (°C)

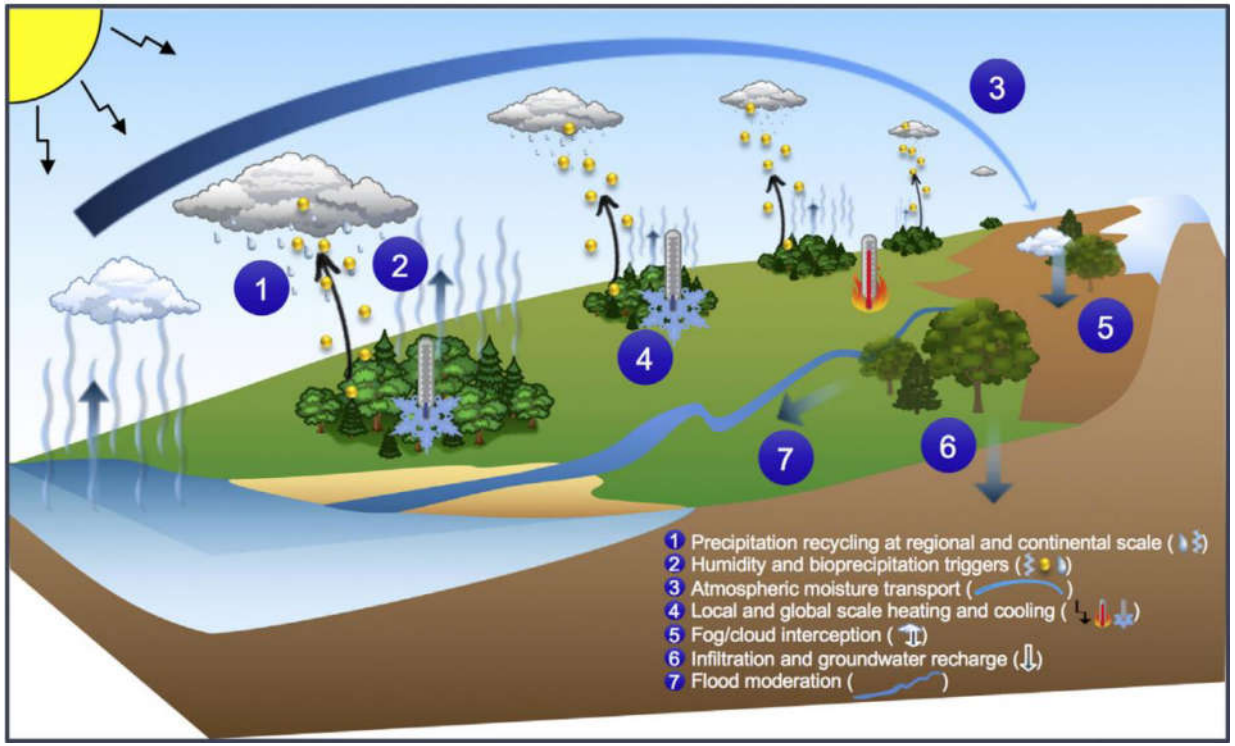


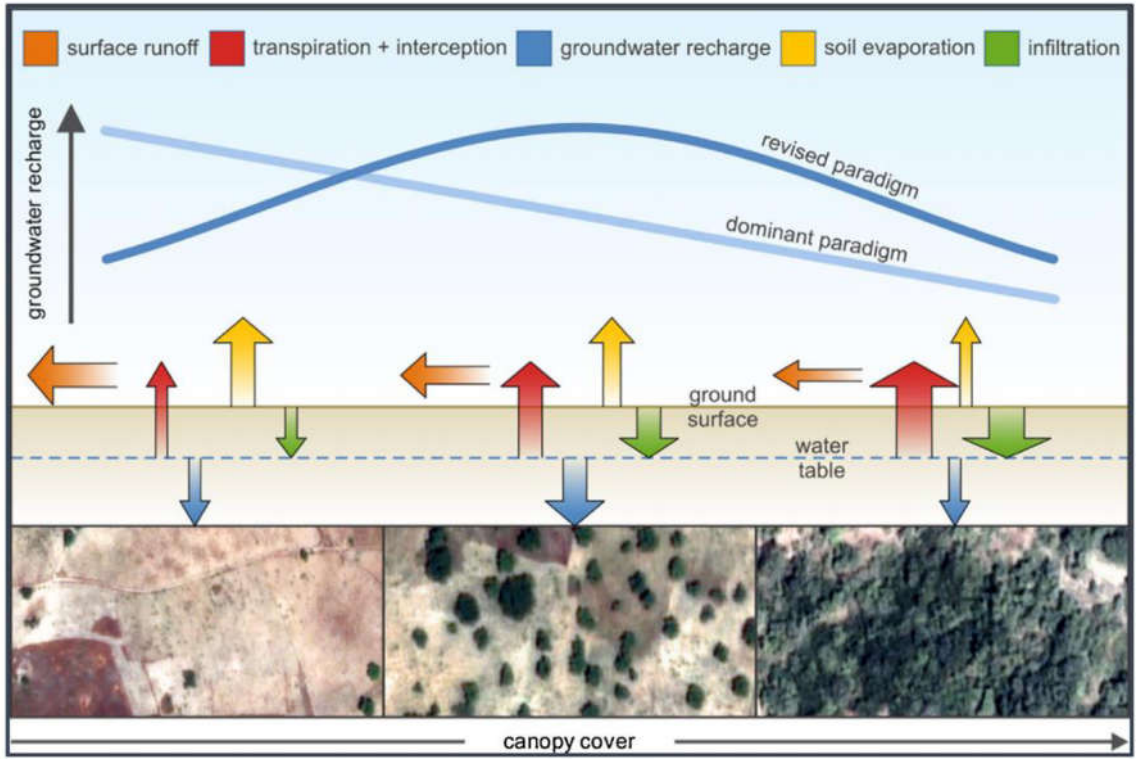


Bildquelle: https://commons.wikimedia.org/w/index.php?curid=107715728


Beschleunigter Wasserkreislauf
Dürre
Starkregen und Hochwasser

Wolken, Regen und Kühlung…





Gehölzlandschaften tragen regional und kontinental zur Wolkenbildung bei.
Lichte Gehölzstrukturen maximieren die Grundwasserneubildung[(19)].


(a)
vi.
vii.
i.
ii.
iii.
iv.
v.


(b)
viii.
ix.
xi.
vii.
x.
iv.
iii.
ii.
i.
v.
vi.

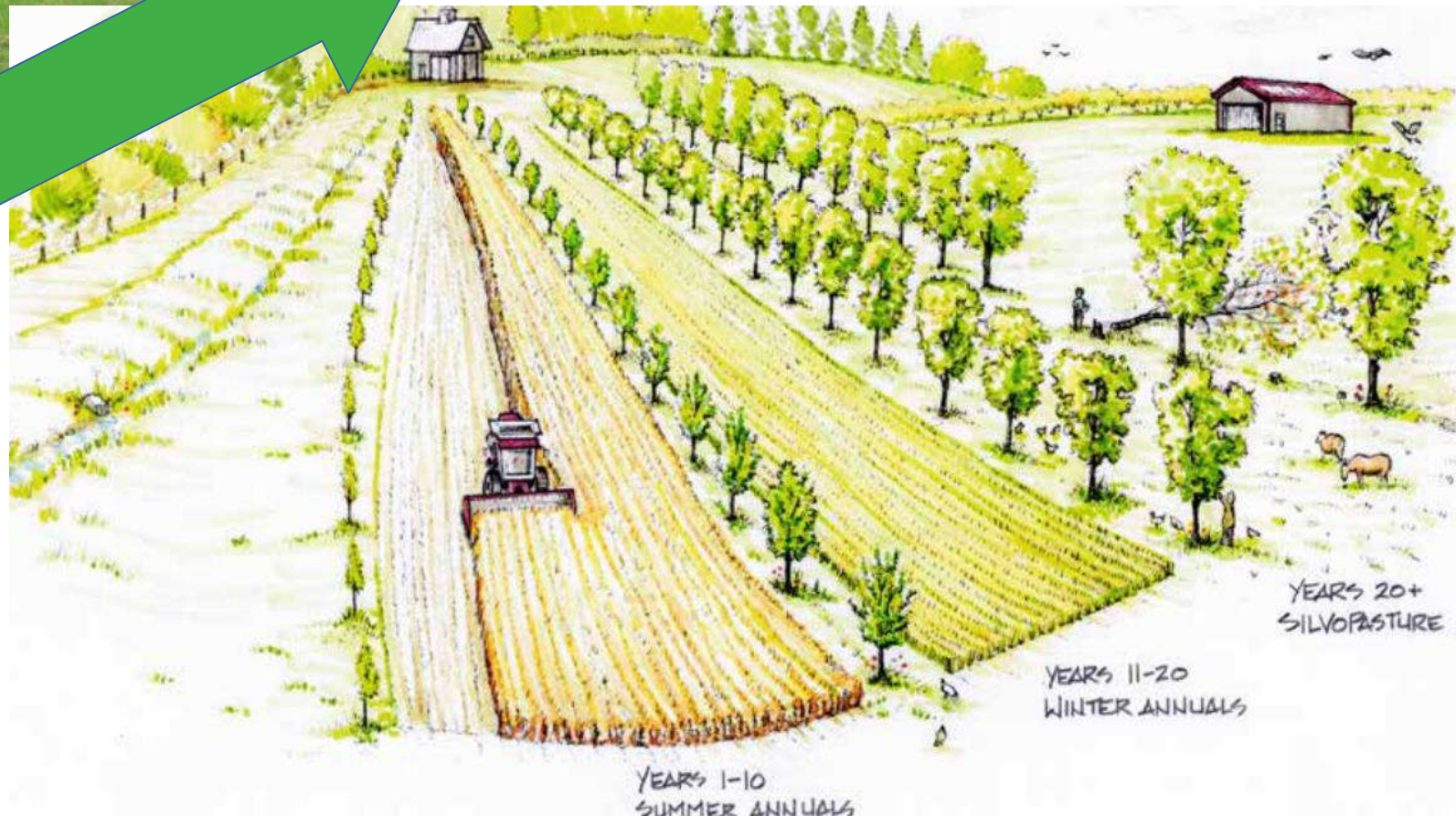
Teil 2:

Agroforst & Wässerlinien

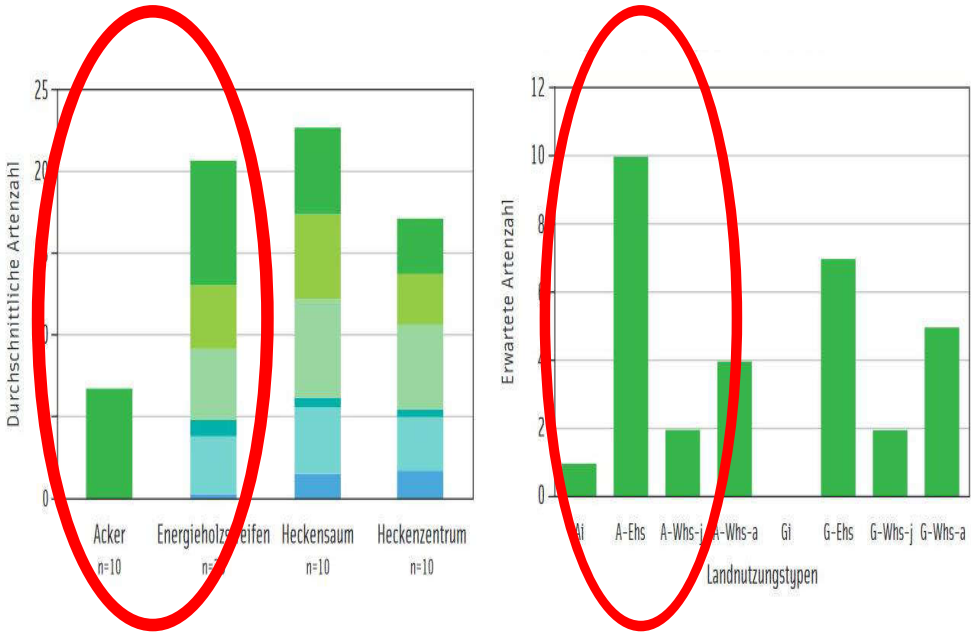
- ein Weg aus dem Teufelskreis?

Ökologisches Modell „Wald-Weide-Landschaft“

Produktionssystem Agroforst



Biodiversität in Agroforstsystemen



Pflanzenarten **Vogelarten**

Quelle: (17)

Bäume in der Landwirtschaft

Bei 10 % Agroforst in Deutschland:

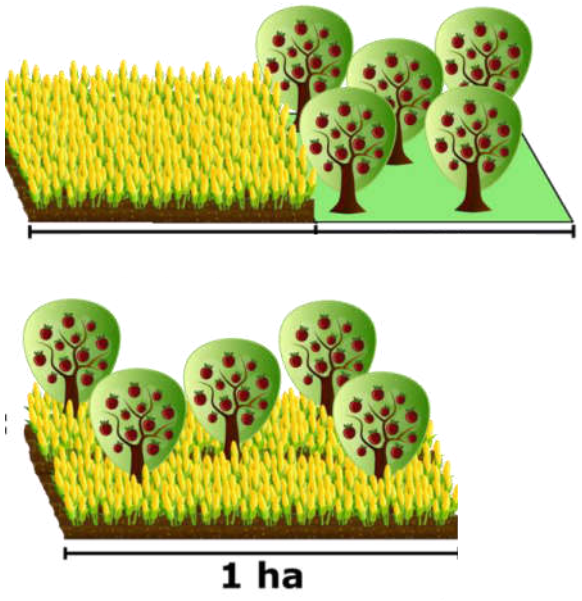
-> 62 Mio Tonnen CO_2 jährlich[(23)]

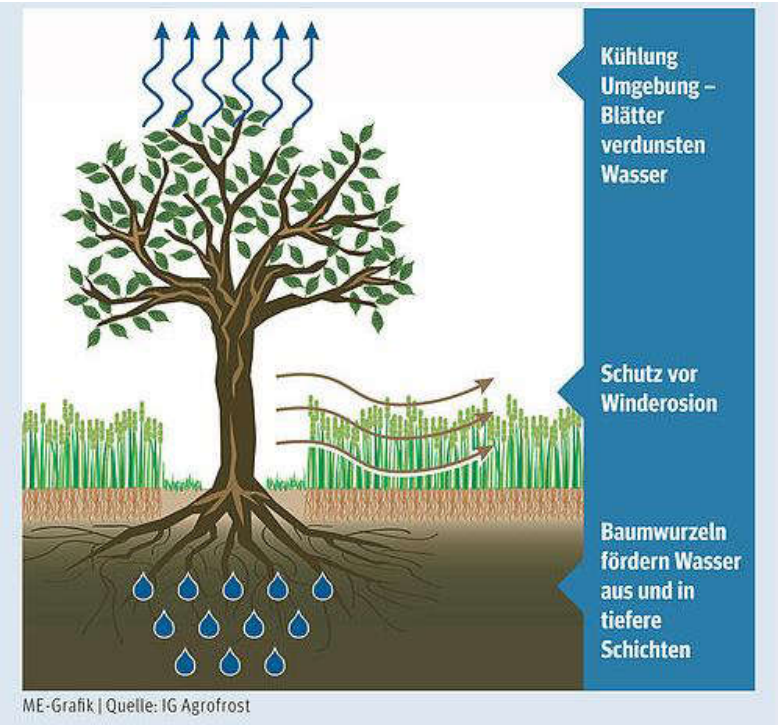
-> C-Speicherung im Boden x4 [(7;8)]

Produktivität – Beispiele aus Brandenburg:

LER = 2,0 bis 2,9 (13)

Steigerung Getreideertrag 16%(18)





Wasserrückhalt:

Verminderter Verdunstungsstress$_{(18)}$

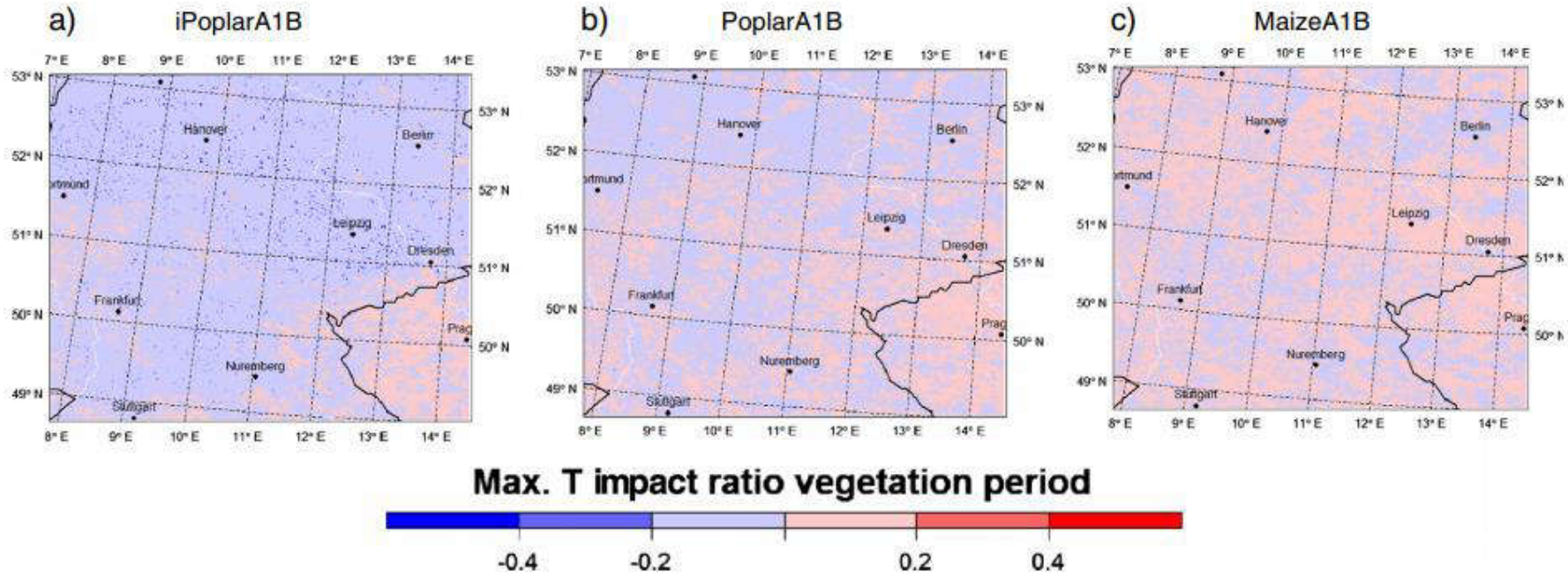
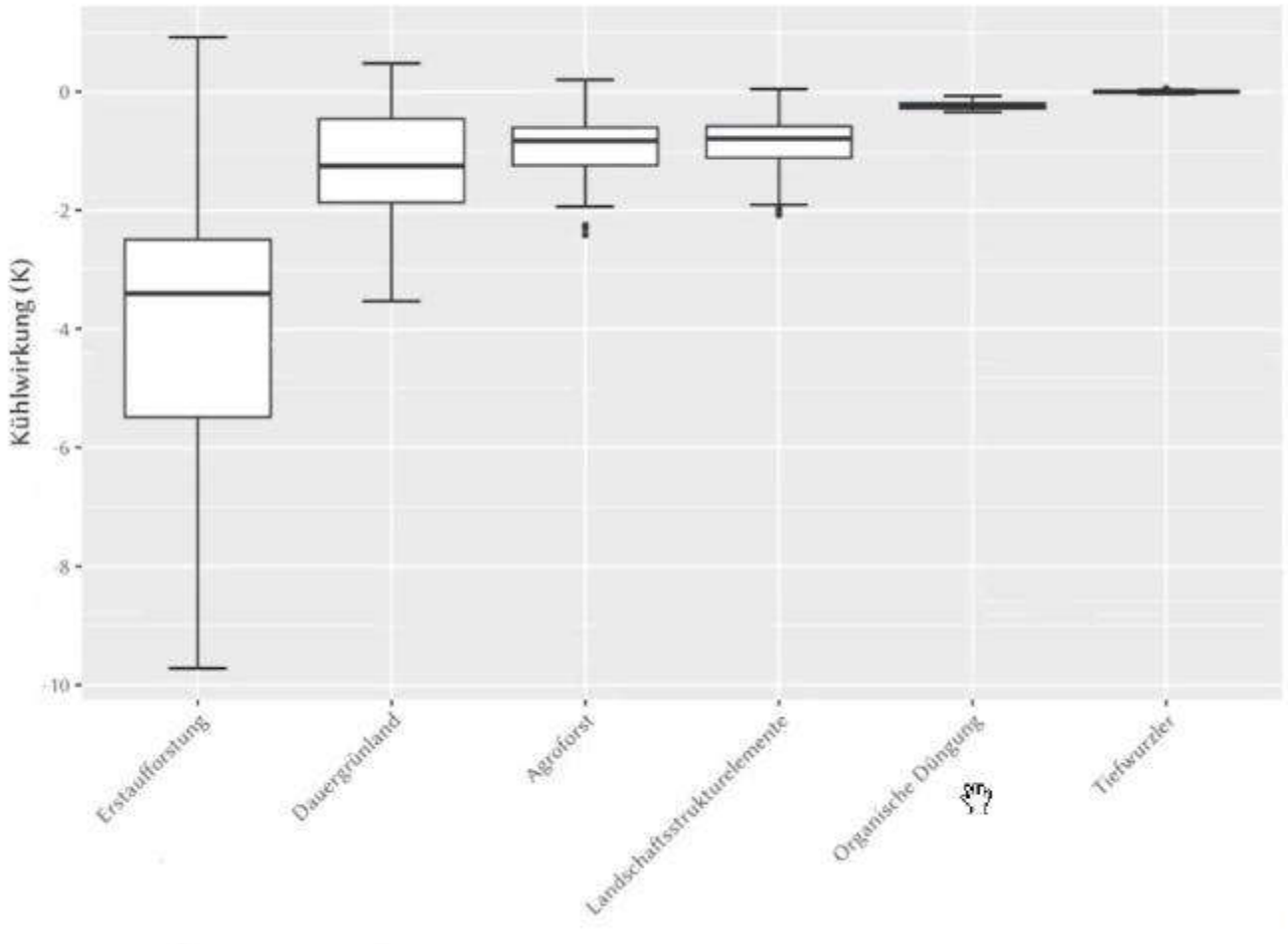


Figure 5. Impact ratio of maximum temperature during the vegetation period for (a) irrigated poplar, (b) nonirrigated poplar, and (c) maize.

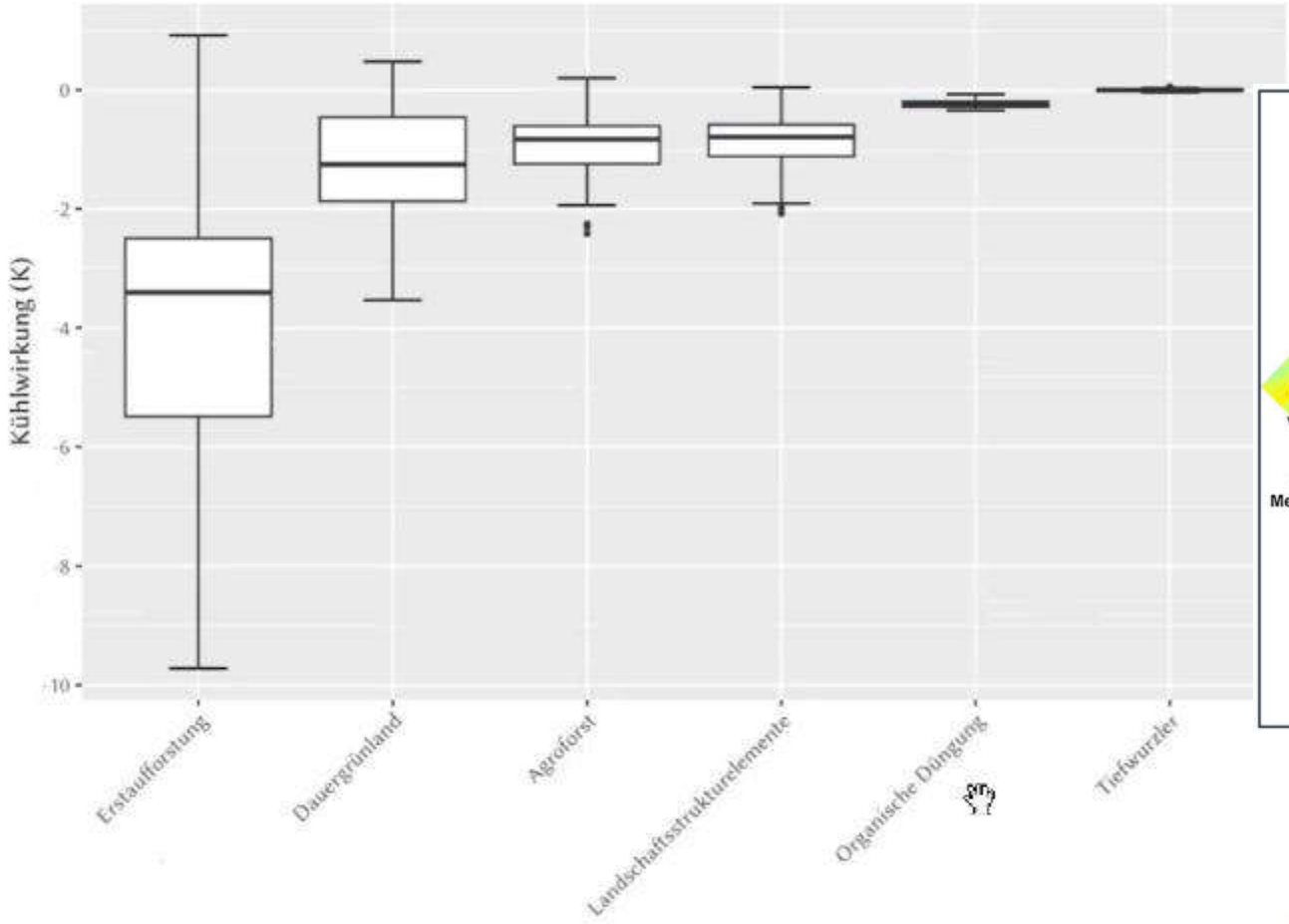
Toelle et al. 2014

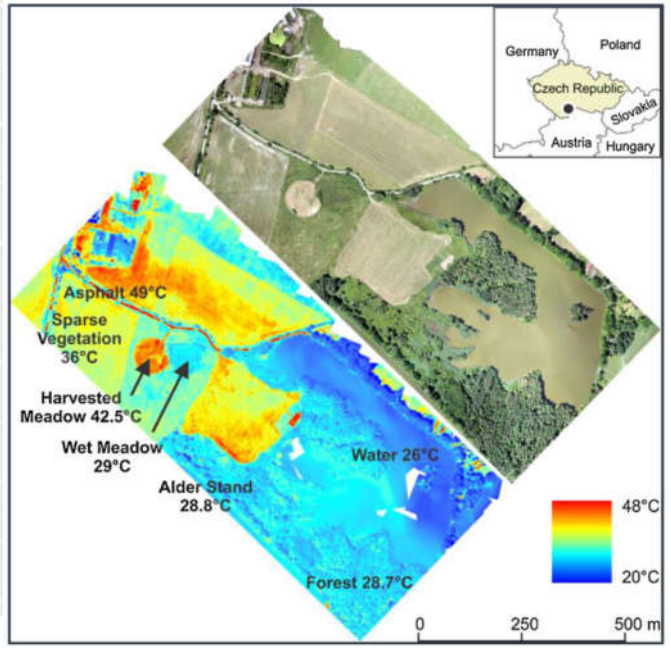
Flächengemittelte Maßnahmenwirkung



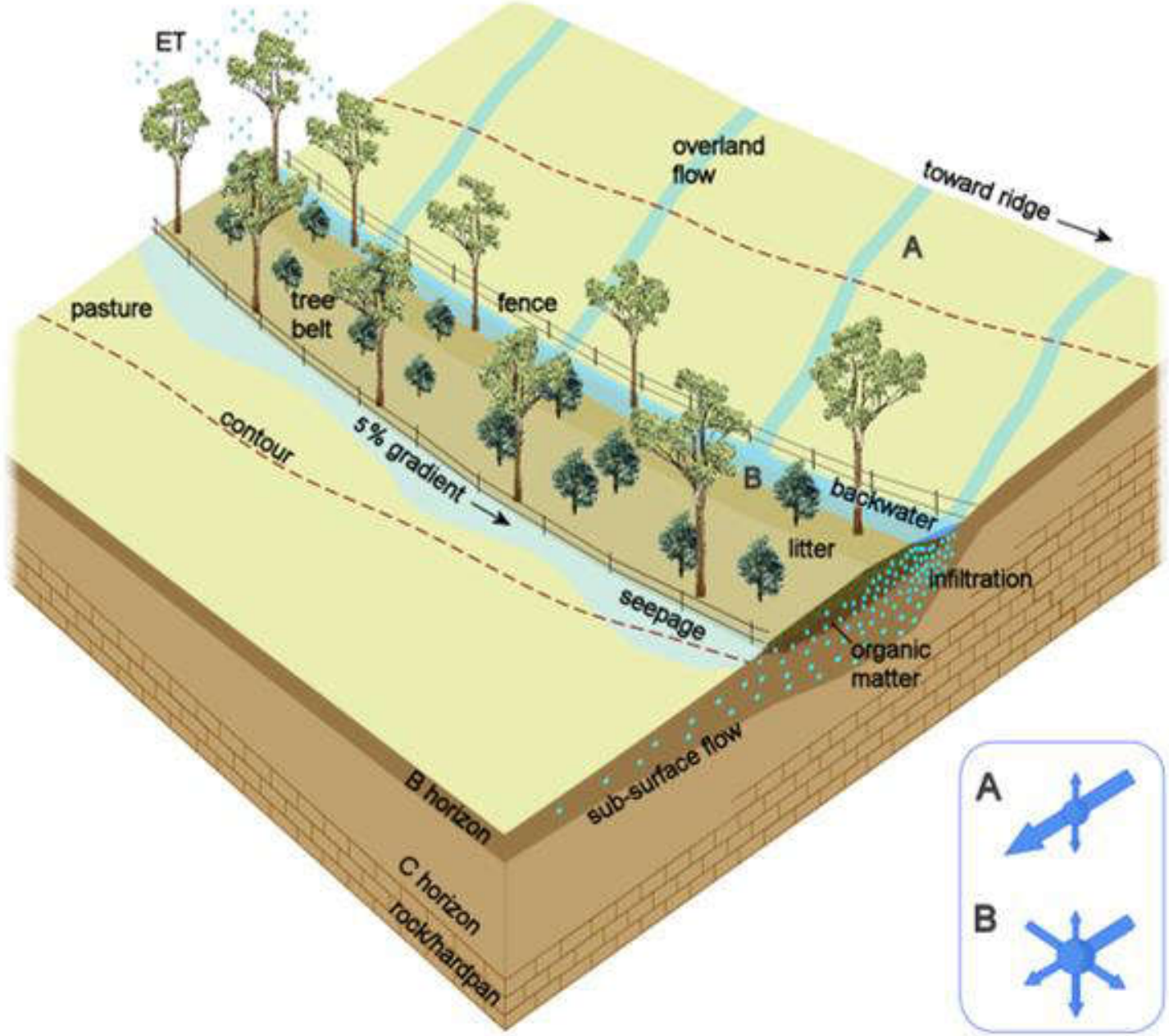
Zimmermann 2023

Flächengemittelte Maßnahmenwirkung

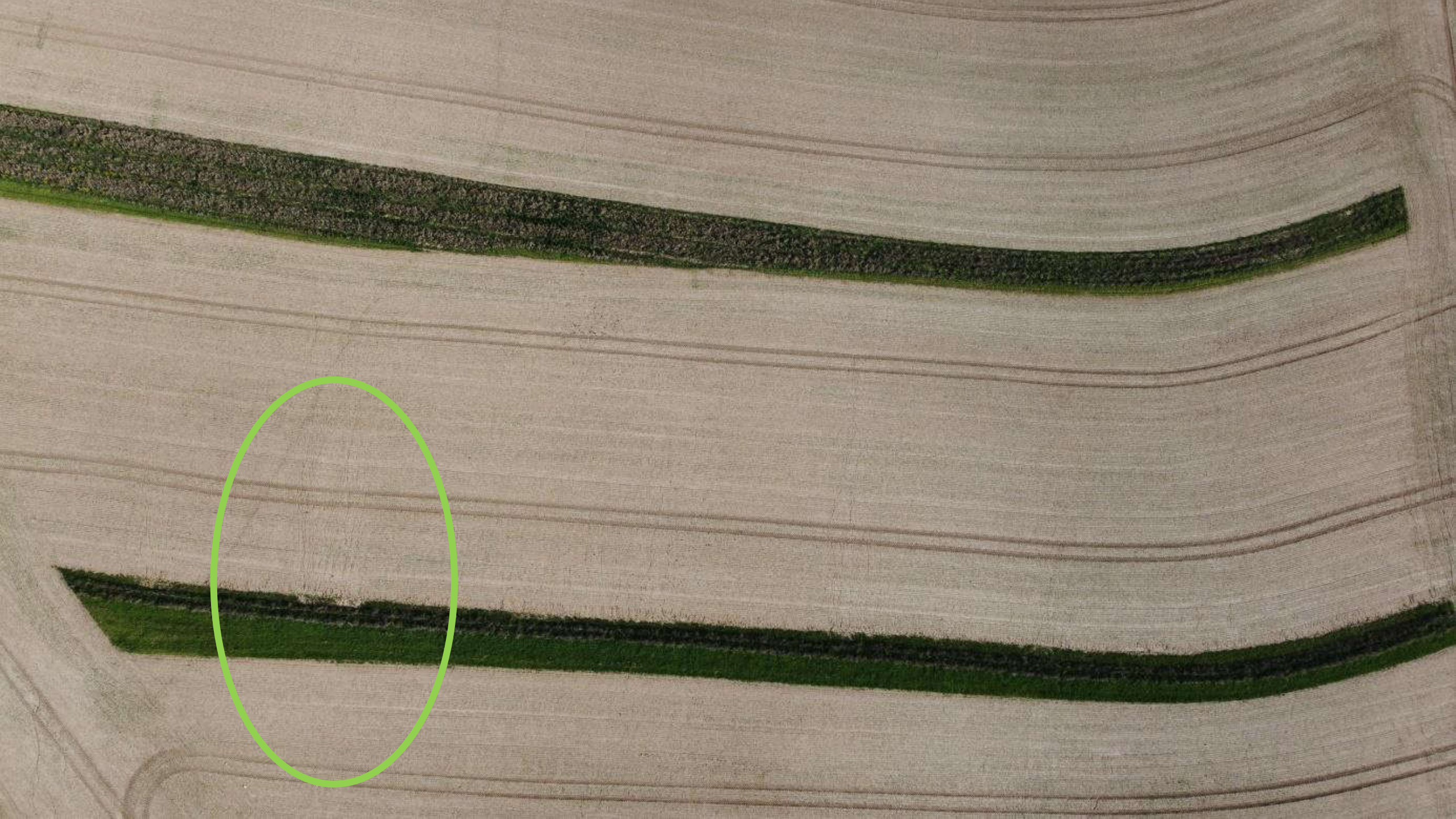


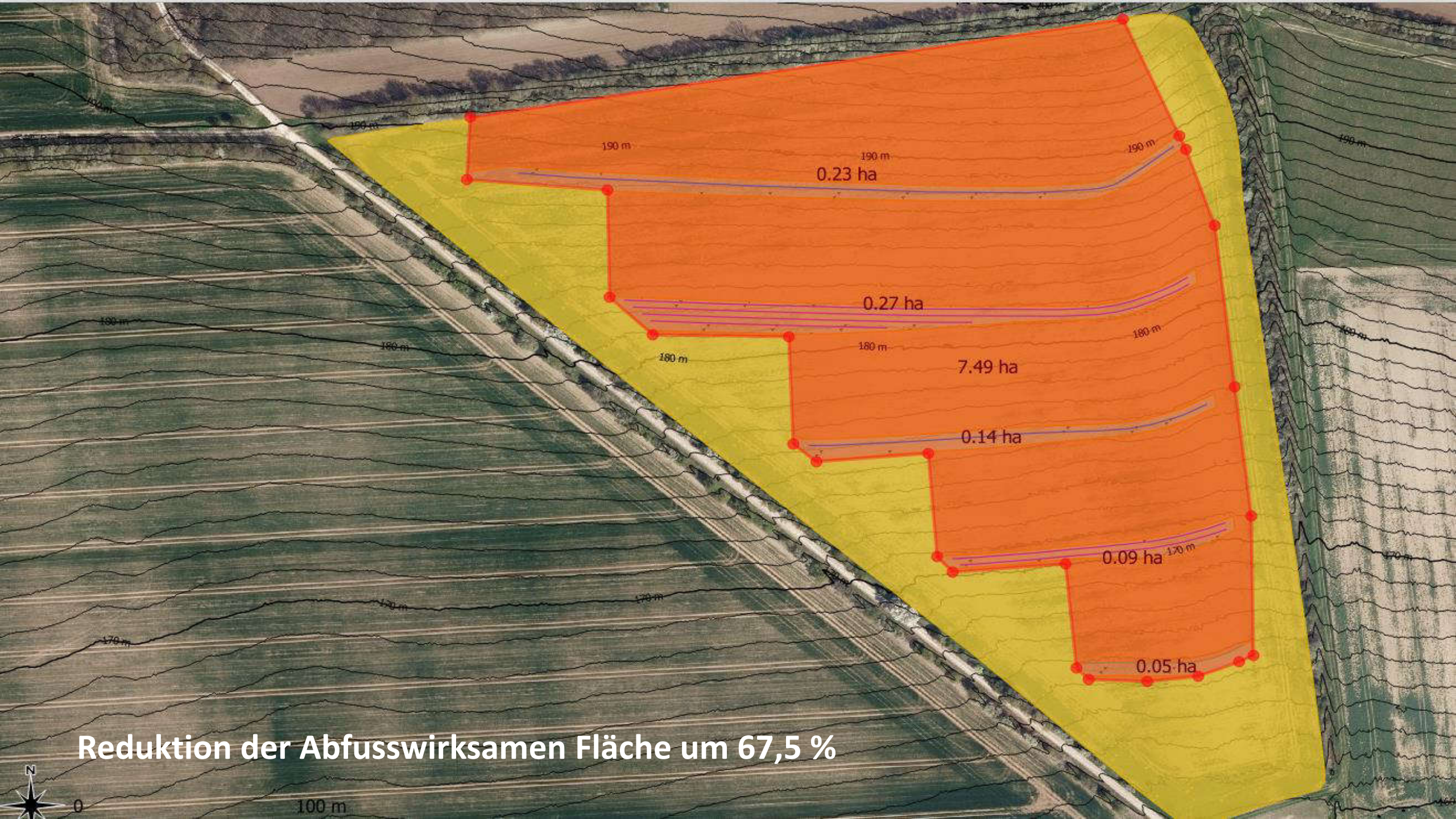


Zimmermann 2023

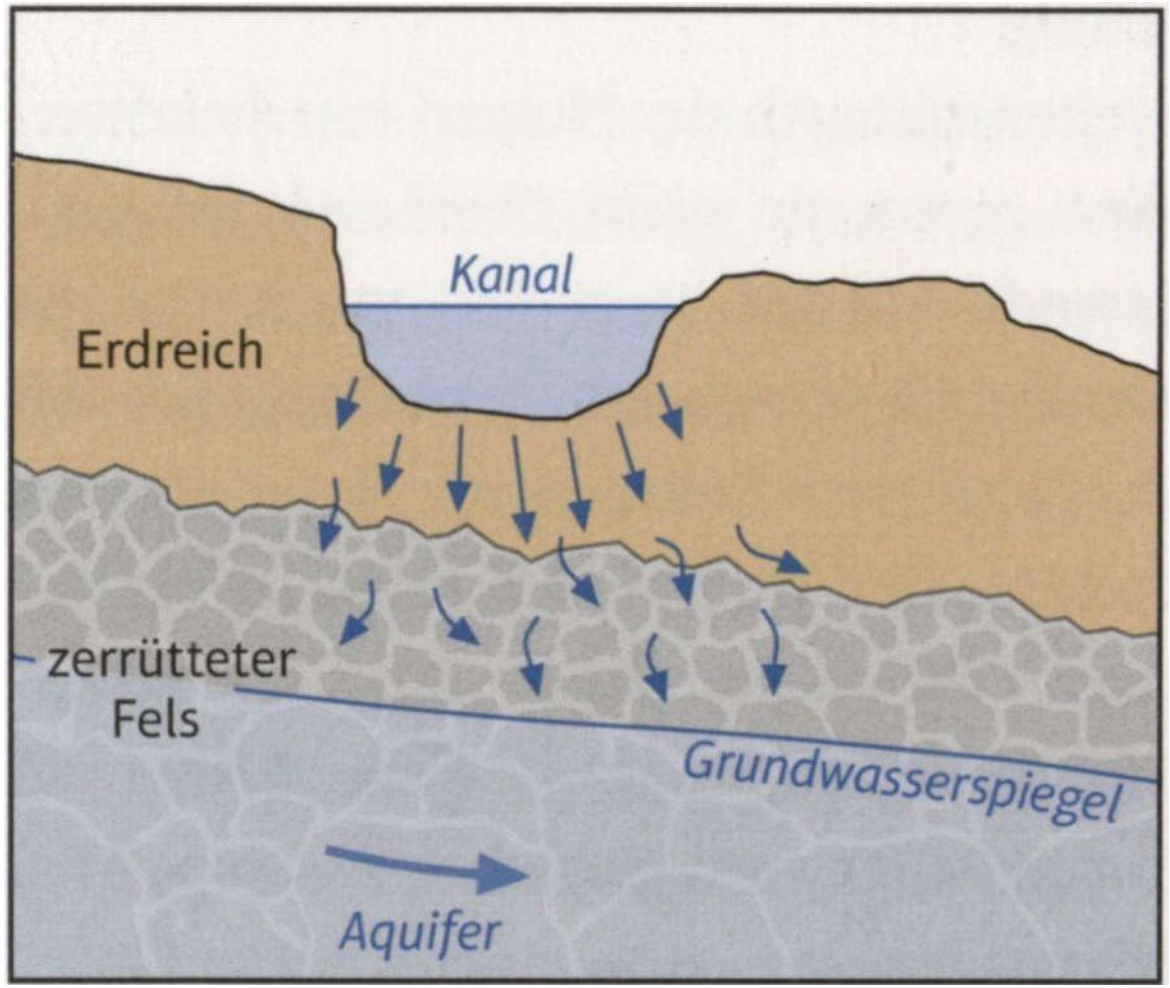

ET
overland flow
toward ridge
A
pasture
tree belt
fence
contour
5% gradient
B
backwater
litter
infiltration
seepage
organic matter
sub-surface flow
B horizon
C horizon
rock/hardpan
A
B

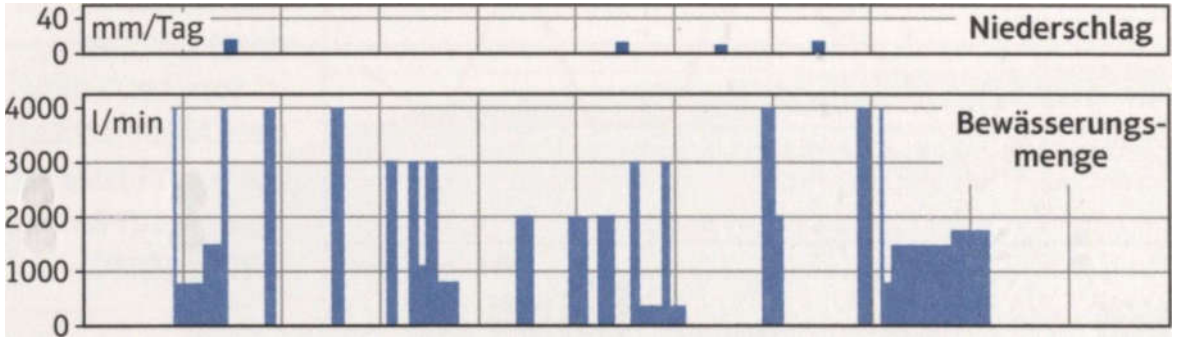

0.23
0.27
7.49
0.14
0.09
0.05

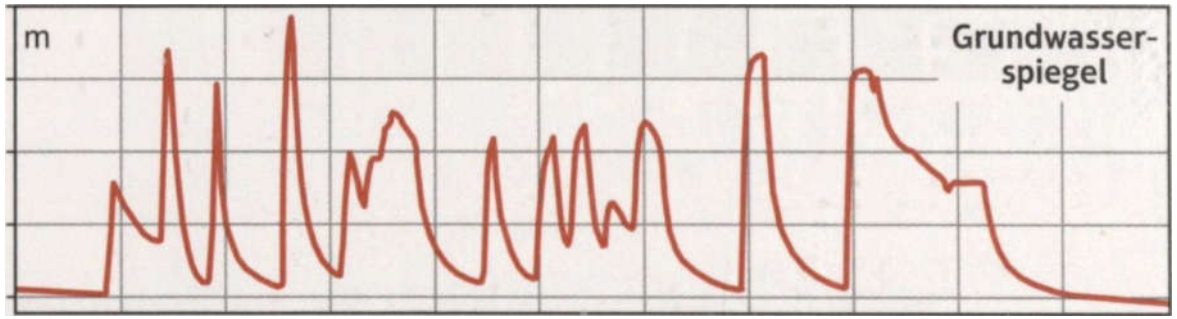


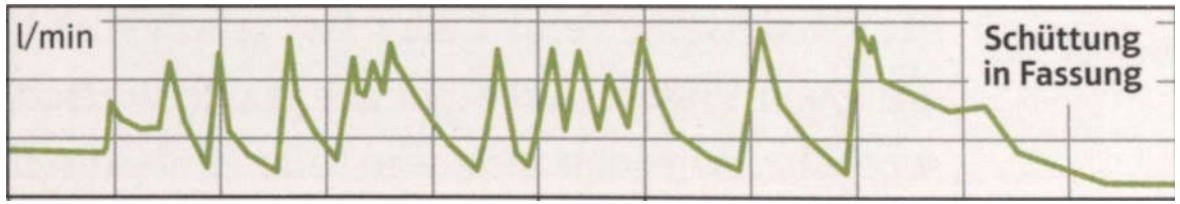


Reduktion der Abfusswirksamen Fläche um 67,5 %


Kanal
Erdreich
zerrütteter
Fels
Grundwasserspiegel
Aquifer

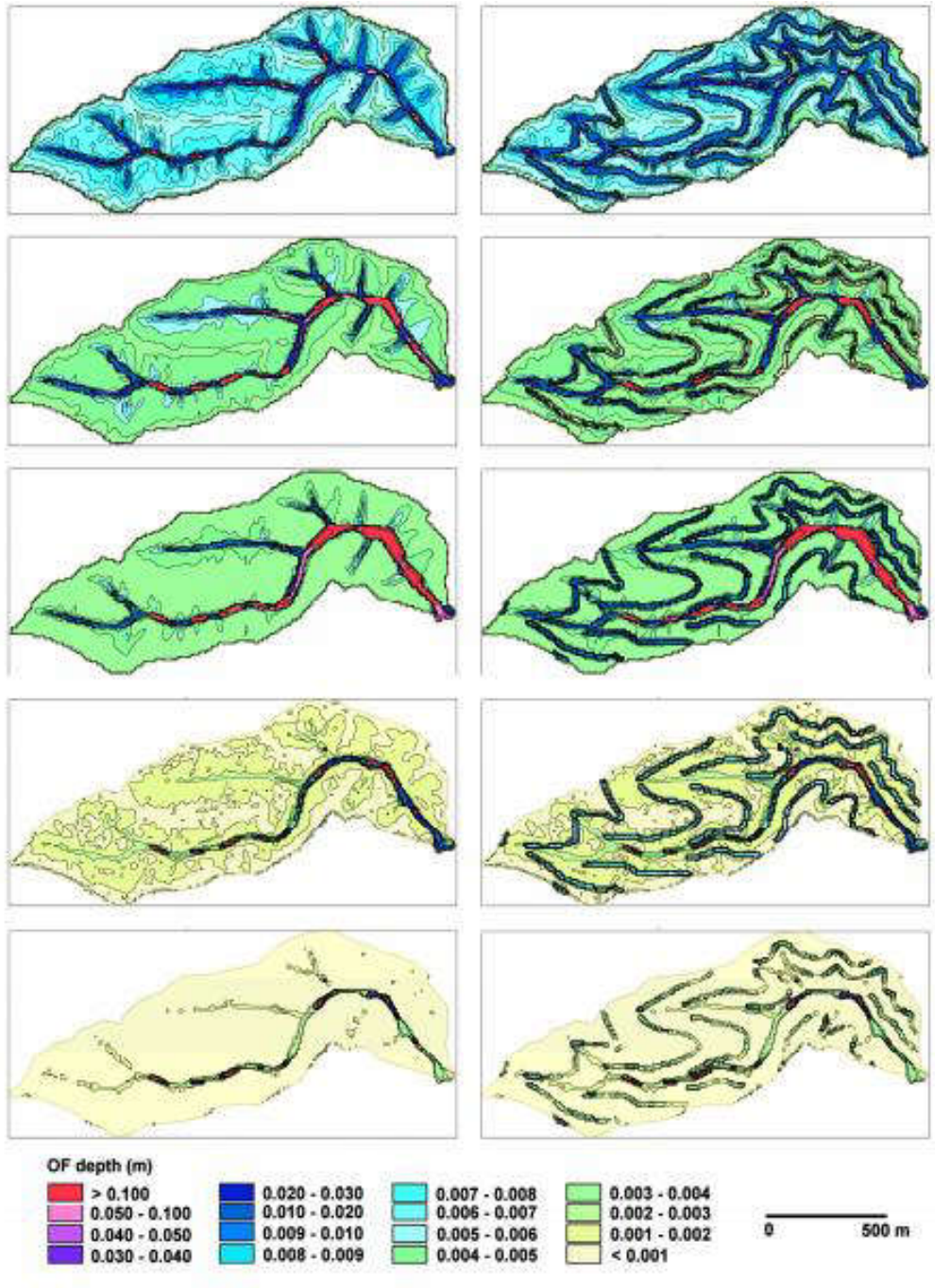

40
0
mm/Tag
Niederschlag
4000
3000
2000
1000
0
l/min
Bewässerungs-
menge


m
Grundwasser-
spiegel


l/min
Schüttung
in Fassung

Keyline Design:

Zusätzlicher Nutzen für den Wasserrückhalt

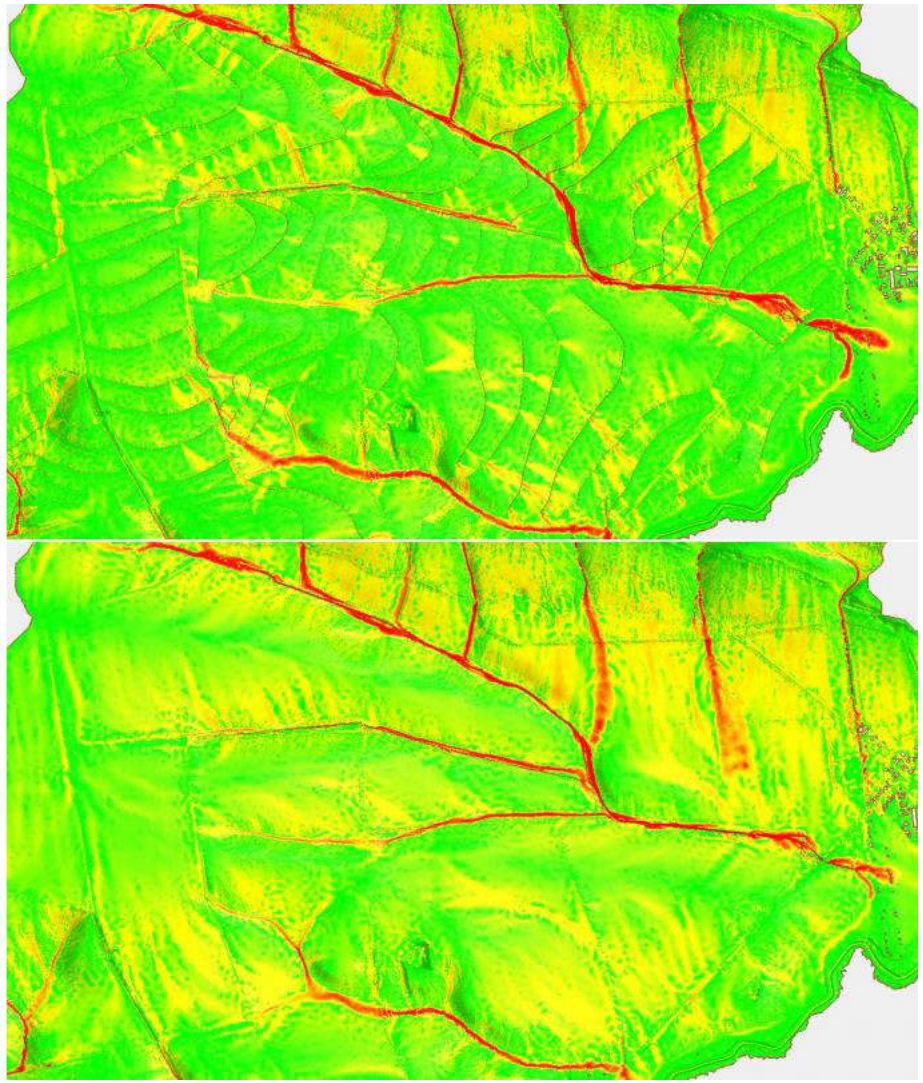


Erste Ergebnisse aus Thüringen:

Wasserrückhalt +13%

Hochwasserspitze -20%

Erosion -60%



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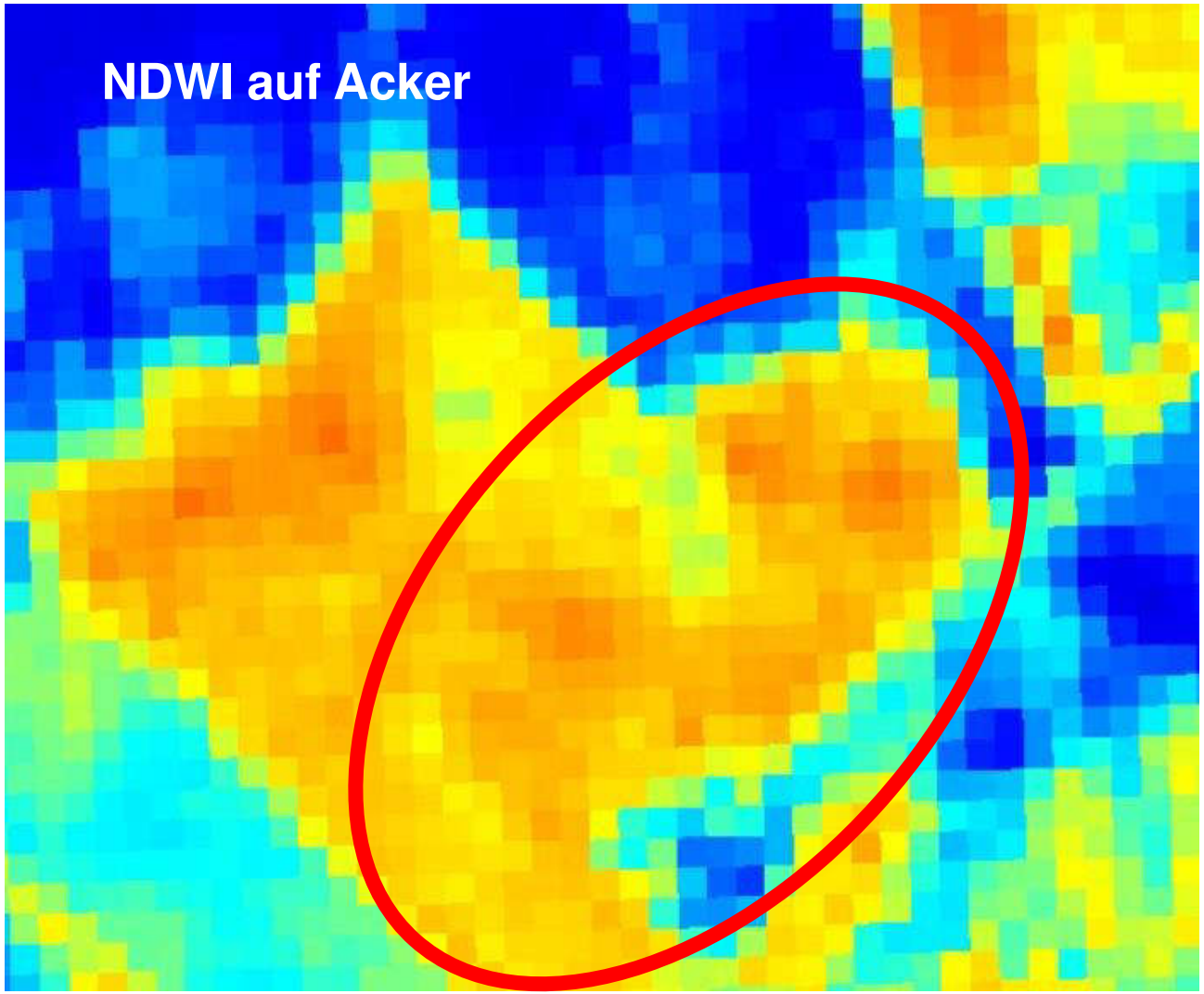
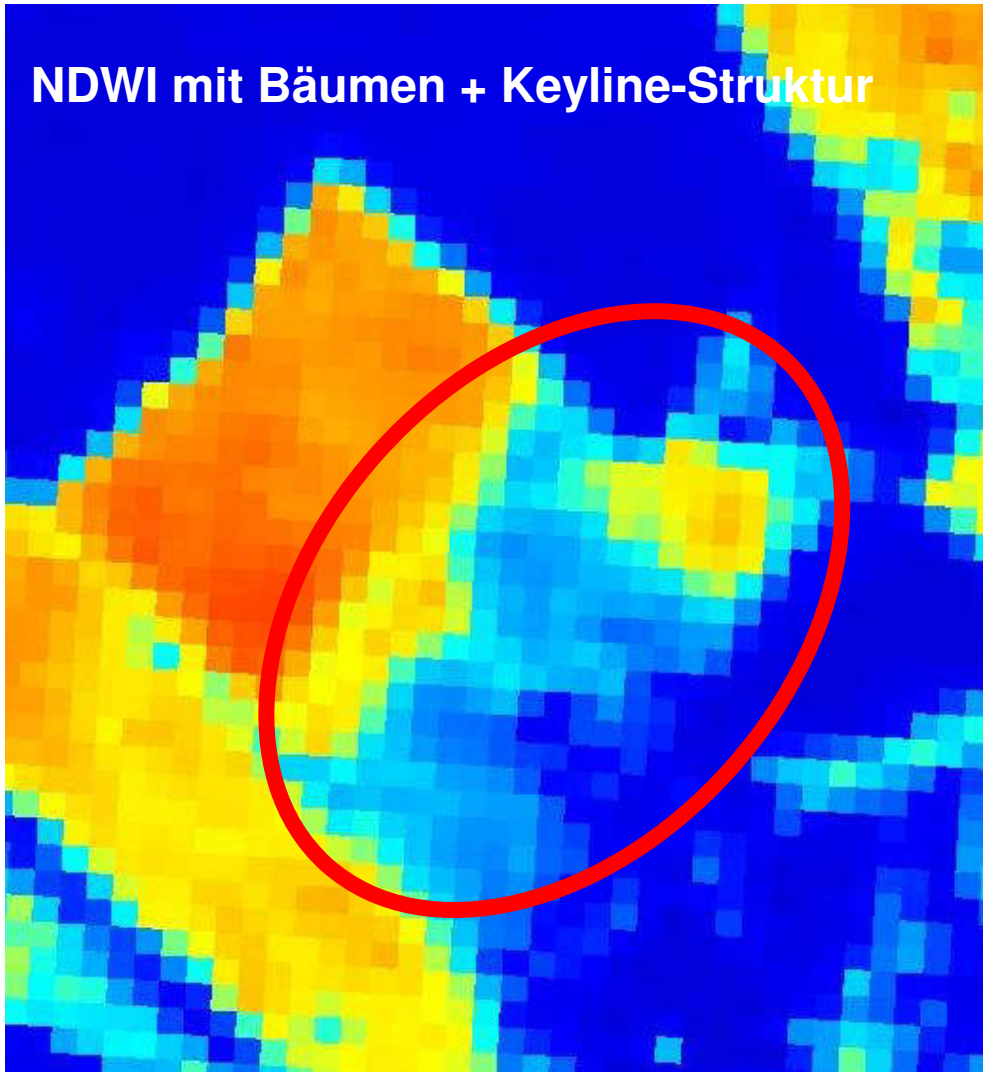

NDWI auf Acker


NDWI mit Bäumen + Keyline-Struktur

1.800.000 Hektar Agroforst bis 2030!?

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Aufbäumen statt aufforsten!

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1: Intergovernmental Panel on Climate Change, 2018. Global warming of 1.5°C. (SR 1.5)

2: Deutsches Klimarechenzentrum: Globale Mitteltemperatur, geändert Lizenz: CC BY-NC-ND 4.0

3: DWD (2017): Nationaler Klimareport. Dritte korrigierte Auflage.

4: EASAC (2018): Policy Report 35. Negative emission technologies: What role in meeting Paris Agreement targets?

5: Rogelj, J., Popp, A., Calvin, K. V., Luderer, G., Emmerling, J., Gernaat, D., … Tavoni, M. (2018). Scenarios towards limiting global mean temperature increase below 1.5 °C. Nature Climate Change, 8(4), 325–332. doi:10.1038/s41558-018-0091-3

6: Bastin, J.-F., Fet al. 2019. The global tree restoration potential. Science 365, 76–79. https://doi.org/10.1126/science.aax0848

7: Zomer 2016: Global Tree Cover and Biomass Carbon on Agricultural Land: The contribution of agroforestry to global and national carbon budgets.

8: Schwarzer, S., 2019. The potental of carbon sequestraton in the soil (No. 013), Foresight Brief - Early Warning, Emerging Issues and Futures. UN Environment Science Division, Geneva, Switzerland.

9: Ryan, J., Mcalpine, C., Ludwig, J., 2010. Integrated vegetation designs for enhancing water retention and recycling in agroecosystems. Landsc. Ecol. 25. https://doi.org/10.1007/s10980-010-9509-7

10: Ryan, J., McAlpine, C., Ludwig, J., Callow, J., 2015. Modelling the Potential of Integrated Vegetation Bands (IVB) to Retain Stormwater Runoff on Steep Hillslopes of Southeast Queensland, Australia. Land 4, 711–736. https://doi.org/10.3390/land4030711

11: Fischer, H.S., Michler, B., Fischer, A., n.d. Die zukünftige pnV Bayerns. LWF Aktuell 2018, 46–49.

12: Kumar 2009: Agroforestry and grass buffers for improving soil hydraulic properties and reducing runoff and sediment losses from grazed pastures.

13: Seserman et al. 2018. Benefits of Agroforestry Systems for Land Equivalent Ratio – Case Studies in Brandenburg and Lower Saxony, Germany.

14: Rogelj et al. 2018: Scenarios towards limiting global mean temperature increase below 1.5 °C.

15: Udawatta et al. 2002: Agroforestry Practices, Runoff, and Nutrient Loss: A Paired Watershed Comparison.

16: Anderson et al. 2008: Soil water content and infiltration in agroforestry buffer strips.

17: BfN 2011: Leitfaden Agroforstsysteme.

18: Kanzler et al. 2019: Microclimate Effects on Evaporation and Winter Wheat (Triticum Aestivum L.) Yield within a Temperate Agroforestry System. Agroforestry Systems volume 93, pages 1821–1841.

19: Ellison et al. 2017: Trees, forests and water: Cool insights for a hot world. Global environmental change 43 (2017): 51-61.

20: Toelle et al. 2014: Increasing bioenergy production on arable land: Does the regional and local climate respond? Germany as a case study. Journal of Geophysical Research: Atmospheres.

21: Schwarzer, S., 2021. Working with plants, soils and water to cool the climate and rehydrate Earths landscapes (No. 025), Foresight Brief - Early Warning, Emerging Issues and Futures. UN Environment Science Division, Geneva, Switzerland.

22: Hildmann et al. 2022: Maßnahmen zur Klimaanpassung über Wasserrückhalt und Kühlung durch Verdunstung für eine dürregefährdete Region in Ostdeutschland. https://zenodo.org/records/6866030

23: Tsonkova, P.; Böhm, C. 2020: CO2-Bindung durch Agroforst-Gehölze als Beitrag zum Klimaschutz. Innovationsgruppe Aufwerten, Brandenburgische Technische Universität, Cottbus.

24: Zimmermann, Beate 2023: Vortrag beim Fachsymposium Wassermanagement in der Landwirtschaft, online 10.10.2023. Forschungsinstitut für Bergbaufolgelandschaften, Finsterwalde.