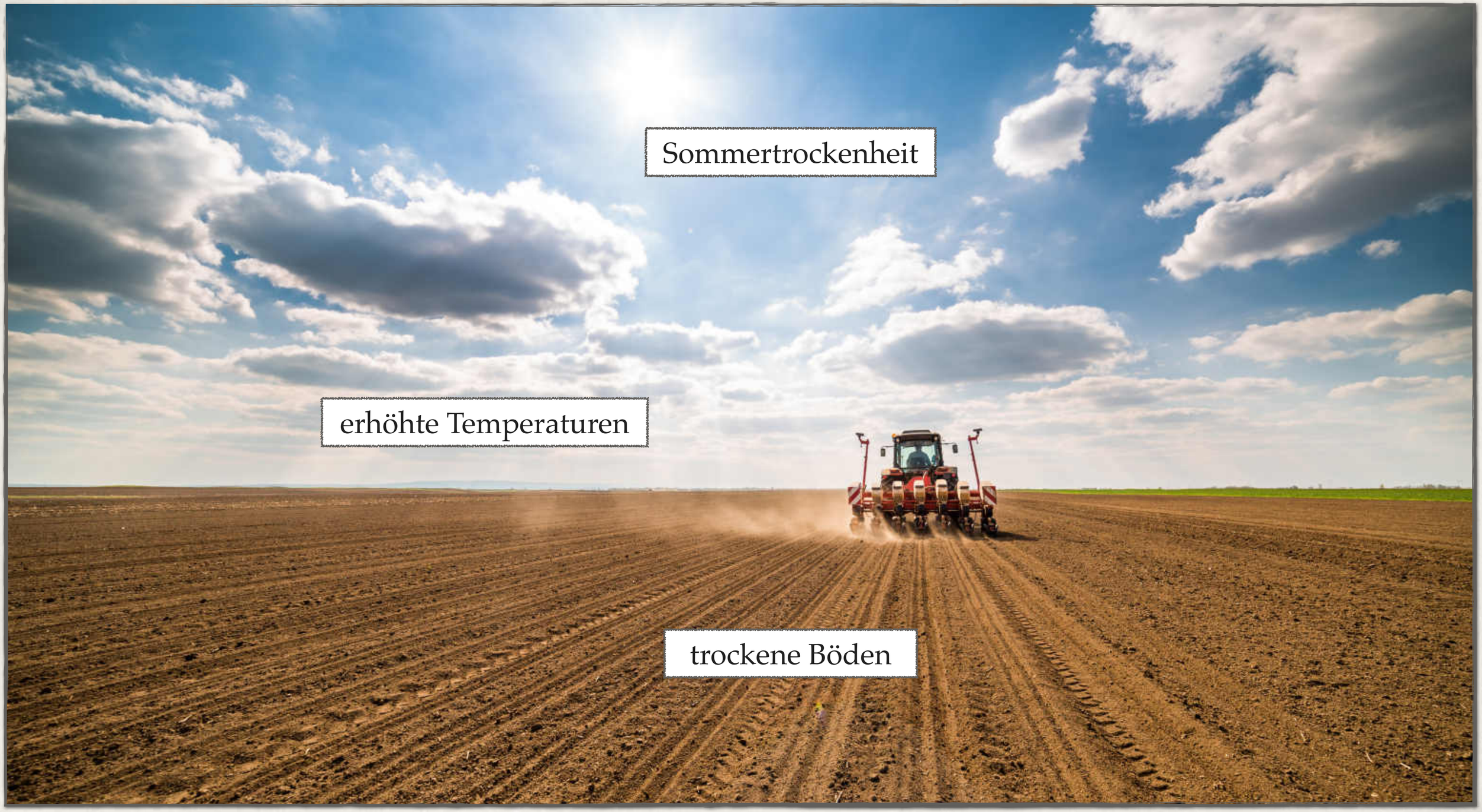
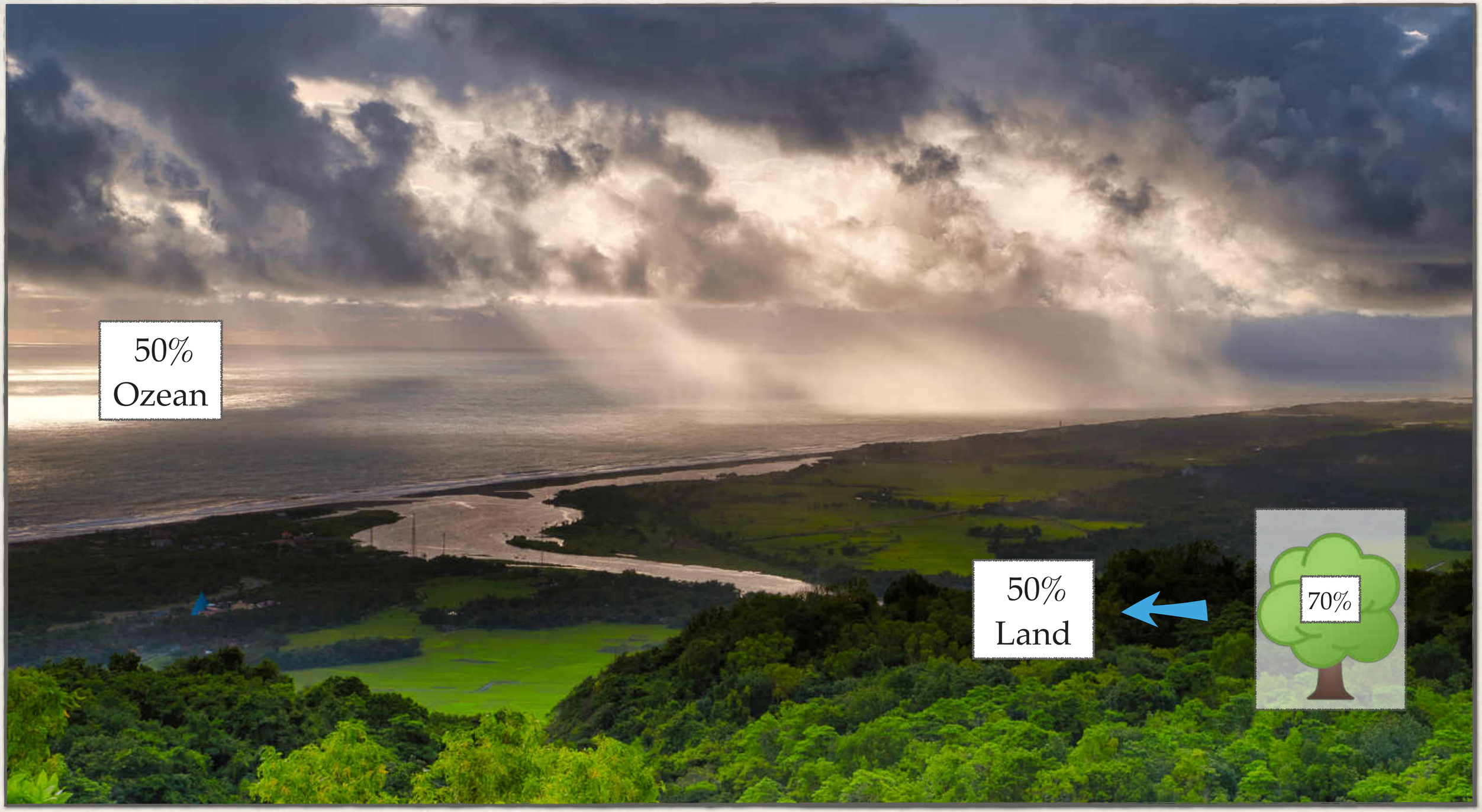
Klimalandschaften

Mit Vegetation die kleinen Wasserkreisläufe stärken und das Klima kühlen

Stefan Schwarzer • Aufbauende Landwirtschaft e.V. • www.aufbauende-landwirtschaft.de


Sommertrockenheit
erhöhte Temperaturen
trockene Böden



Ellison, D., Wang-Erlandsson, L., van der Ent, R. & van Noordwijk, M. Upwind forests: managing moisture recycling for for nature-based resilience

Schlesinger, W. H. & Jasechko, S. Transpiration in the global water cycle.

Pflanzen als Regenmacher

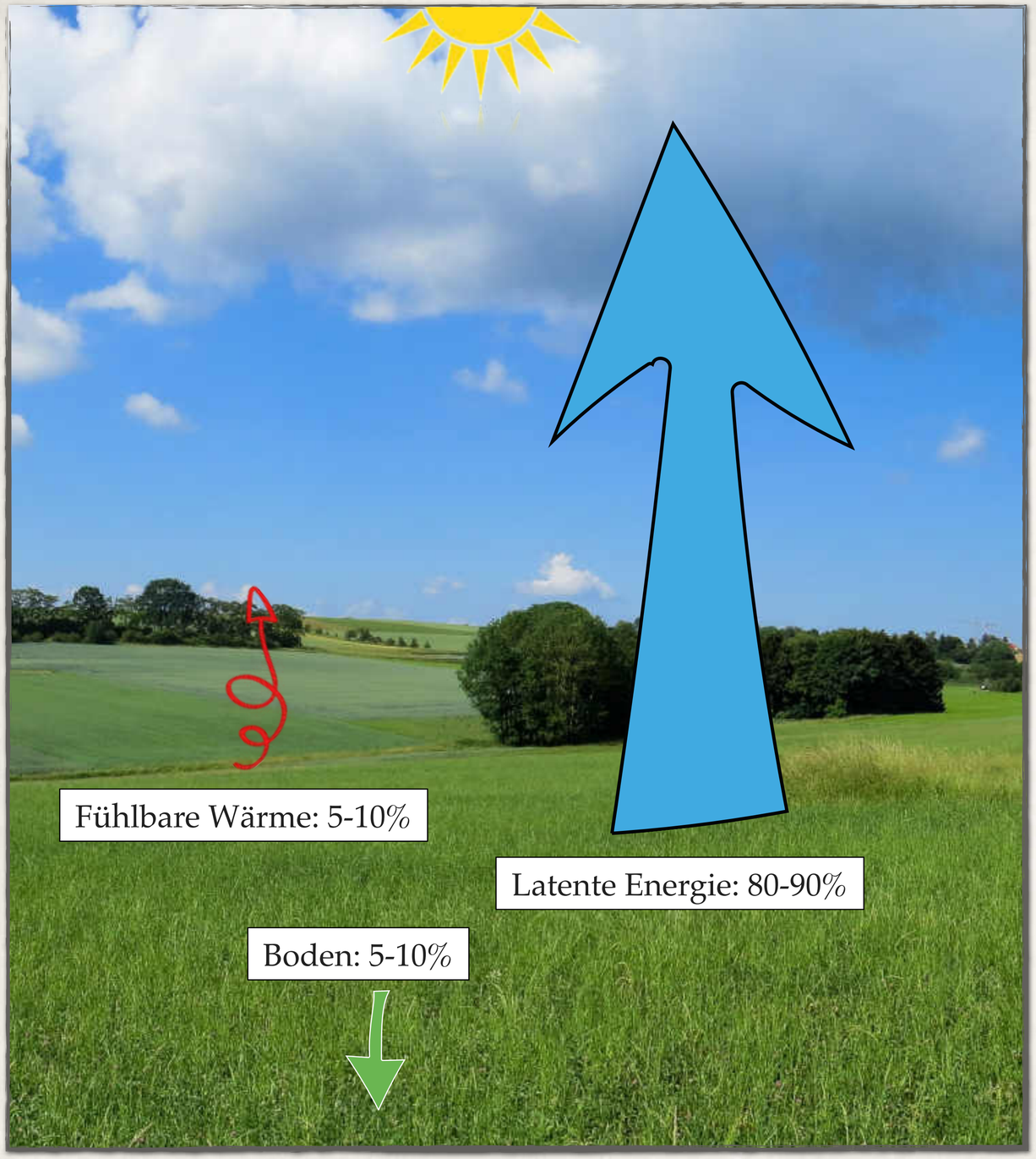
Pflanzen zur Klimakühlung

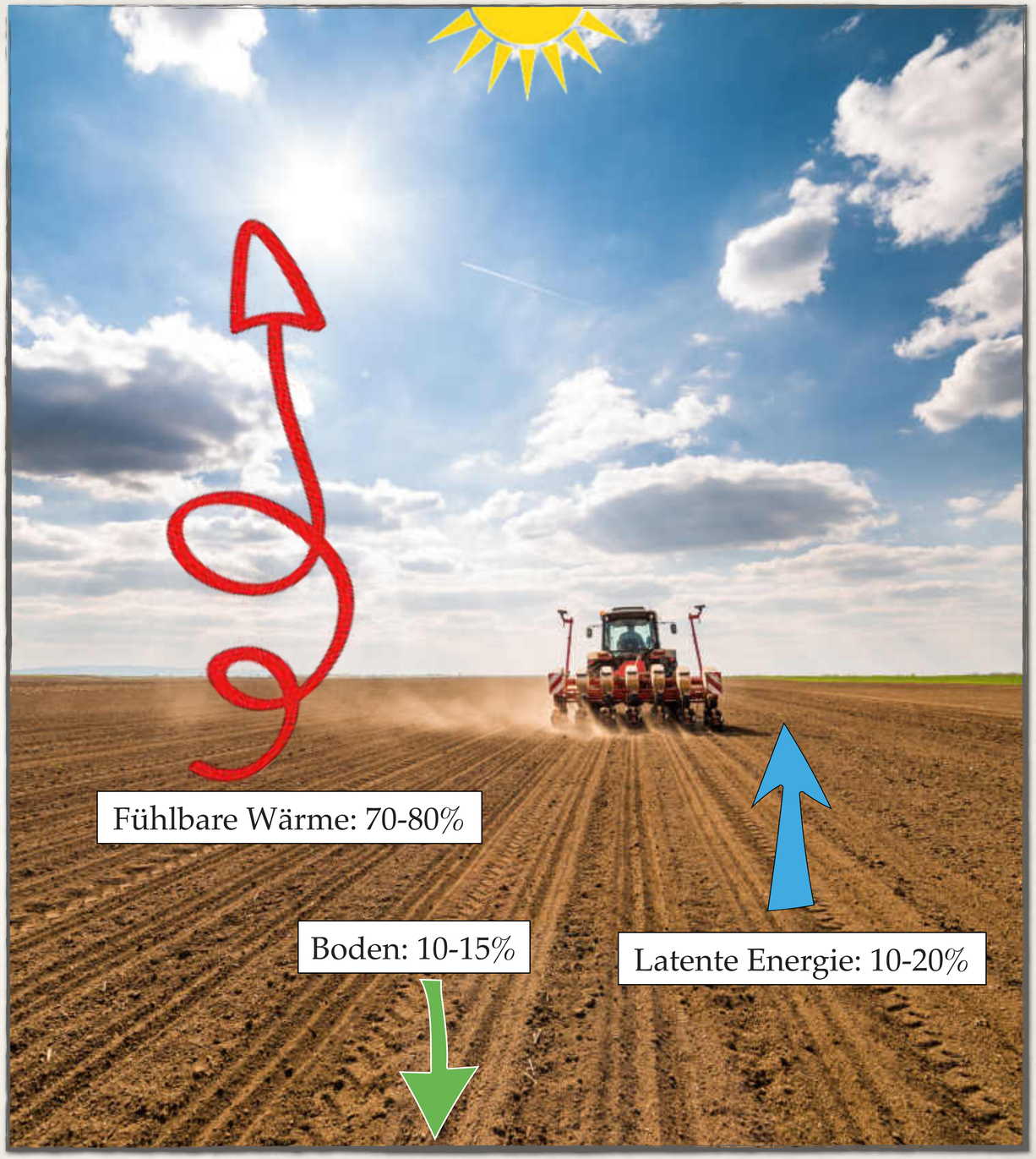
Wasserrückhalt in der Land(wirt)schaft

200 Liter Wasser / Tag

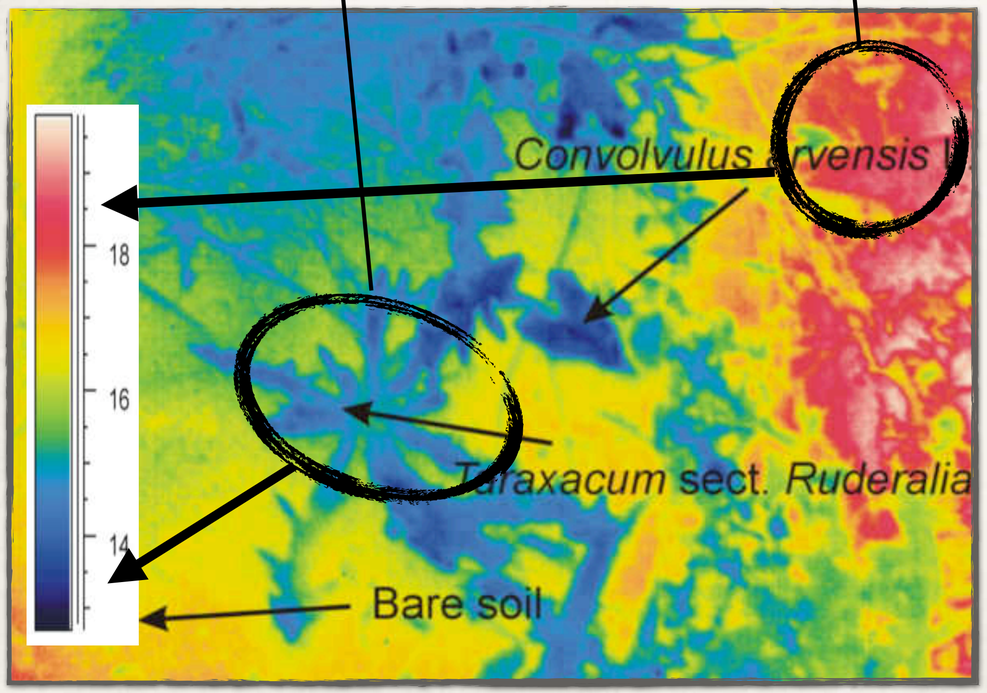
5 Klimaanlagen

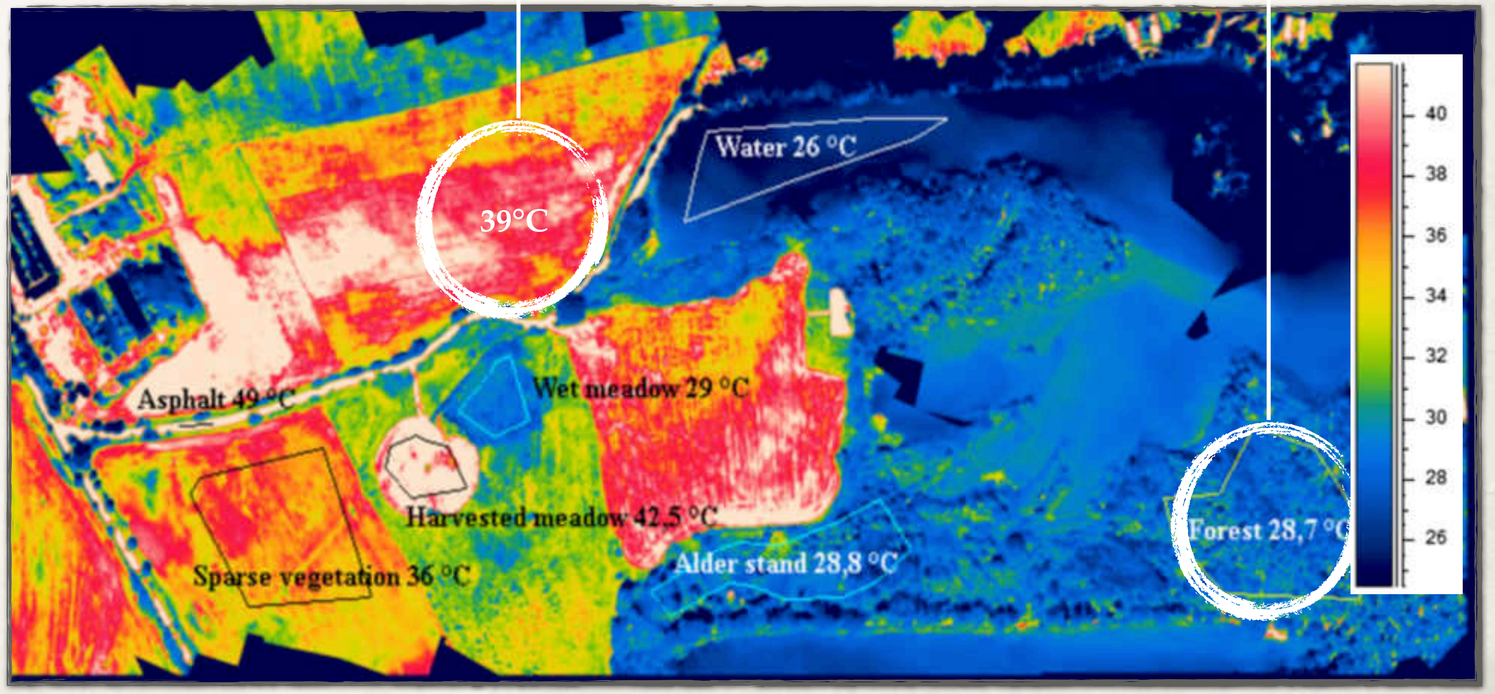
Pokorny, J., 2019. Evapotranspiration, in: Encyclopedia of Ecology. Elsevier, pp. 292–303





Pokorny, J., 2019. Evapotranspiration, in: Encyclopedia of Ecology. Elsevier, pp. 292–303

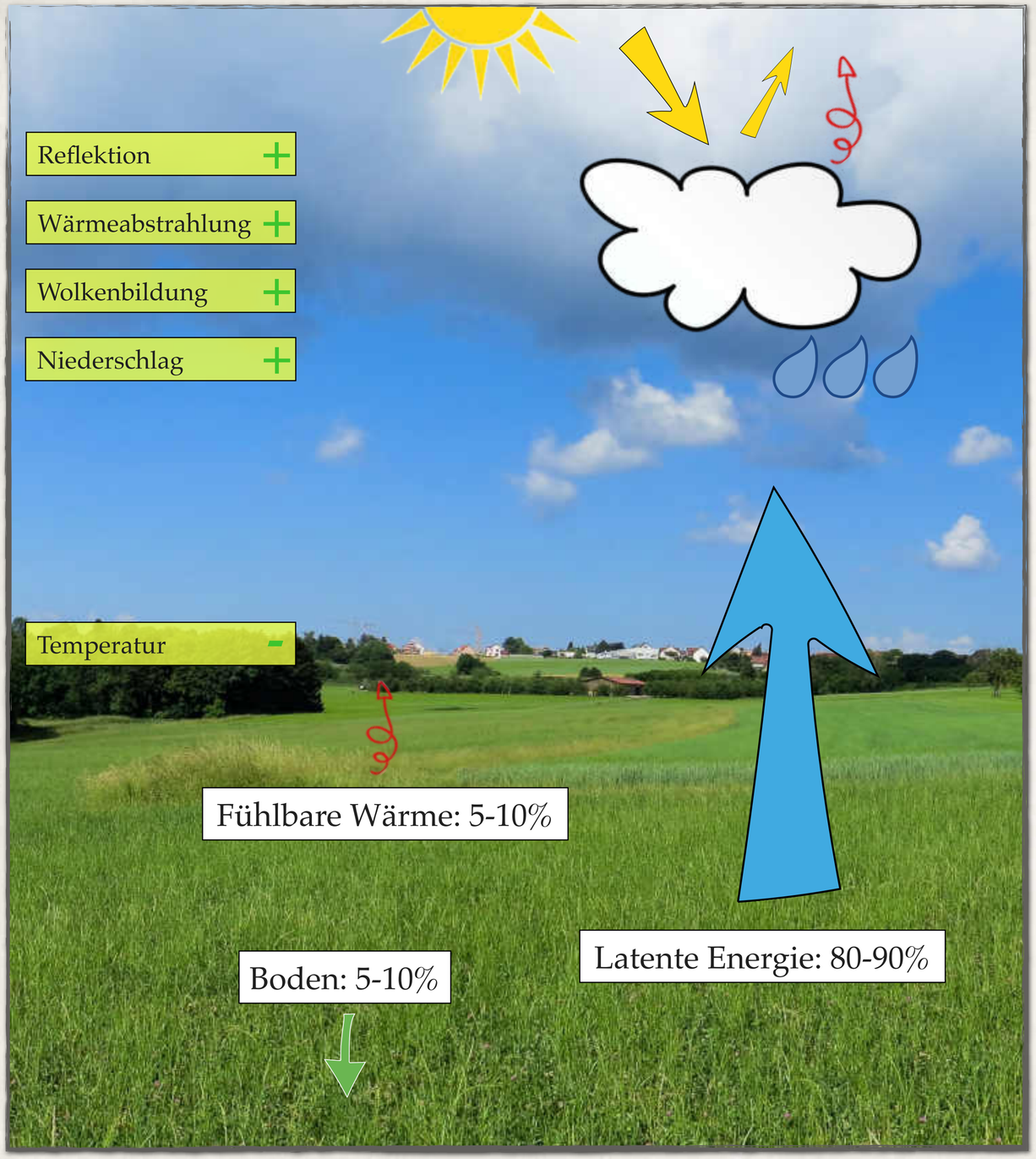


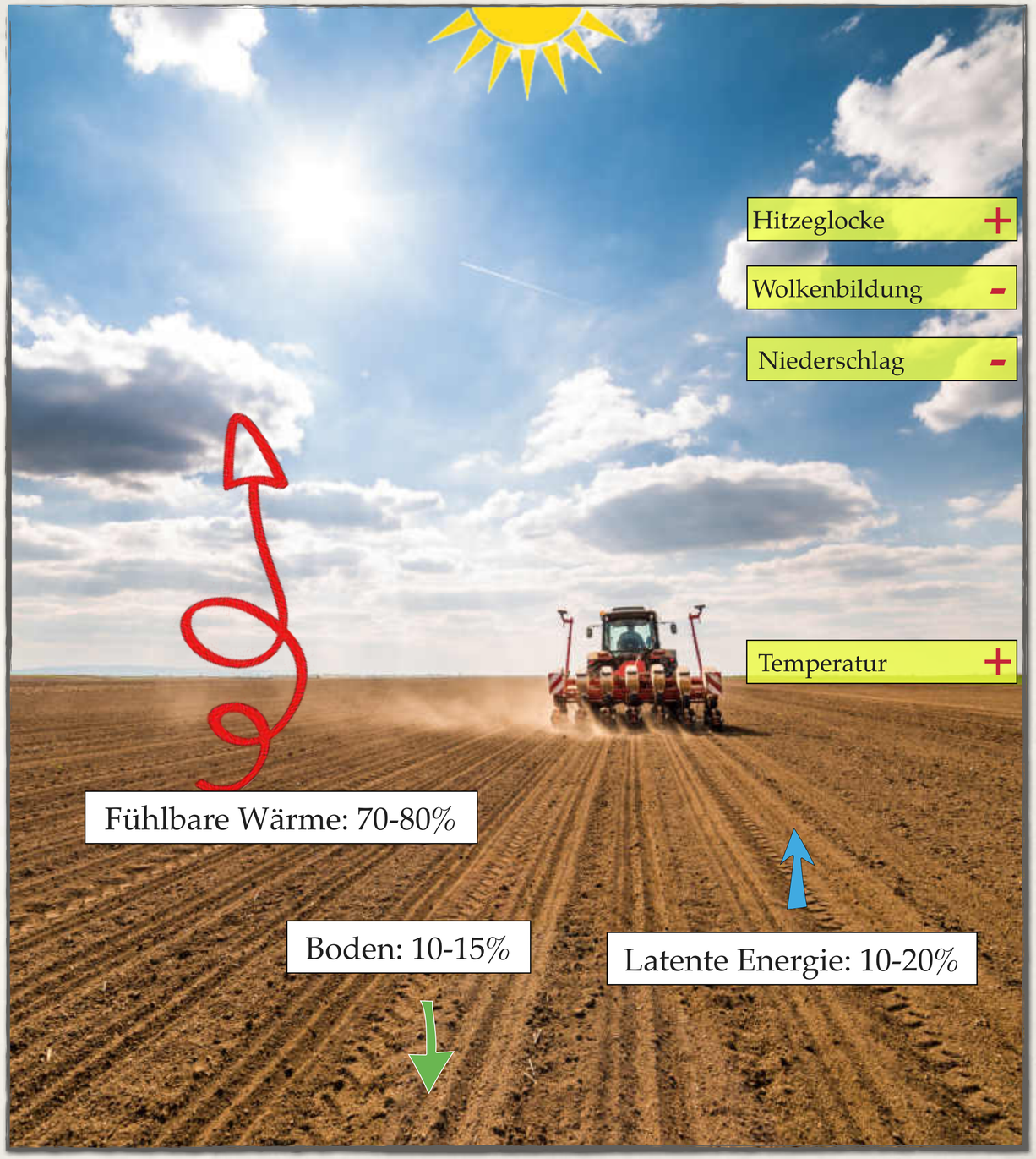


Kravčík, M., Pokorný, J., Kohutiar, J., Kováč, M., Tóth, E., 2007. Water for the Recovery of the Climate - A New Water Paradigm

Pokorny, J., 2019. Evapotranspiration, in: Encyclopedia of Ecology. Elsevier, pp. 292–303.

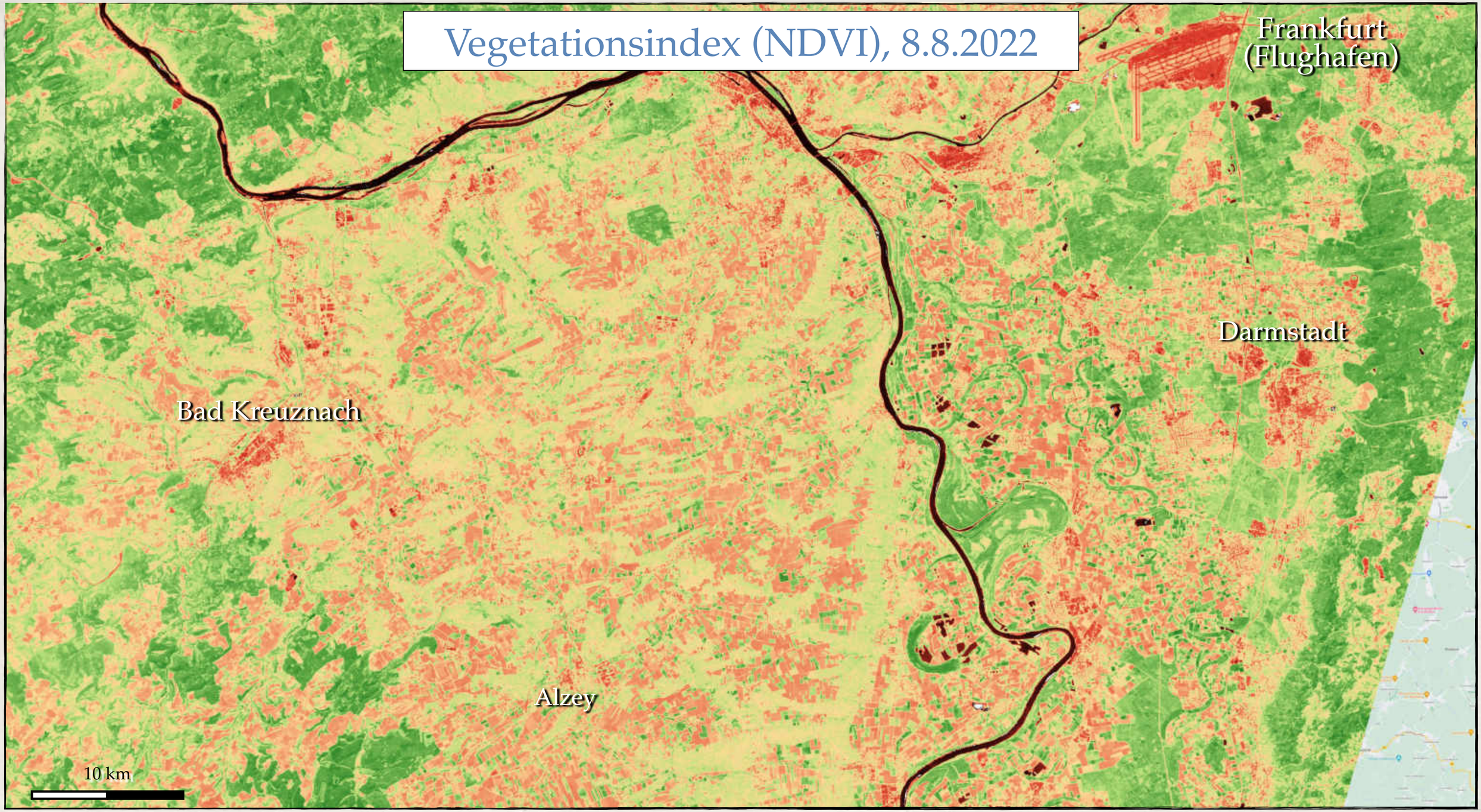
01.08.2022, Lufttemperatur: 37°C





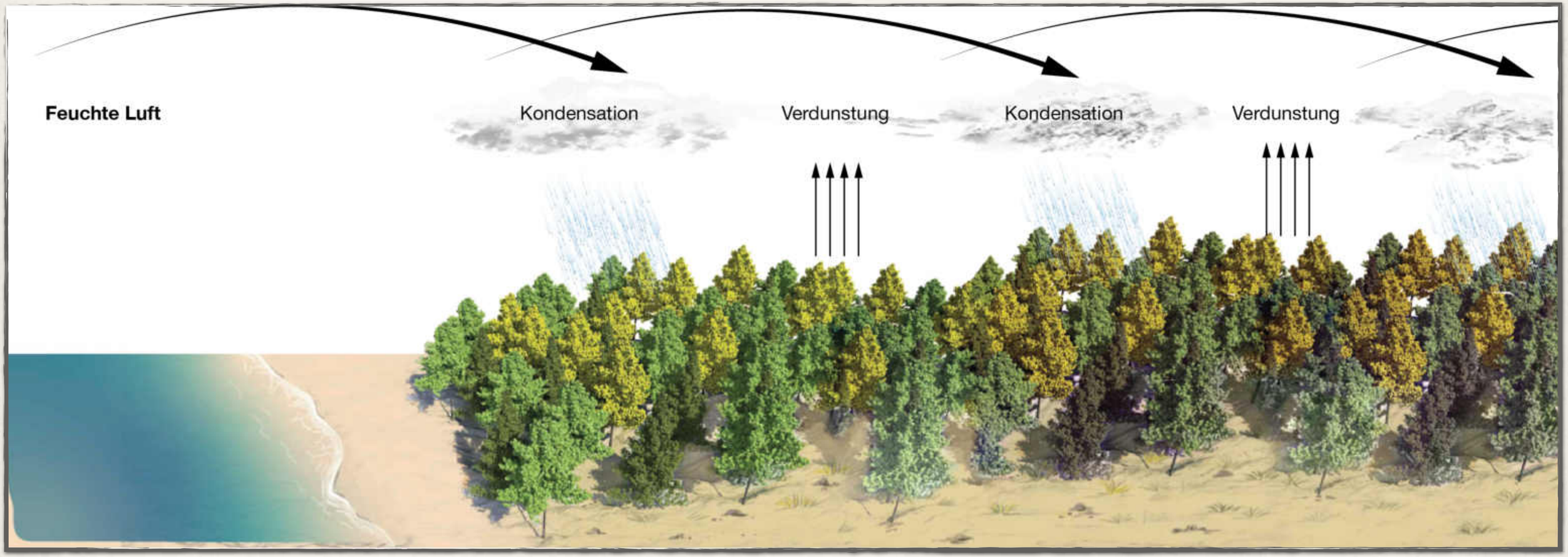
Pokorny, J., 2019. Evapotranspiration, in: Encyclopedia of Ecology. Elsevier, pp. 292–303

Vegetationsindex (NDVI), 8.8.2022



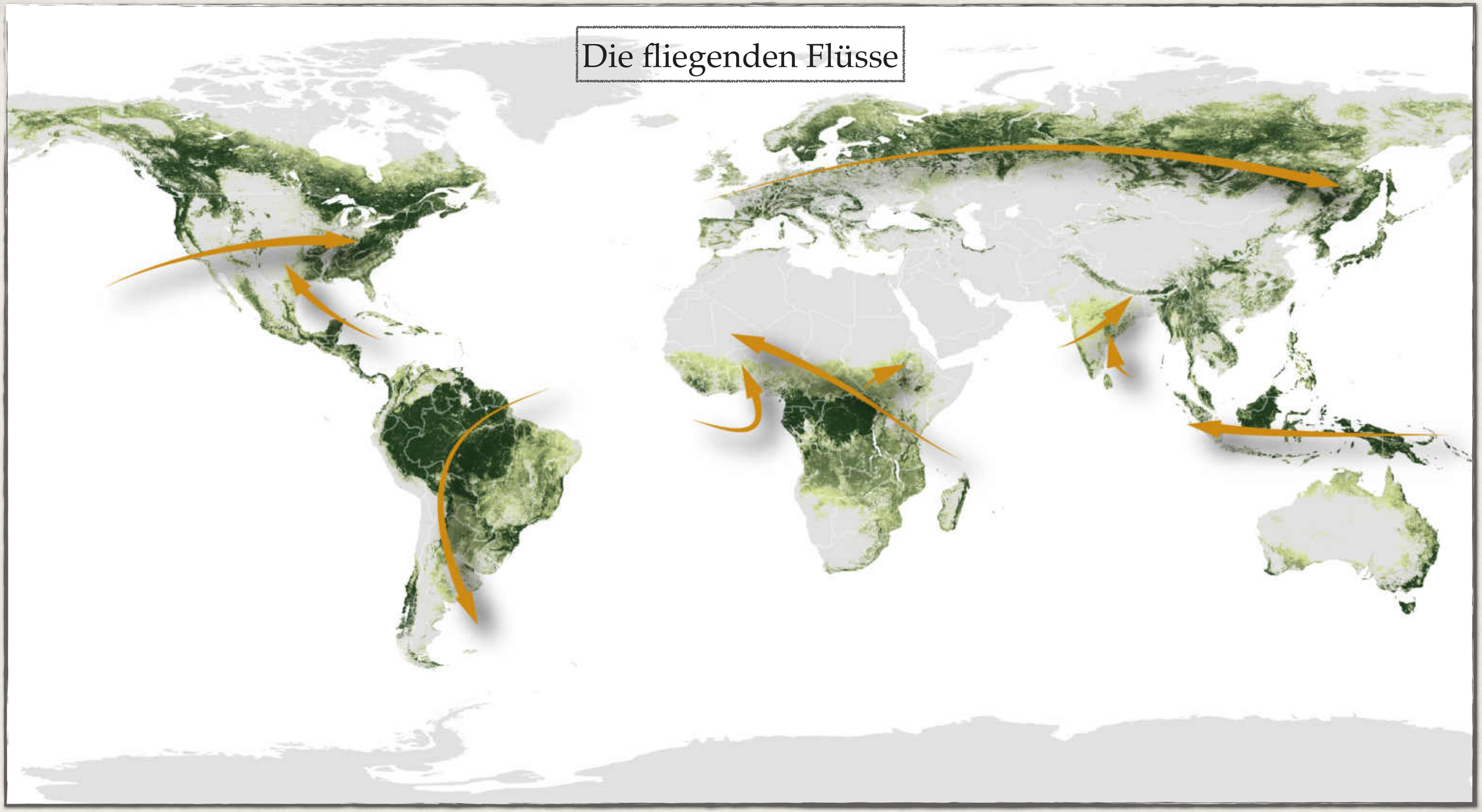
Lyons, T. J. Clouds prefer native vegetation. *Meteorology and Atmospheric Physics* **80**, 131–140 (2002).

Der kleine Wasserkreislauf



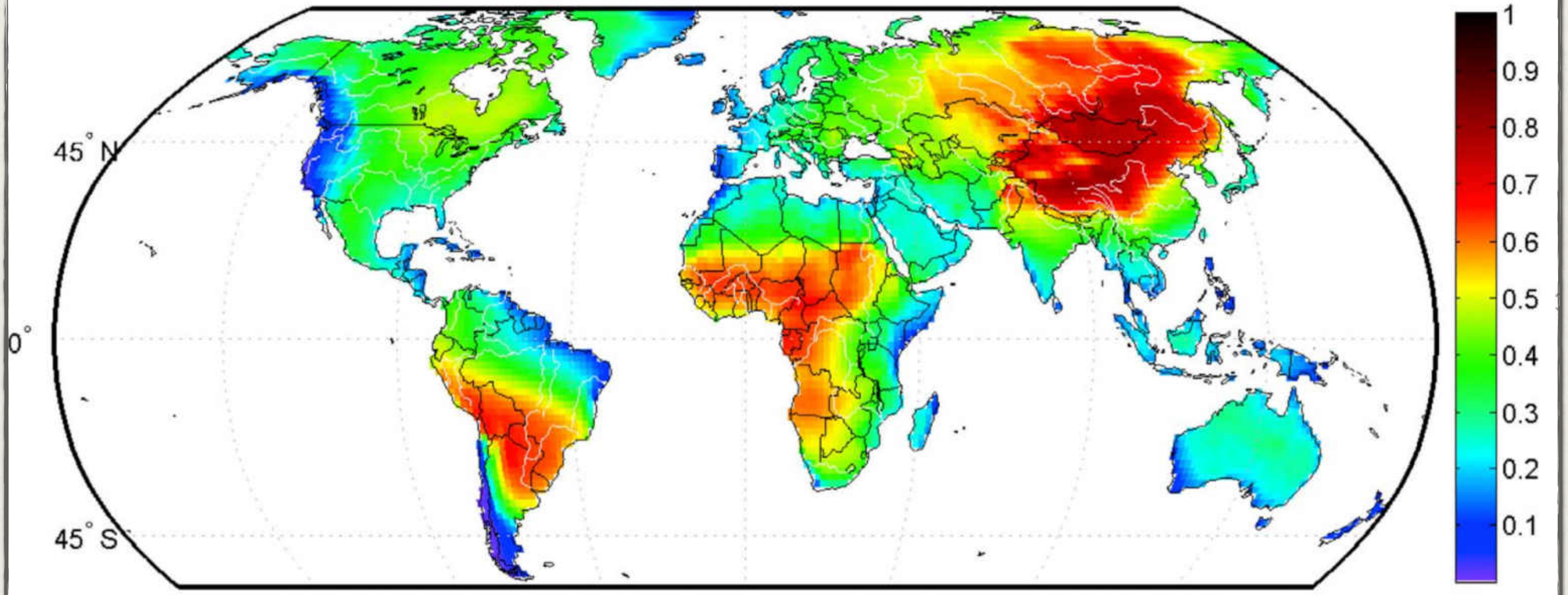
Graphic: https://www.sciencemag.org/news/2020/06/controversial-russian-theory-claims-forests-don-t-just-make-rain-they-make-wind

Die fliegenden Flüsse



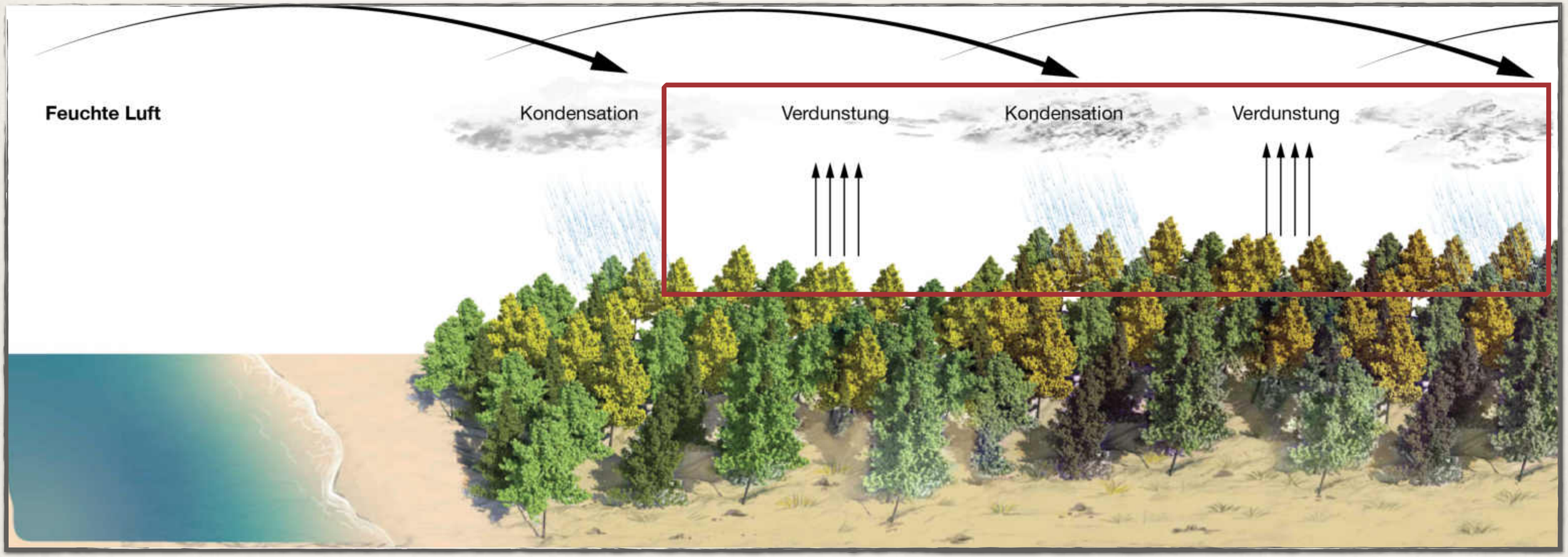
van der Ent, R. J., Savenije, H. H. G., Schaefli, B. & Steele-Dunne, S. C. Origin and fate of atmospheric moisture over continents. *Water Resources Research* **46**, (2010).

Niederschlags-Recycling-Verhältnis

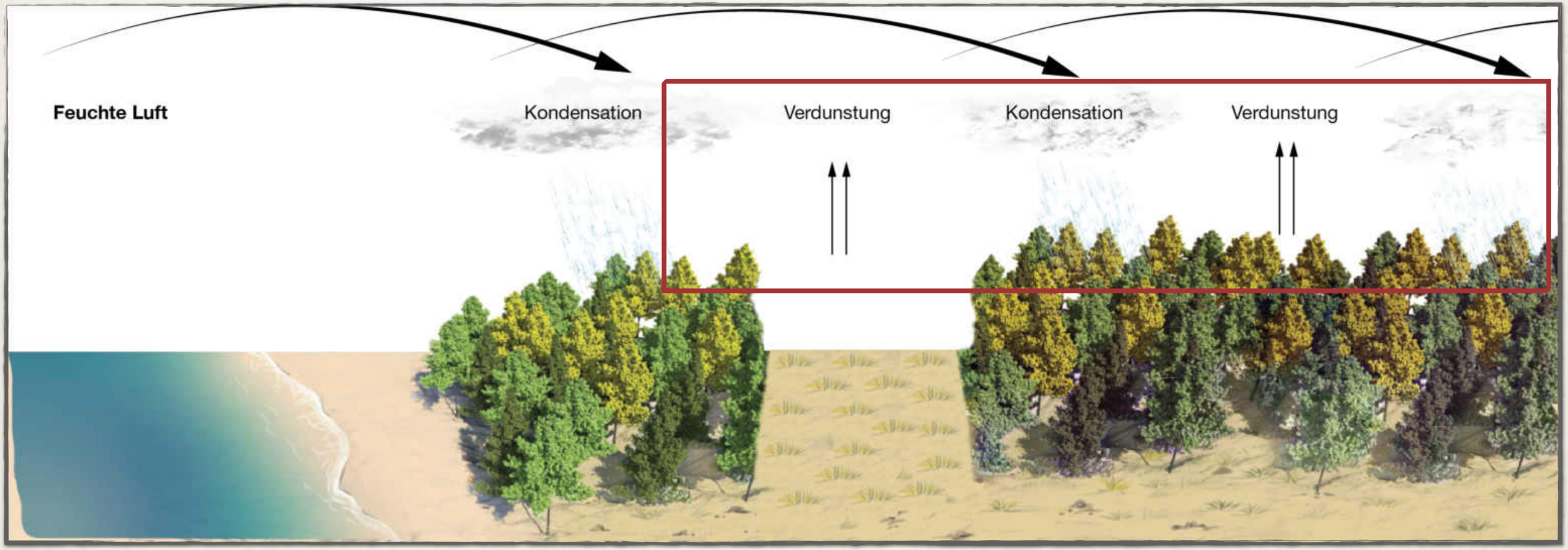


1999-2008

van der Ent, R. J., Savenije, H. H. G., Schaefli, B. & Steele-Dunne, S. C. Origin and fate of atmospheric moisture over continents. *Water Resources Research* **46**, (2010).



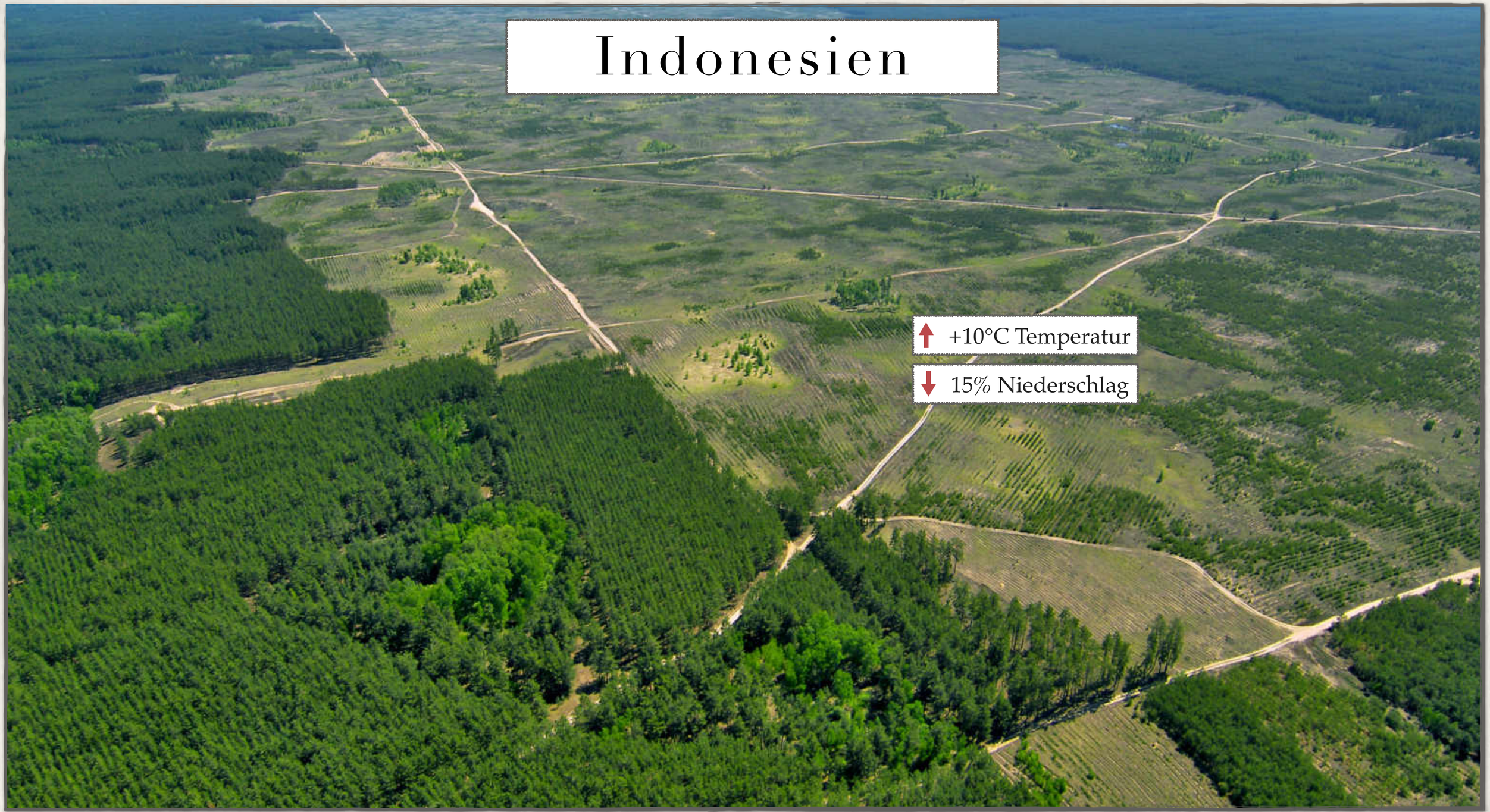
Grafik (adaptiert): https://www.sciencemag.org/news/2020/06/controversial-russian-theory-claims-forests-don-t-just-make-rain-they-make-wind



Grafik (adaptiert): https://www.sciencemag.org/news/2020/06/controversial-russian-theory-claims-forests-don-t-just-make-rain-they-make-wind

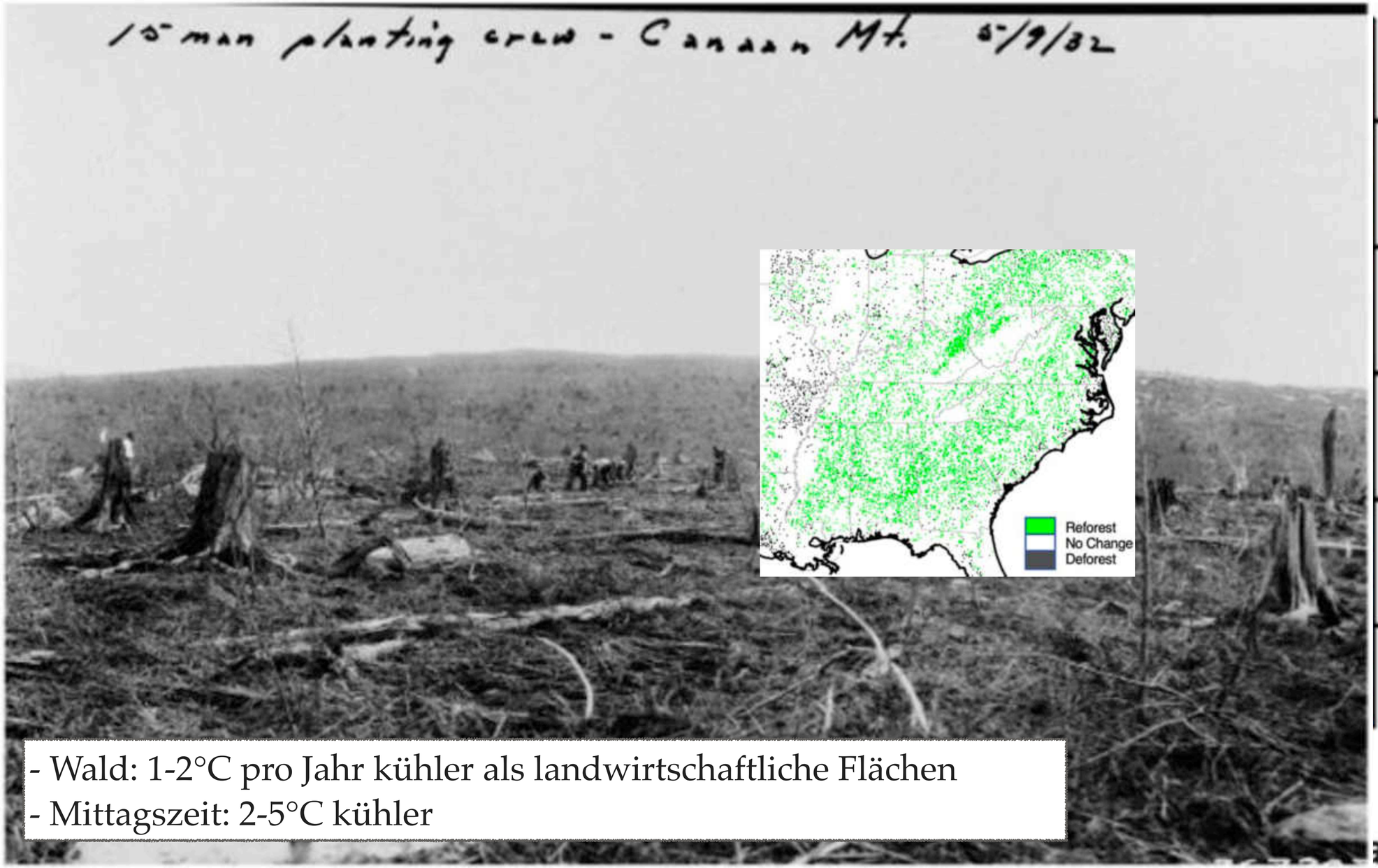
Trockenheit in Ostdeutschland:
50% Klimawandel
50% falsche Landnutzungsmaßnahmen
Prof. Dr. Dietrich Borchardt, UFZ, Dürre-Monitor

Indonesien



Sabajo, C. R. *et al.* Expansion of oil palm and other cash crops causes an increase of the land surface temperature in the Jambi province in Indonesia. *Biogeosciences* **14**, 4619–4635 (2017)
McAlpine, Clive A et al. 2018. “Forest Loss and Borneo’s Climate.” Environmental Research Letters 13(4): 044009.

50°N
45°N
40°N
35°N
30°N
25°N



1.0
0.5
0.0
-0.5
-1.0

- Wald: 1-2°C pro Jahr kühler als landwirtschaftliche Flächen
- Mittagszeit: 2-5°C kühler

ars)

Barnes ML, Zhang Q, Robeson SM, Young L, Burakowski EA, Oishi AChristopher, Stoy PC, Katul G, Novick KA (2024) A Century of Reforestation Reduced Anthropogenic Warming in the Eastern United States

Journal of Environmental Management 366 (2024) 121595

Contents lists available at ScienceDirect

Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

Research article

Assessing the cooling potential of climate change adaptation measures in rural areas

Beate Zimmermann [a,*], Sarah Kruber [a], Claas Nendel [b,c], Henry Munack [d], Christian Hildmann [a]

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[b] Leibniz Centre for Agricultural Landscape Research (ZALF), Eberswalder Straße 84, Müncheberg, 15374, Brandenburg, Germany
[c] Institute of Biochemistry and Biology, Am Mühlenberg 3, Potsdam, 14476, Brandenburg, Germany
[d] Faculty of Science, Medicine and Health, School of Earth, Atmospheric and Life Sciences, and ARC Centre of Excellence for Australian Biodiversity and Heritage, Northfields Ave Wollongong, Wollongong, 2522, NSW, Australia

ARTICLE INFO

Dataset link: https://earthexplorer.usgs.gov/, https://land.copernicus.eu/en, https://www.dwd.de/EN/

Keywords:
Climate change adaptation
Land surface temperature
Water retention
Evapotranspiration
Cooling effect
Measure evaluation

ABSTRACT

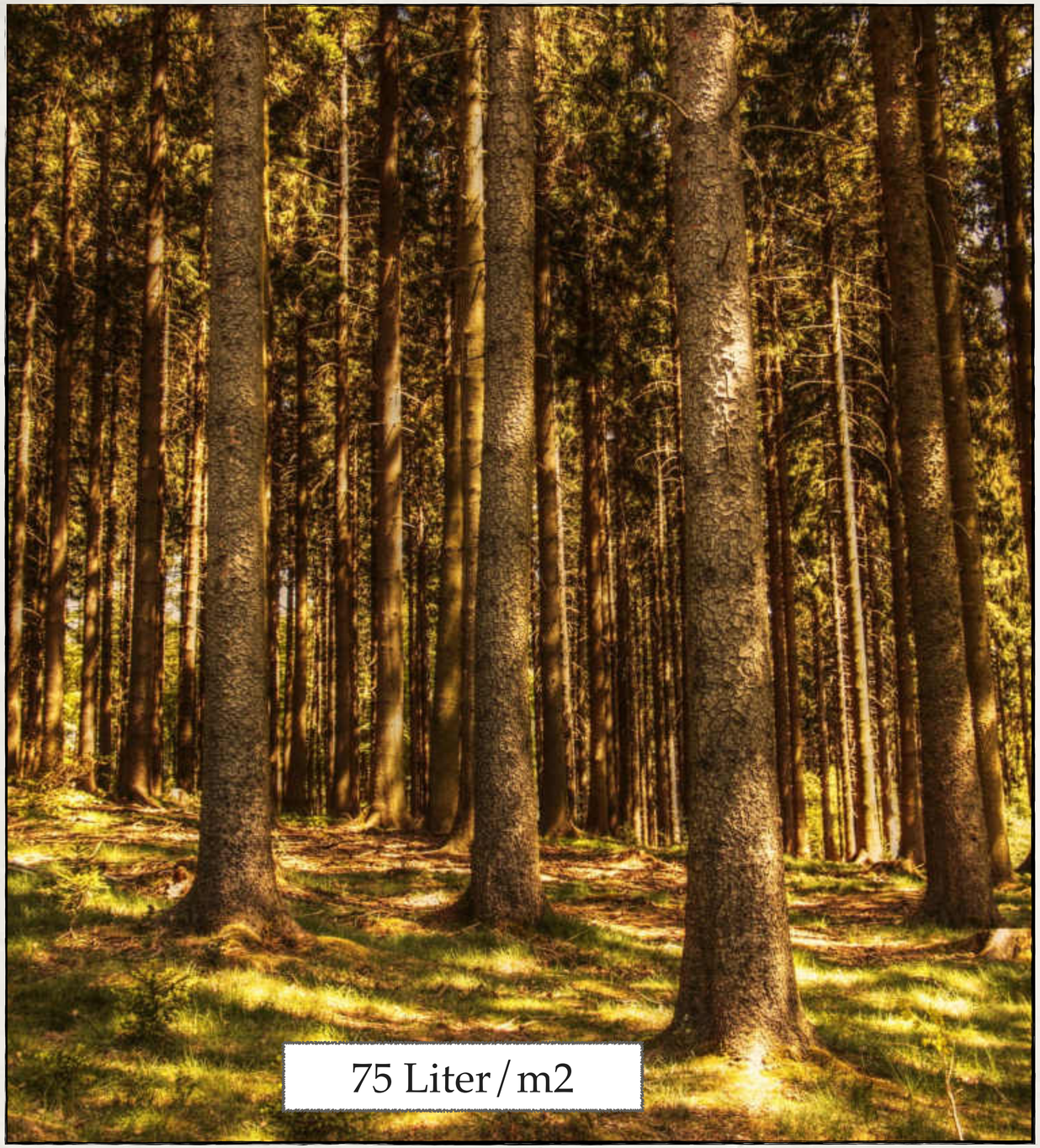
Atmospheric heat has become a major public concern in a rapidly warming world. Evapotranspiration, however, provides effective land surface cooling during the vegetation period. Adversely, modern cultural landscapes – due to both water and potential evapotranspiration pathways lacking – are increasingly incapable of offering this important benefit.

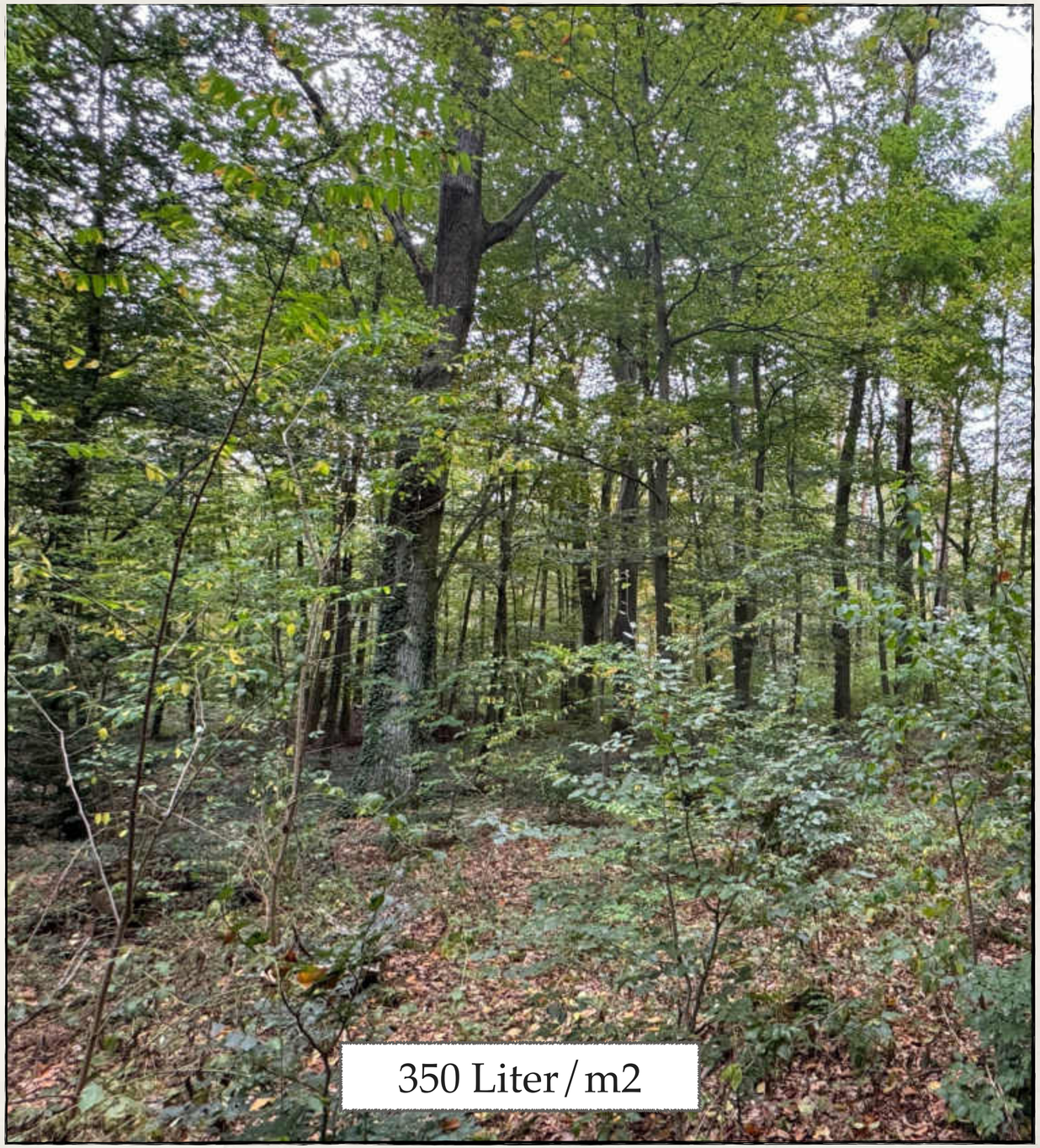
We hypothesised that concerted measures for a revived landscape water retention can fuel plant transpiration, especially during dry periods, and thus contribute to climate change adaptation by stabilising the regional climate. Seeking nature-based ways to an improved landscape water retention, we used the land surface temperature (LST) as a proxy for landscape mesoclimate. For our drought-prone rural study area, we identified potential candidate environmental predictors for which we established statistical relationships to LST. We then, from a set of potential climate change adaptation measures, mapped selected items to potential locations of implementation. Building on that, we evaluated a certain measures' probable cooling effect using (i) the fitted model and (ii) the expected expression of predictors before and after a hypothetical measure implementation.

In the modelling, we took into account the spatial and temporal autocorrelation of the LST data and thus achieved realistic parameter estimates. Using the candidate predictor set and the model, we were able to establish a ranking of the effectiveness of climate adaptation measures. However, due to the spatial variability of the predictors, the modelled LST is site-specific. This results in a spatial differentiation of a measure's benefit. Furthermore, seasonal variations occur, such as those caused by plant growth. On average, the afforestation of arable land or urban brownfields, and the rewetting of former wet meadows have the largest cooling capacities of up to 3.5 K. We conclude that heat countermeasures based on fostering both evapotranspiration and landscape water retention, even in rural regions, offer promising adaptation ways to atmospheric warming.

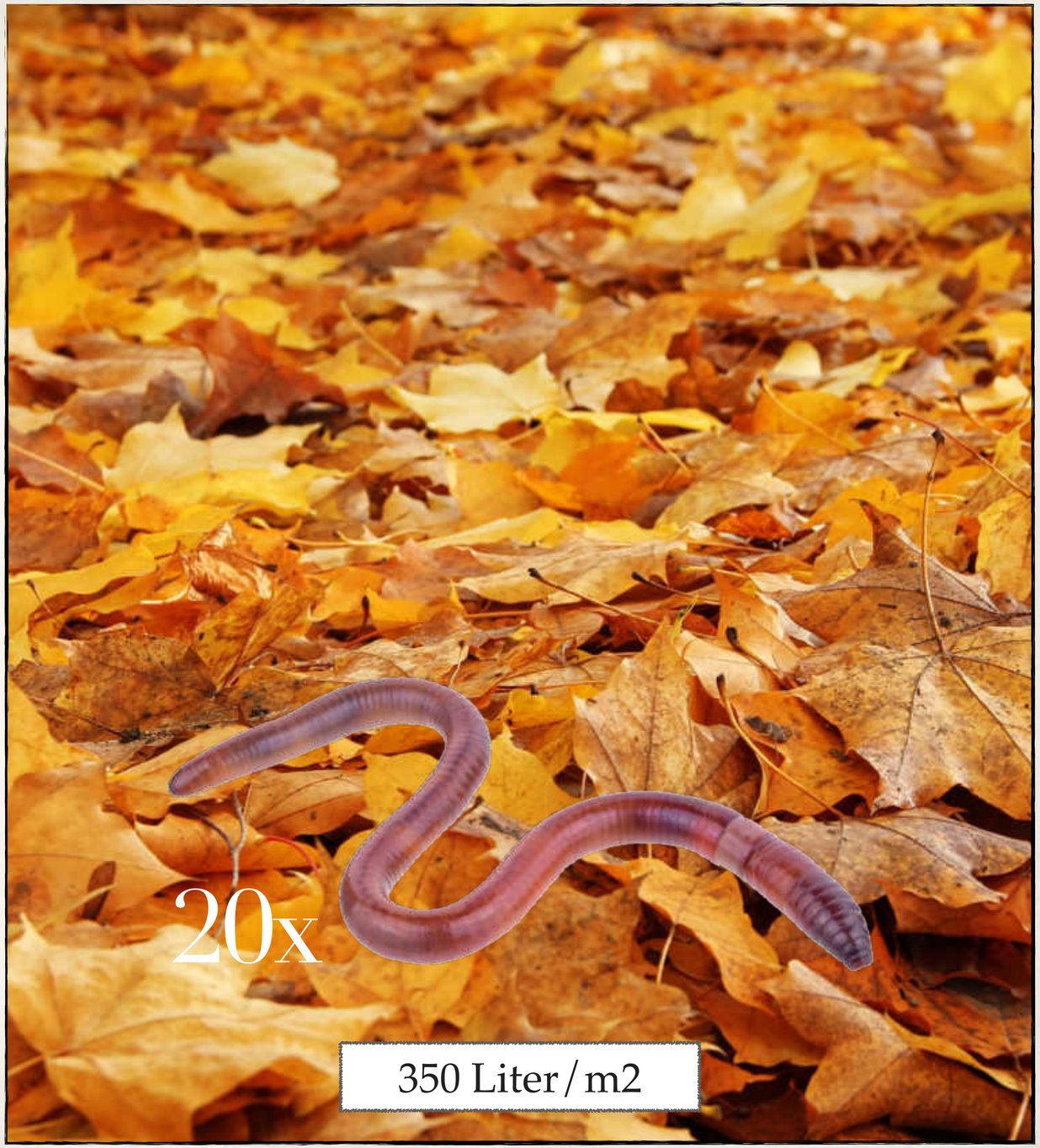
… dass durch gezielte Landnutzungsänderungen eine bedeutsame Kühlung von bis zu **3,5 °C** erreicht werden kann

Zimmermann, Beate, et al. "Assessing the Cooling Potential of Climate Change Adaptation Measures in Rural Areas." Journal of Environmental Management, vol. 366, Aug. 2024, p. 121595. DOI.org (Crossref), doi:10.1016/j.jenvman.2024.121595.


75 Liter / m2

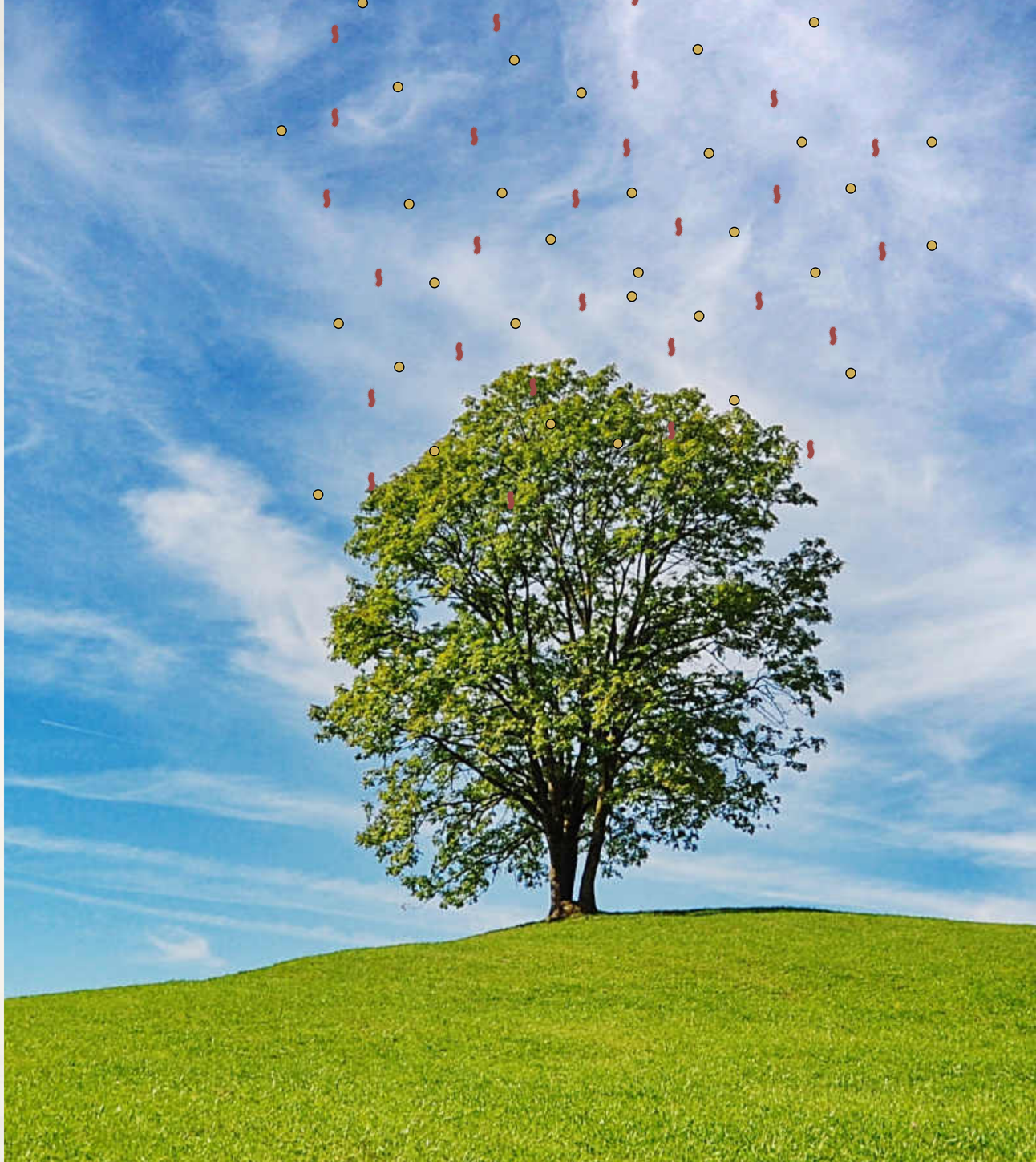

350 Liter / m2


75 Liter / m2


20x
350 Liter / m2

VOC* & Mikroorganismen

* flüchtige organische Verbindungen



Bigg, E.K., Soubeyrand, S., Morris, C.E., 2015. Persistent after-effects of heavy rain on concentrations of ice nuclei and rainfall suggest a biological cause. Atmospheric Chemistry and Physics

Joung, Y.S., Ge, Z., Buie, C.R., 2017. Bioaerosol generation by raindrops on soil. Nature Communications

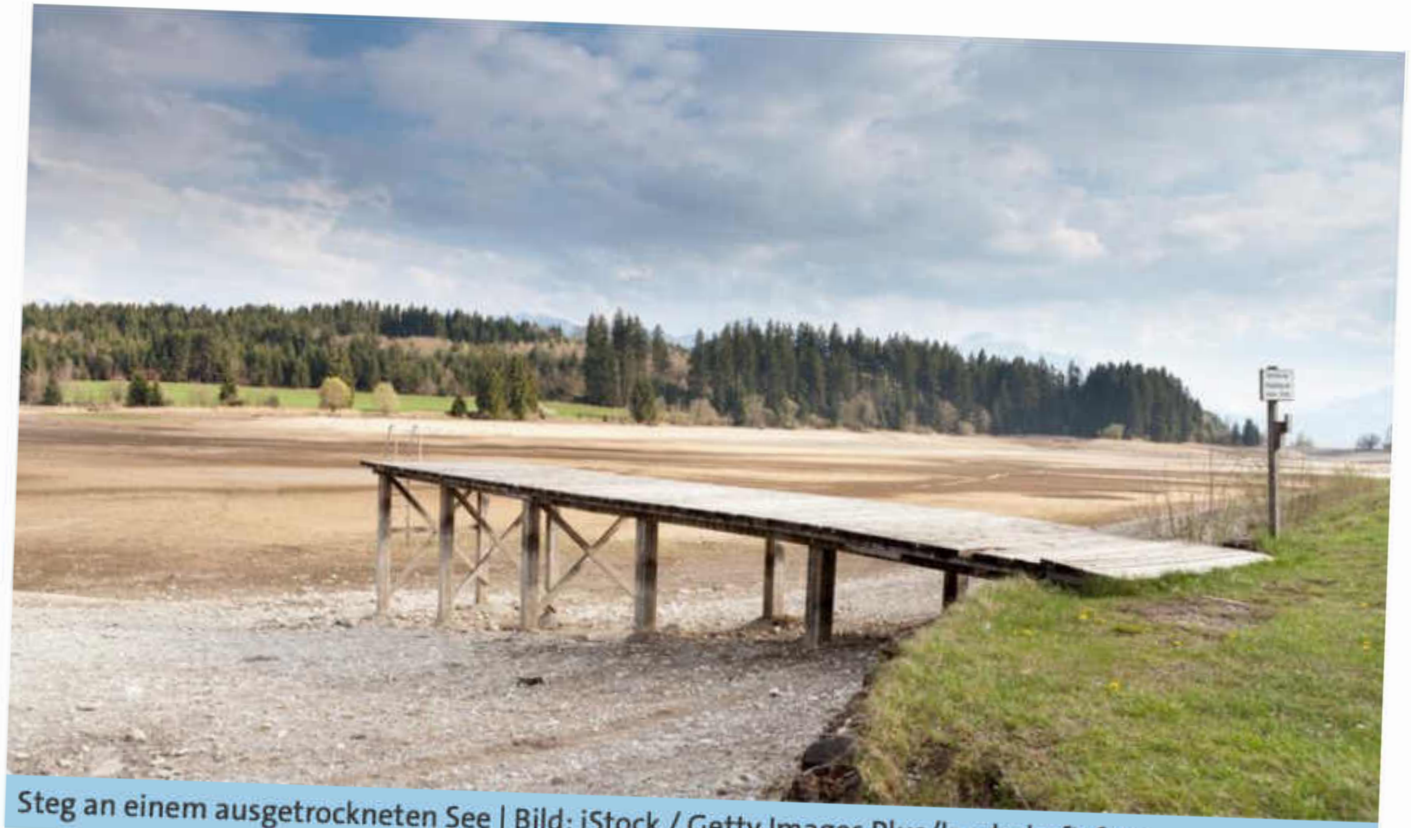
https://upload.wikimedia.org/wikipedia/commons/b/ba/Los_Angeles_River_channelized.jpg

Das Erste

Startseite | Sendungen | TV-Programm | Live | Mediathek | Teletext | Über uns

Deutschlands Wasser verschwindet

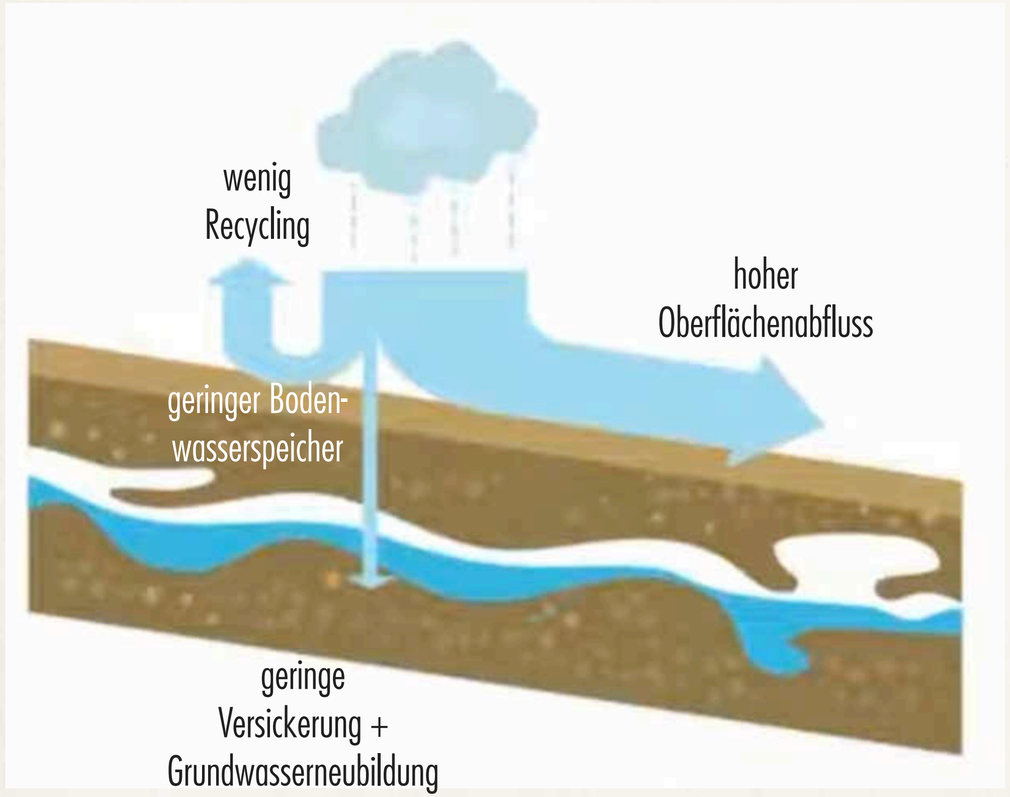
Neue Satellitendaten zeigen dramatische Wasserverluste

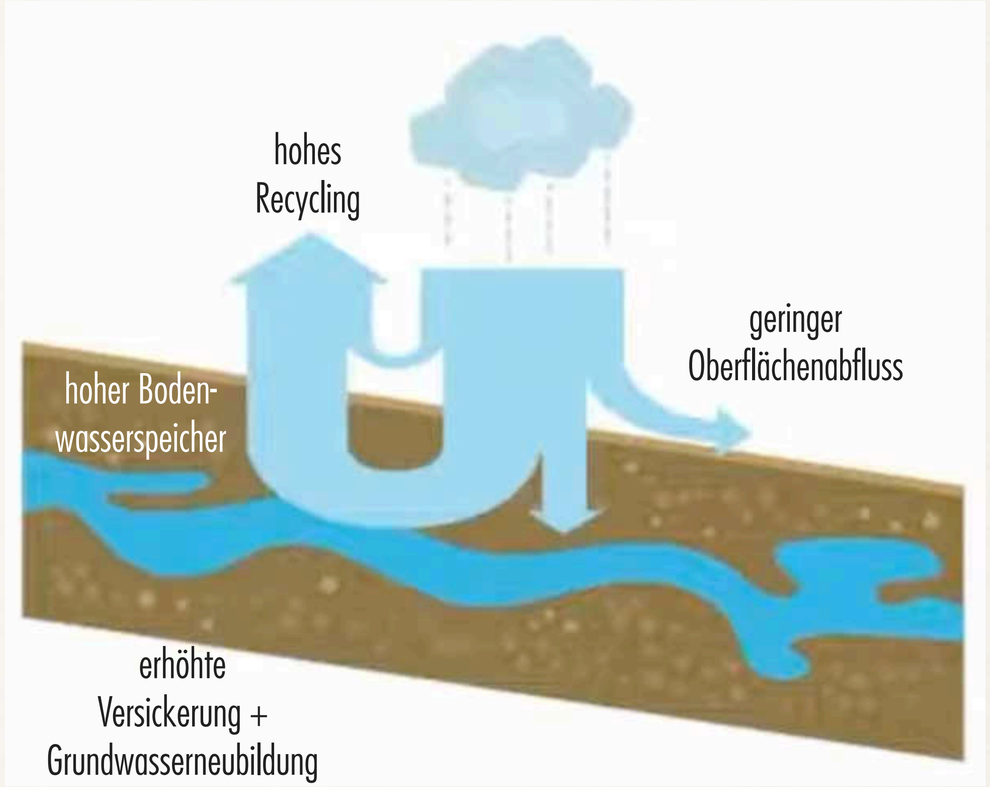


Steg an einem ausgetrockneten See | Bild: iStock / Getty Images Plus/landschaftsfoto

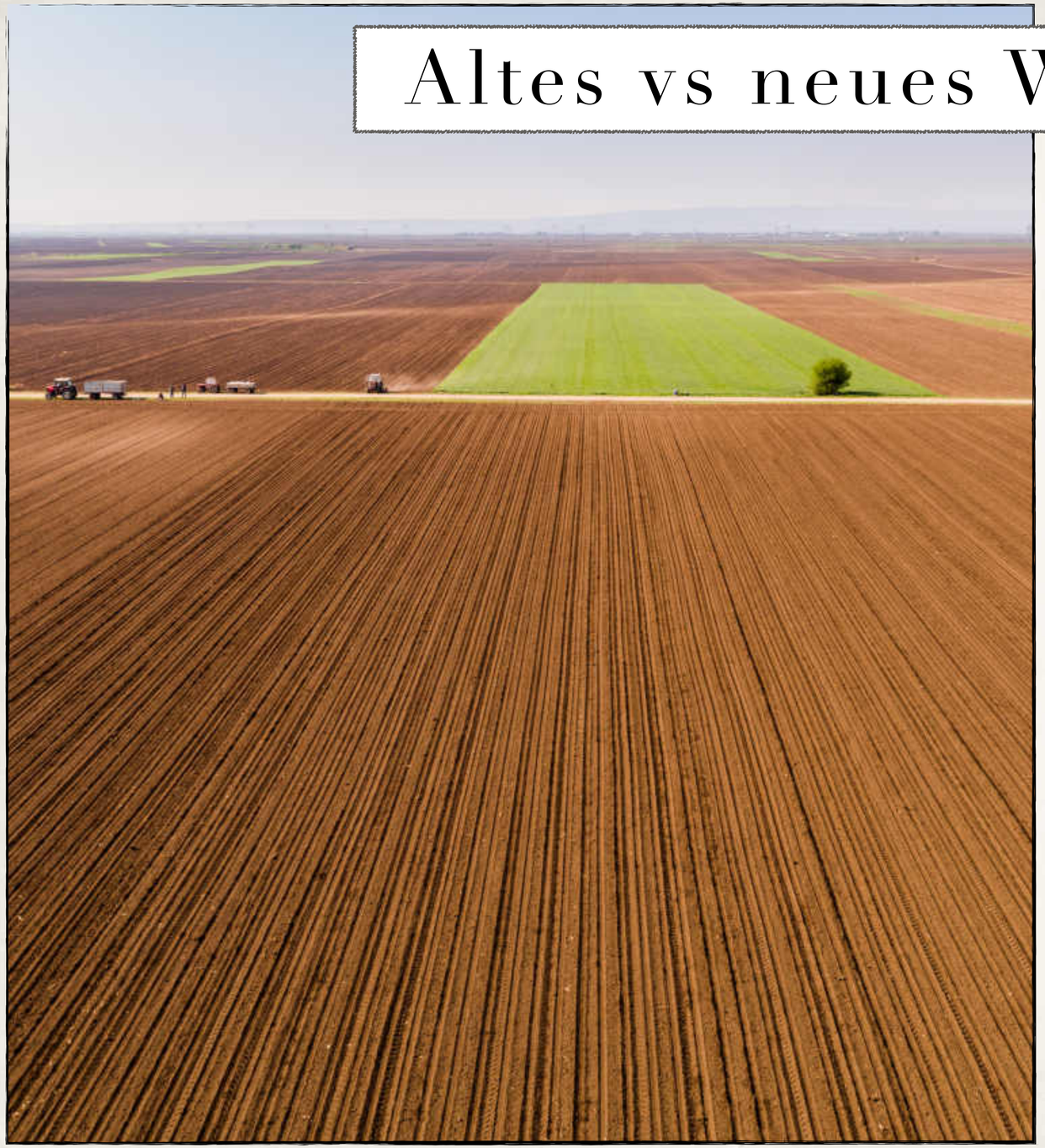
Deutschland hat in den vergangenen 20 Jahren dramatisch an Wasser verloren. Experten schätzen, dass der Verlust der gesamten Wassermenge des Bodensees entspricht. Das zeigen neue Analysen.

Altes vs neues Wasserparadigma





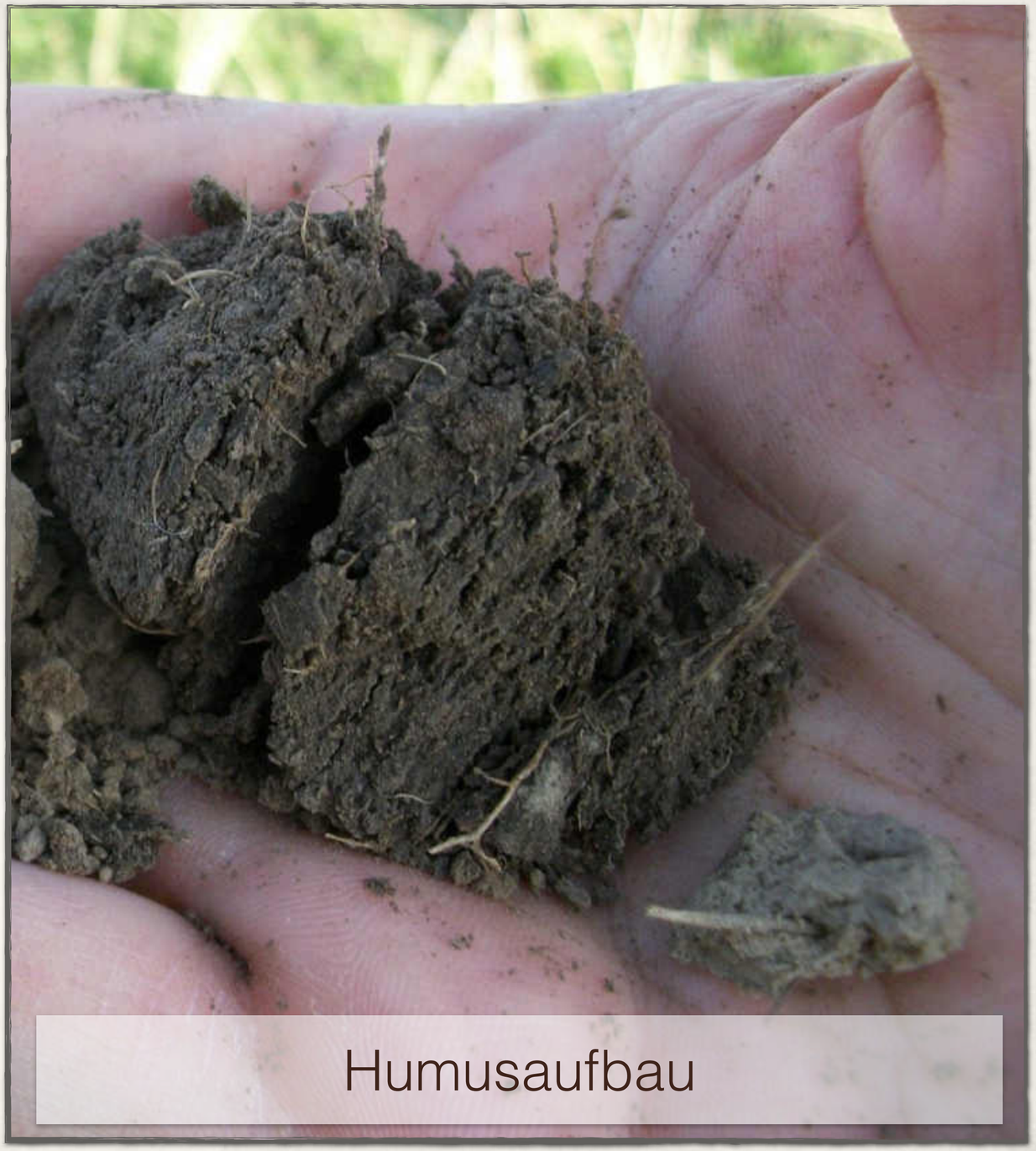
Altes vs neues Wasserparadigma



Wir müssen mehr Wasser verdunsten,
damit es feucht bleibt.

https://unsplash.com/photos/a-building-with-a-parking-lot-and-trees-around-it-m7kjX78P_kQ


"Don't blame us...
it's a natural disaster!"

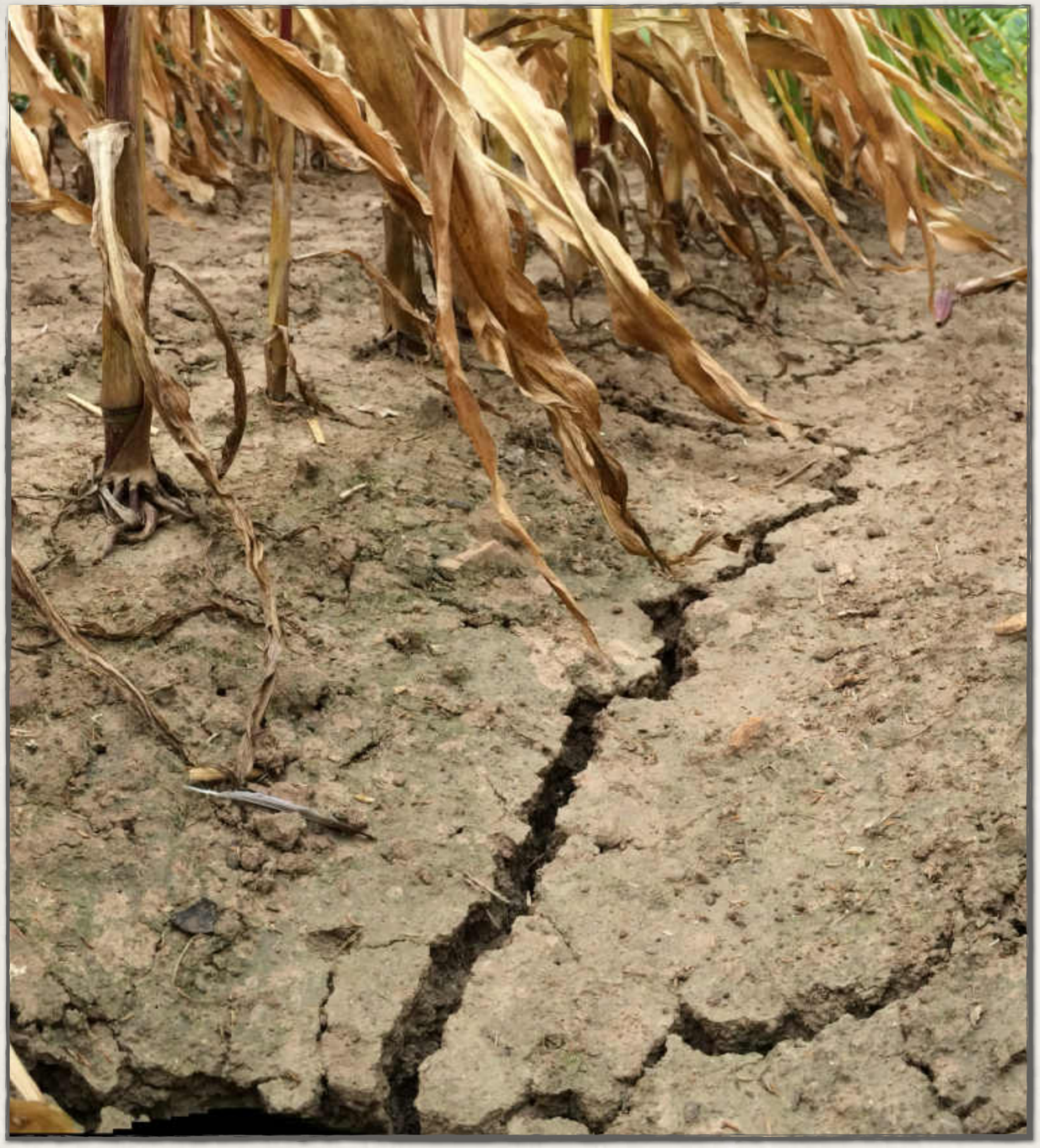


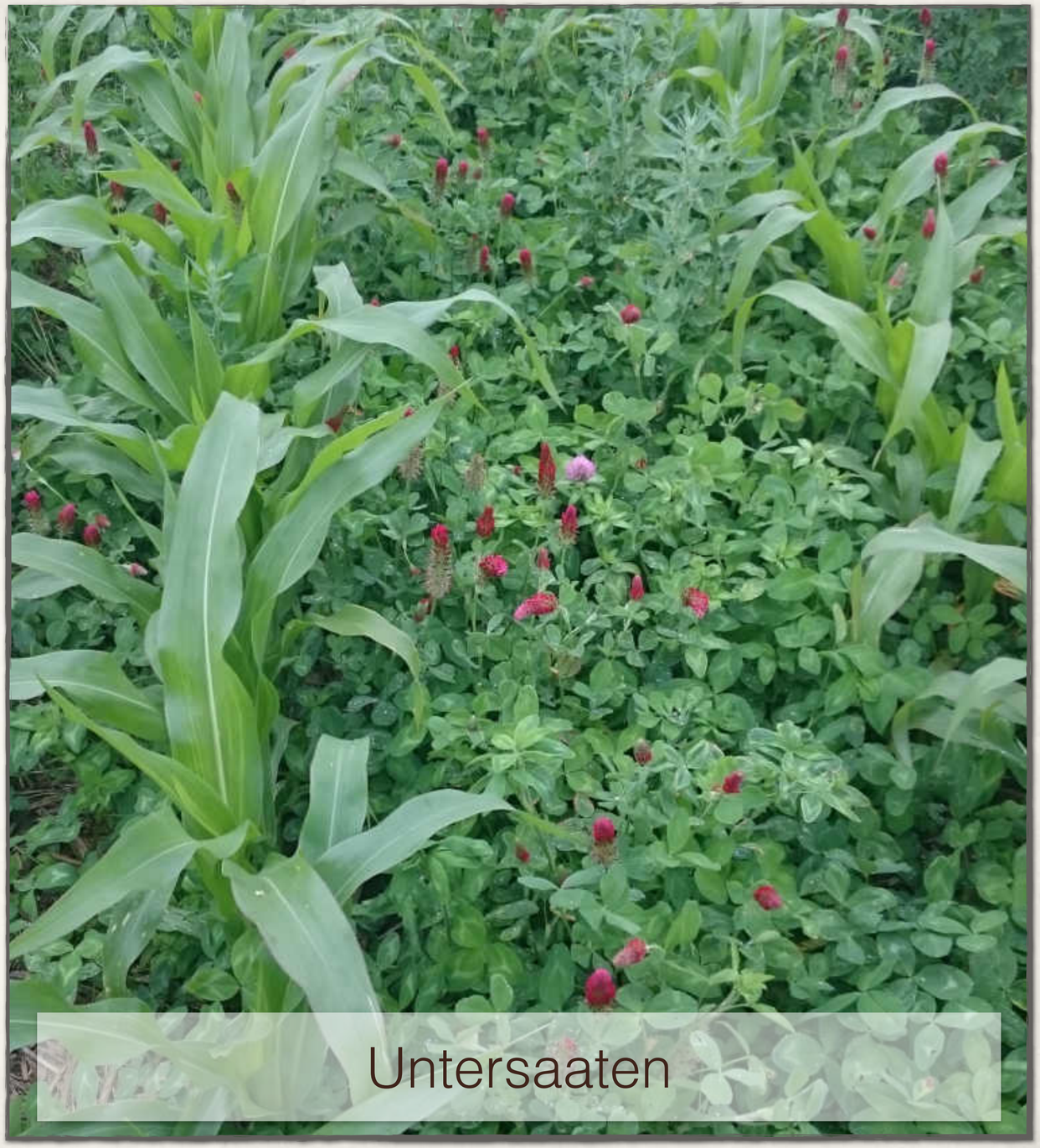
Humusaufbau

Achslast reduzieren

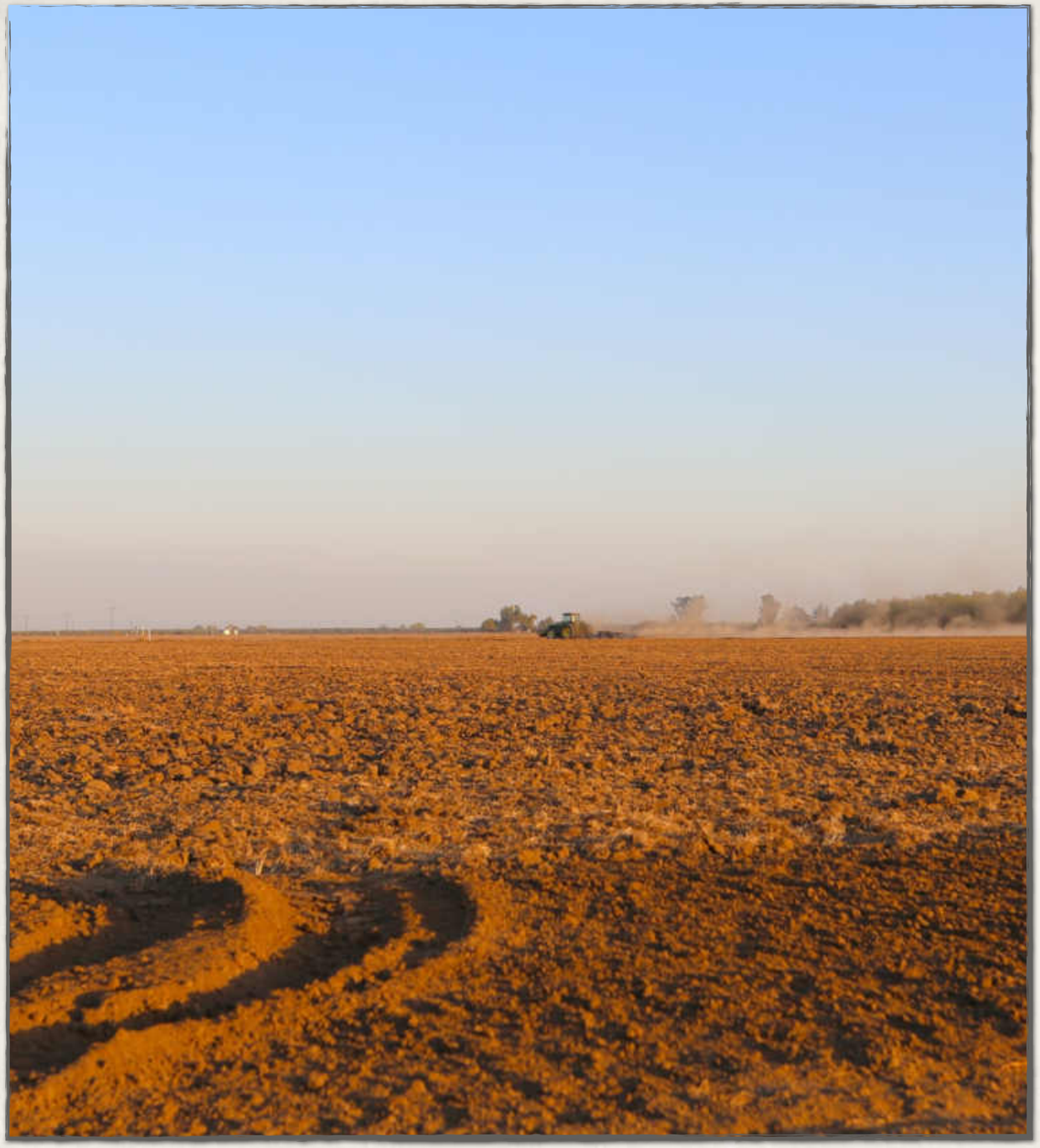
Minimal-Bodenbearbeitung

Direktsaat

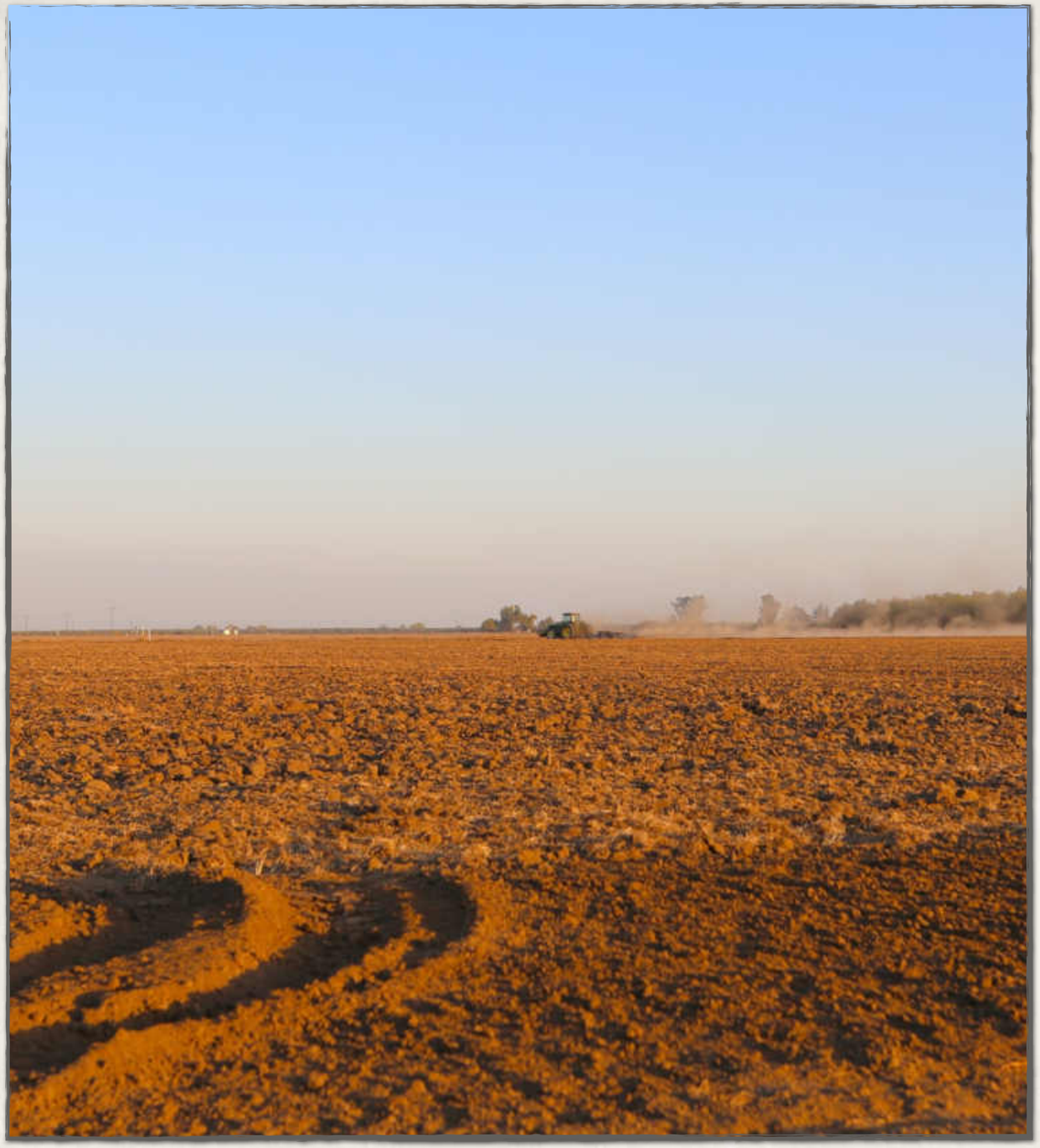


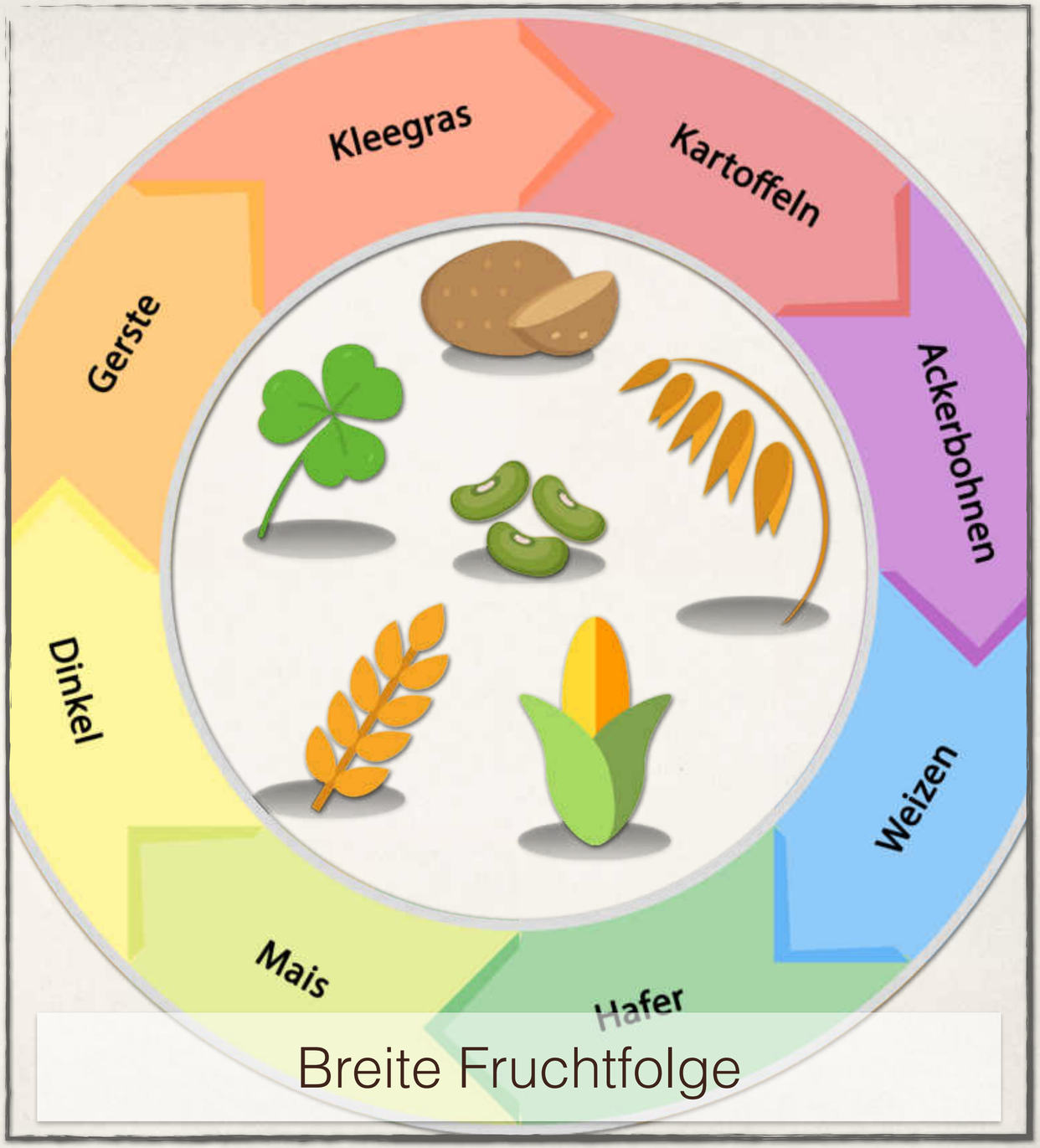


Untersaaten

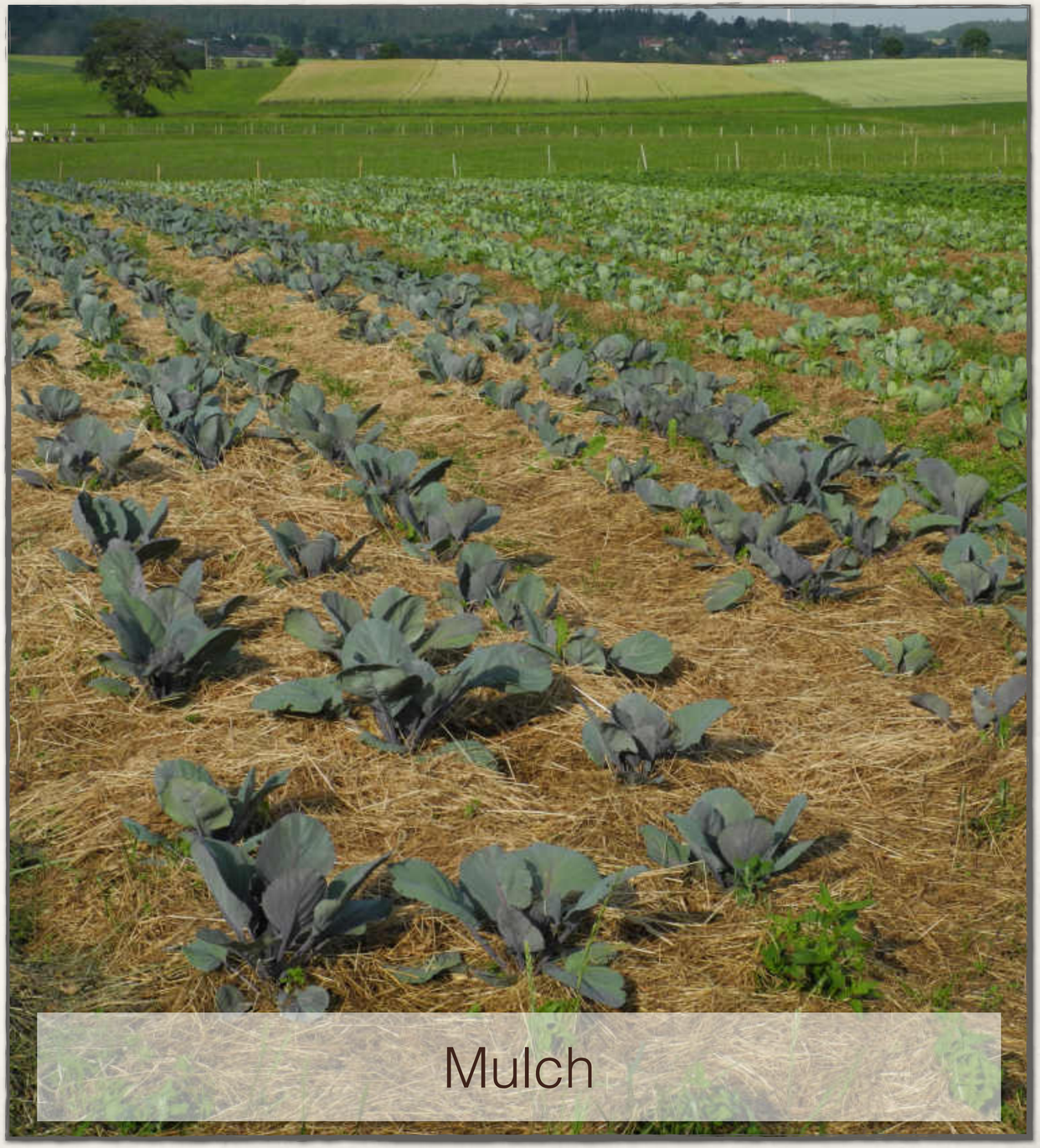


Zwischenfrüchte





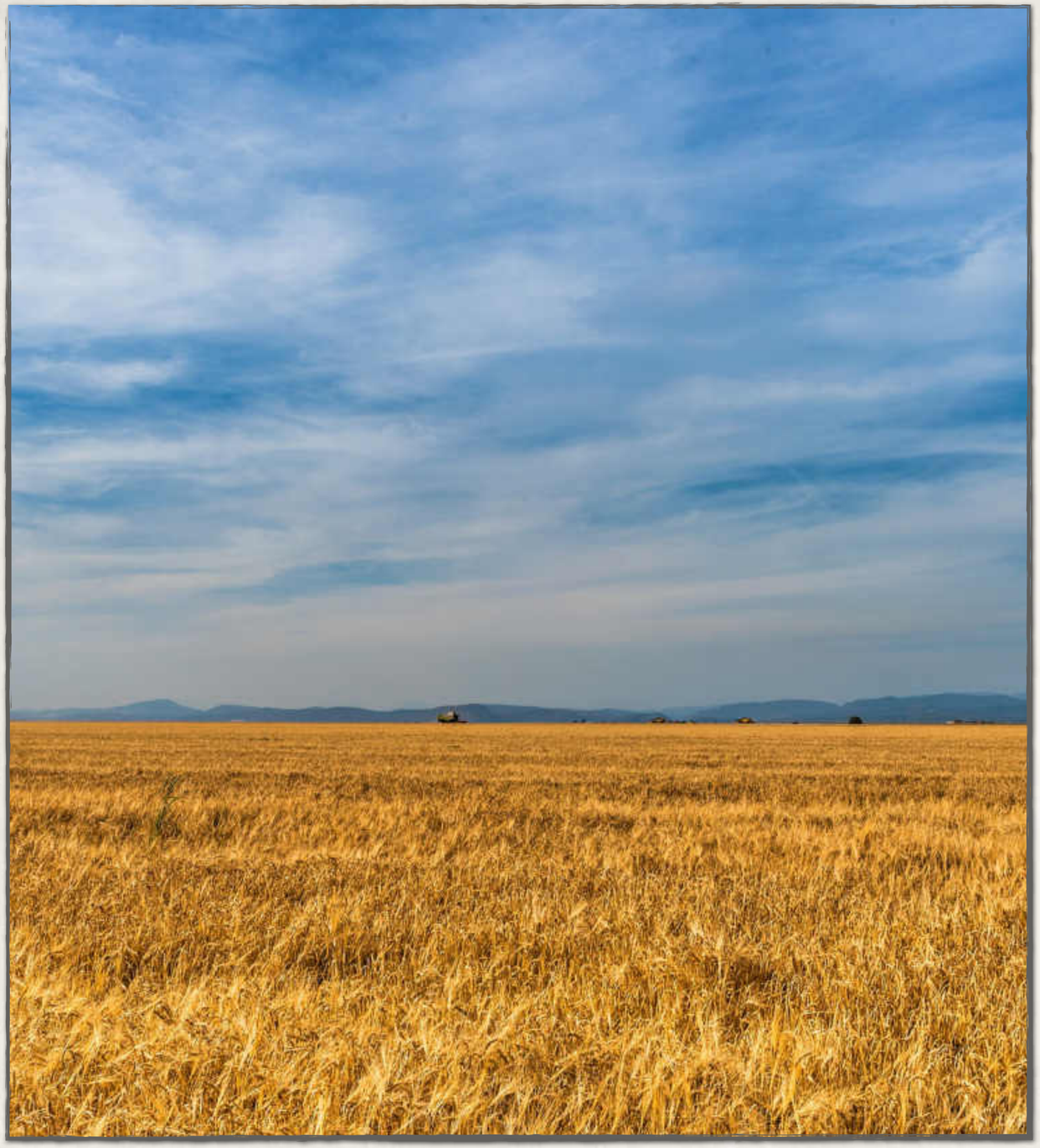
Breite Fruchtfolge

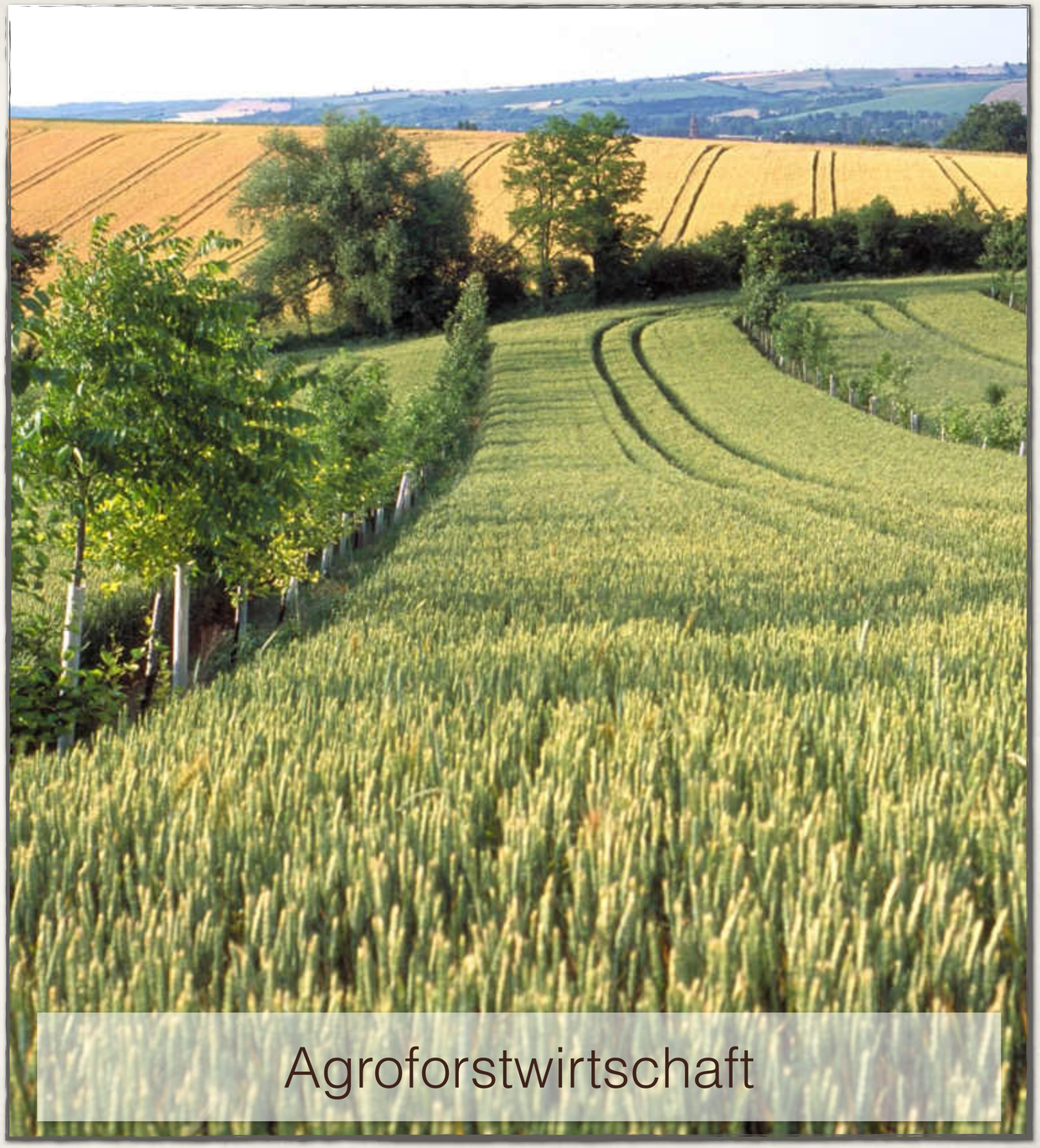


Mulch

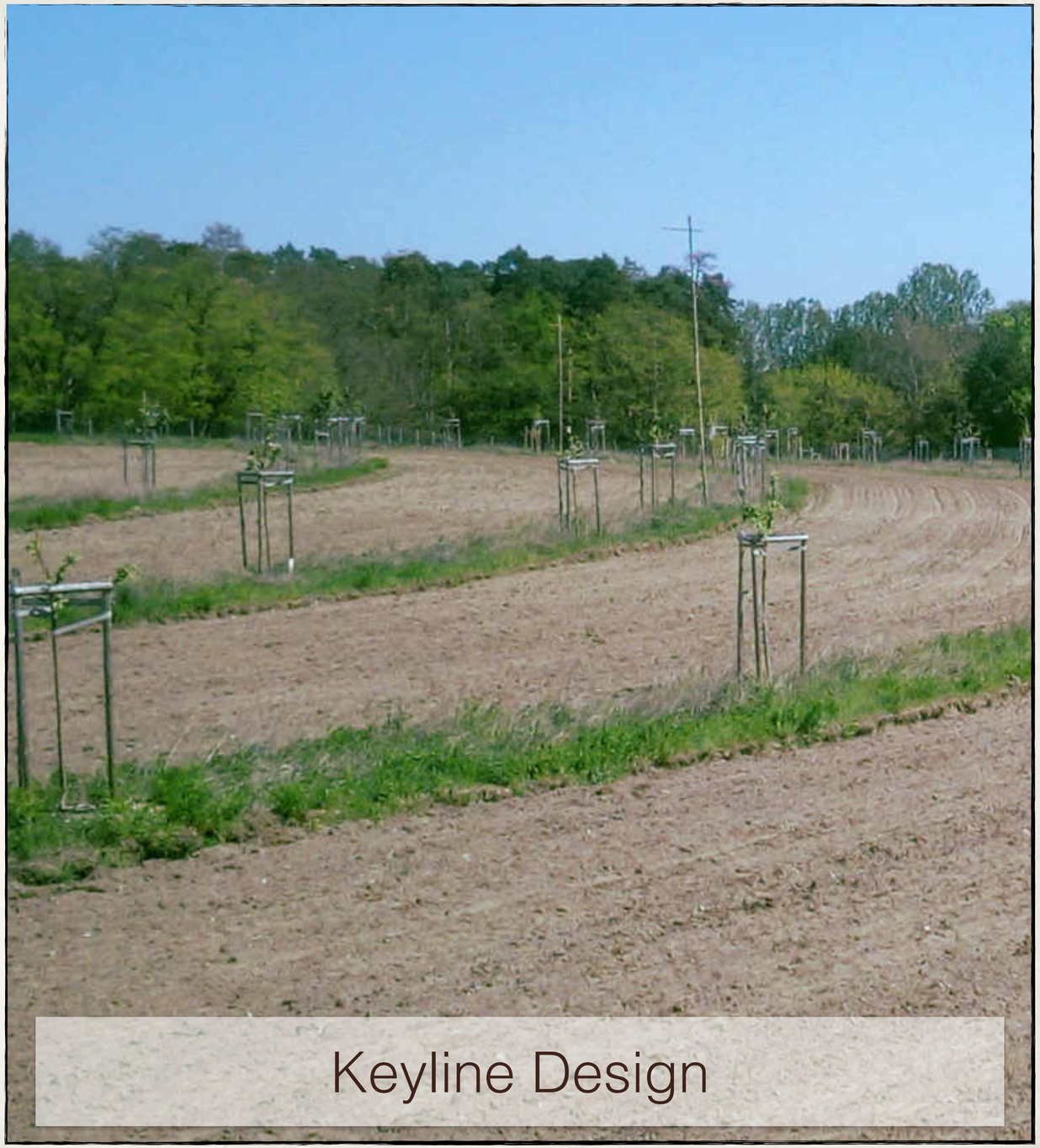
https://www.bauernzeitung.ch/artikel/pflanzen/freiburg-investiert-in-den-biologischen-gemueseanbau-354519

Integration von Tieren in den Ackerbau





Agroforstwirtschaft

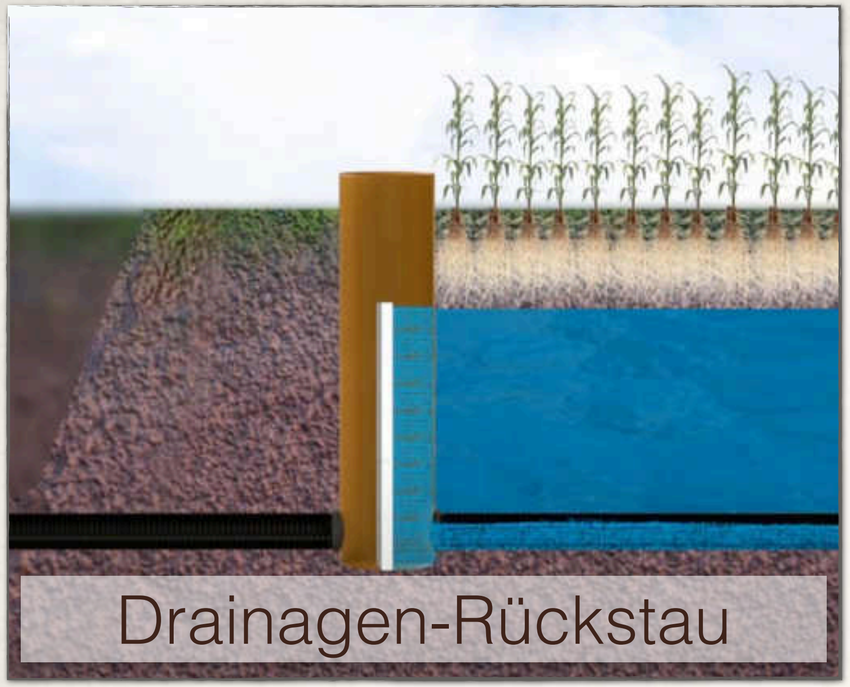


Keyline Design

https://commons.wikimedia.org/wiki/File:Alentejo_landscape.jpg

Holistisches Weidemanagement

Manuel Winter



Drainagen-Rückstau

Kulturwehre

Biberdämme

Staustufen

Seen

Auen

UTE SCHEUB / STEFAN SCHWARZER

Die Humus revolution

Wie wir den Boden heilen, das Klima retten und die Ernährungswende schaffen

Mit Praxistipps zu Humusaufbau und Permakultur

oekom

UTE SCHEUB / STEFAN SCHWARZER

AUFBÄUMEN GEGEN DIE DÜRRE

Wie uns die Natur helfen kann, den Wassernotstand zu beenden

Alles über regenerative Landwirtschaft, Schwammstädte, Klimalandschaften & Co.

oekom

GESUNDHEIT

UTE SCHEUB | STEFAN SCHWARZER

BEGINNT

Alles ist verbunden: Mikrobiom, Boden, Pflanzen, Tiere & Menschen

Warum die Gesundheit allen Lebens von winzigen Mikroben abhängt

IM BODEN

oekom

Slow it, spread it, store it, sink it
Plant it, cover it, keep it

the soil

the water

Stefan Schwarzer • Aufbauende Landwirtschaft e.V. • www.aufbauende-landwirtschaft.de
• Regenerate Forum • www.regenerateforum.org
• stefan@aufbauende-landwirtschaft.de, stefan.schwarzer@regenerateforum.org