



Revitalising silvo-pastoral and agroforestry systems for biodiversity and sustainability: a German-Romanian perspective

ZENAPA

Co-funded by the European Union

AFaktive

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Jacob Bussmann & Frank Wagener

Institute for Applied Material Flow Management (IfaS)
Areas & Fields of Work

MANAGING DIRECTOR

Prof. Dr. Peter Heck

DEPUTY MANAGING DIRECTOR

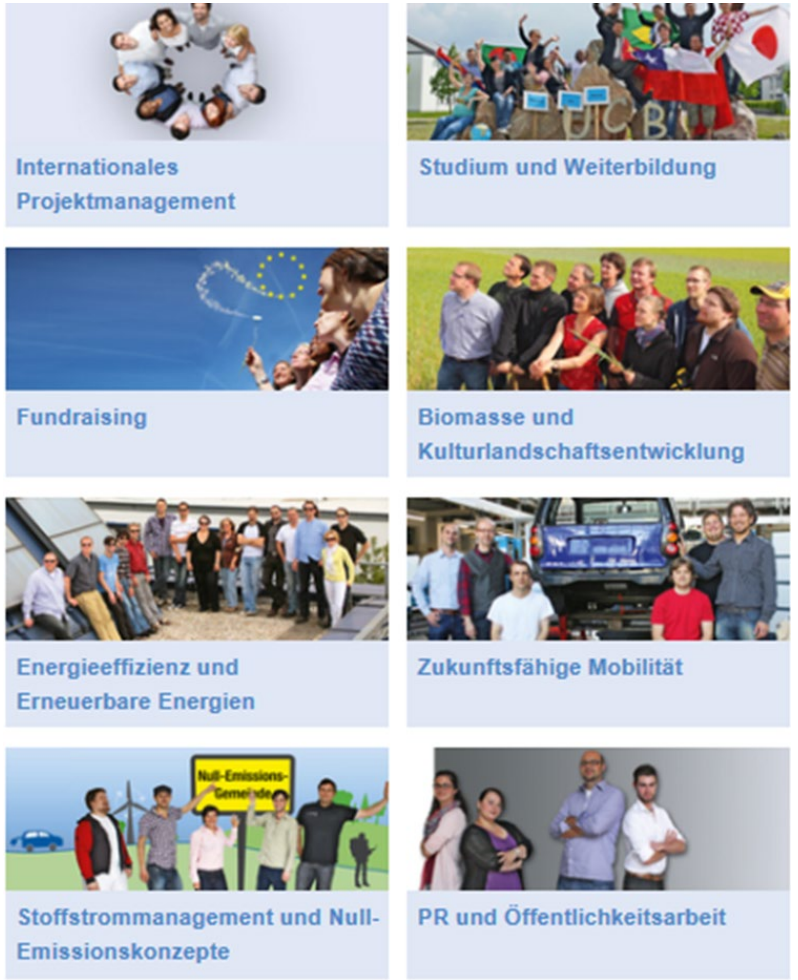
Prof. Dr. Klaus Helling

Institute of Trier University of Applied Science

- Founded end 2001
- 9 professors
- About 80 employees
- Research assistants and interns (about 20)

Key areas:

- International Material Flow Management
- Education and Training
- European Research Projects
- Biomass and Cultivated Landscape Development
- Energy Efficiency & Renewable Energies
- Sustainable Mobility
- Strategic Material Flow Management and Zero Emission
- Public Relations



Environmental Campus Birkenfeld

IfaS

GERMANY'S FIRST "ZERO-EMISSION CAMPUS„ THE MOST SUSTAINABLE CAMPUS IN GERMANY AND THIRD IN THE WORLD

25 JAHRE UMWELT-CAMPUS BIRKENFELD

Nachhaltigkeit. Fortschritt. Zukunft.

UI GreenMetric World University Rankings

1 | The challenge climate change & biodiversity = need for action

Climate change and the loss of biodiversity are the two central environmental problems of the 21st century.

(e.g. WBGU 2009, SRU 2009, EEA 2010, WBA 2010)

Area competition or co-operation?

Conflict of land use in cultivated landscapes:

1. Food security,
2. Climate protection (mitigation & adaptation) and
3. Biodiversity conservation

The focus in practice is on the

I. Rural communities
II. Availability of spaces and
III. their current creation of values (users, owners, municipalities, public services...)

Evolution of cultivation forms

The aims of the **projects presented** here are

1. **analyse old farming** systems and their position in the development of cultivated landscapes,
2. gain information for the **development of new farming systems** and
3. **combine** this **knowledge** with current **technical and economic** requirements.

Development and cooperation

- **LIFE IPC ZENAPA** – **Z**ero **E**mission **Na**ture **P**rotection **A**reas (2016 – 2026)
  - Comprehensive planning process with analysis of regional potentials
  - Establishing customers for wood from agroforestry systems (construction of heating systems as an investment measure) - Linking climate change mitigation and adaptation in protected areas
  - Provision of funding for the establishment of agroforestry systems
- **Transylvanian wood-pastures** (2021 – 2025)
  - Knowledge building and dissemination on silvo-pastoral systems in Romania
- **LIFE AFaktive** – Agroforestry as a Key to improve Water Management & Adaptation to Extreme Weather Events (2023 – 2028)
  - Intense monitoring of existing agroforestry systems for the development of new tools for water-optimized planning of agroforestry systems
- **Agroflow** (2024 – 2027)
  - Development and implementation of new innovative agroforestry systems with a focus on water cycles

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Transylvanian Wood Pastures

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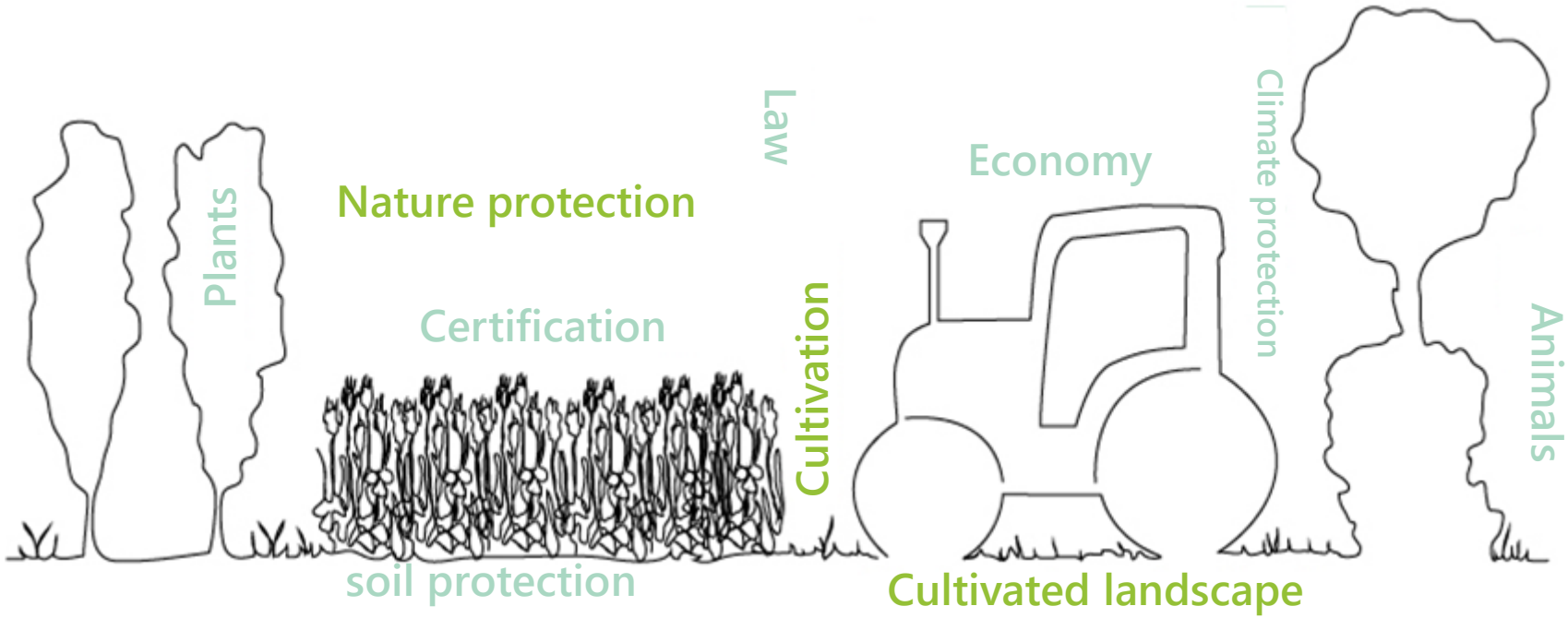
AGROFLOW

2 | Evolution of agroforestry systems = smart learning processes

Cultivated landscape development

Sustainable land use

The history of the cultural landscapes of Central Europe spans **more than 7,000 years**. There are **no comparable landscapes in the world** with **similar climatic conditions** and such long periods of development, which have been **shaped and continuously changed** primarily **by cultivation**, i.e. **by human use.**



Decay time of knowledge e.g. timber cultivation in Germany (1965)

... "The agroforestry ideas (with poplars) are old and your ancestors have served it all up before" ... (Tobias Peschel)

Today, we are taking up these ideas again and starting with new technical processes and varieties, both in research and in practical farming.

An evolution of ancient cultivation forms.

We are currently at new **starting point** ...

3 | Wood pastures in Transylvania
= Europe's treasure

Old breeds and diversity of grazing animals (Transylvania)

- Wood pastures are traditional landscapes combining grassland, shrubs, and trees
- Used for livestock grazing for centuries
- Build up due to different feed intake - change in vegetation
- Most remaining in Romania

Transylvanian Wood Pastures
DBU

Cultivation successor & high biodiversity - Gurghiu

Why are they special?

- Link production, conservation, and tradition
- Cultural and visual value; socially important in many regions
- High biodiversity compared to regular pastures

Transylvanian Wood Pastures

gefördert durch DBU Deutsche Bundesstiftung Umwelt

Tree species diversity oaks & leaf dimorphism due to browsing

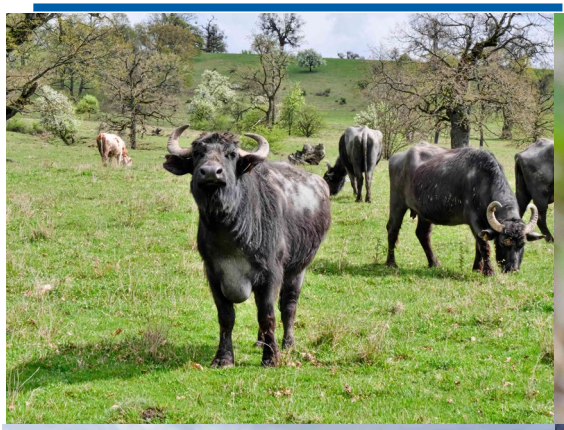
Turkey oak (Quercus cerris)

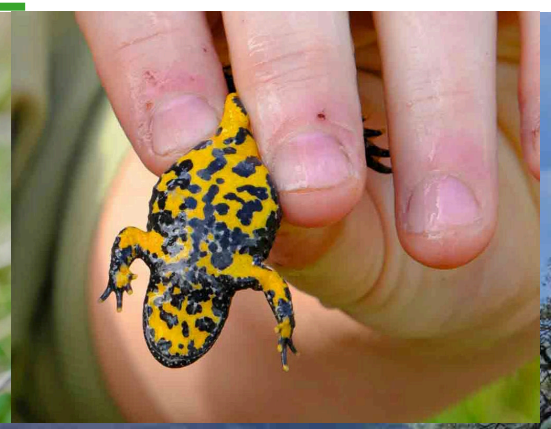
Transylvanian Oak,
(Quercus polycarpa
= Q. iberica)

Transylvanian Wood Pastures

gefördert durch DBU Deutsche Bundesstiftung Umwelt

Mercheasa more than 1000 ha of wood pasture



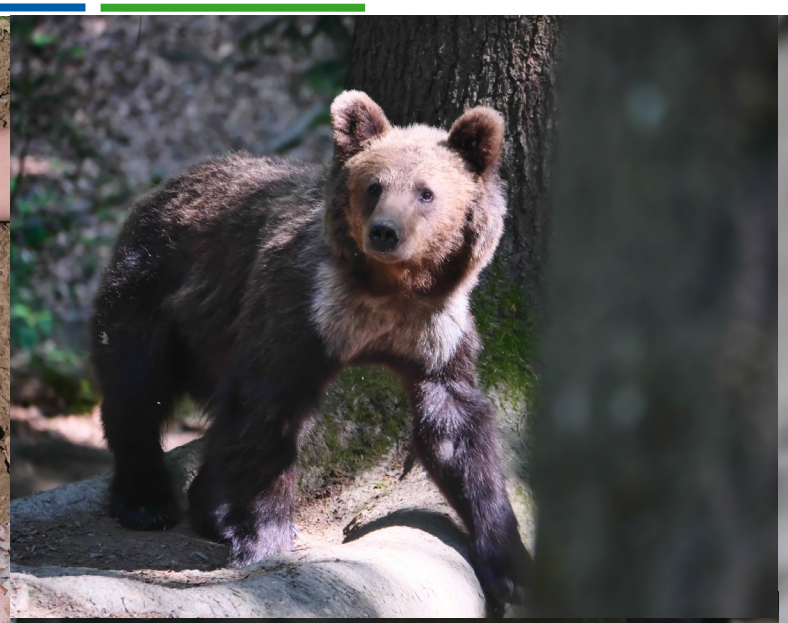





Transylvanian Wood Pastures

gefördert durch DBU Deutsche Bundesstiftung Umwelt

Brown bears are in the wood pasture at night: no fences!



Transylvanian Wood Pastures

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Temperature niches: Heat & cold

Transylvanian Wood Pastures

gefördert durch DBU Deutsche Bundesstiftung Umwelt

Reforestation & tree logging & overgrazing (flocks of sheep)

Transylvanian Wood Pastures

gefördert durch DBU Deutsche Bundesstiftung Umwelt

Shepherds are shapers of the wood pastures,they deserve respect & recognition

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Transylvanian Wood Pastures

DBU Deutsche Bundesstiftung Umwelt

Take aways from the project Transylvanian Wood Pastures

- There are still large contiguous wood pastures in Romania
  - Structure creates **temperature niches**
  - Diverse habitats are a **hotspot of biodiversity**
  - High biodiversity can **strengthen climate resilience** in other regions
- Wood pasture management is declining, due to
  - The rural population is undergoing **demographic change**
  - Shepherds are hard to find, as seasonal work competes with **other employment opportunities** (in Europe)
  - Management form cannot withstand **market pressure** from industrial agriculture
  - **Land purchase** by large (European) companies for meat production
- There is a need for...
  - **New** sources of **income**,
  - Prospects for landowners, herders and their families
  - **Strengthening and development of village structures**

➢ **Variety of learnings for modern agroforestry systems**

Transylvanian Wood Pastures

DBU

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BABEŞ-BOLYAI TUDOMÁNYEGYETEM
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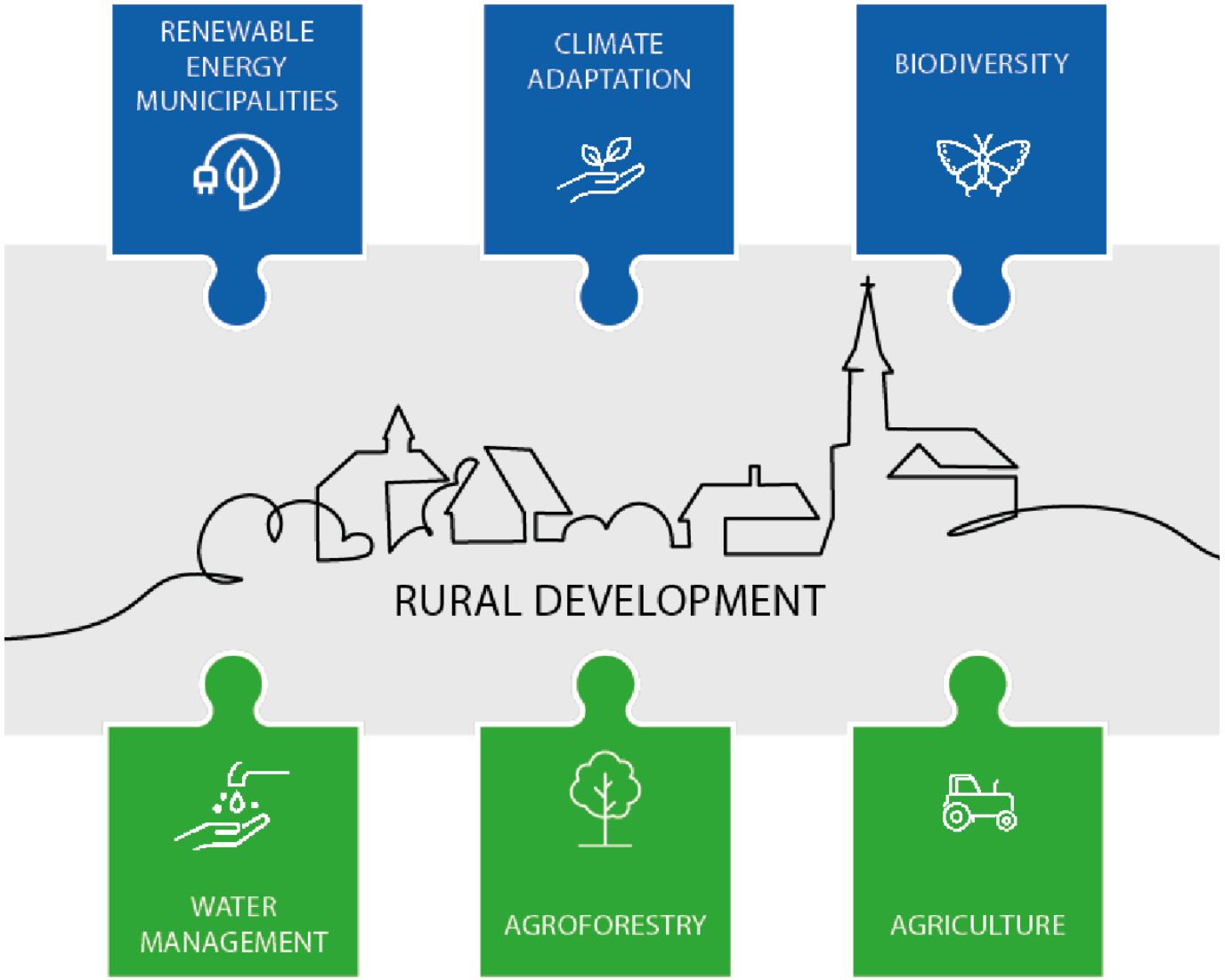
BABEŞ-BOLYAI UNIVERSITY
TRADITIO ET EXCELLENTIA

Homepage:
https://transylvanian-wood-pastures.eu/
YouTube:
https://www.youtube.com/@transylvanian-wood-pastures

4 | Structure of modern agroforestry systems fundamentals

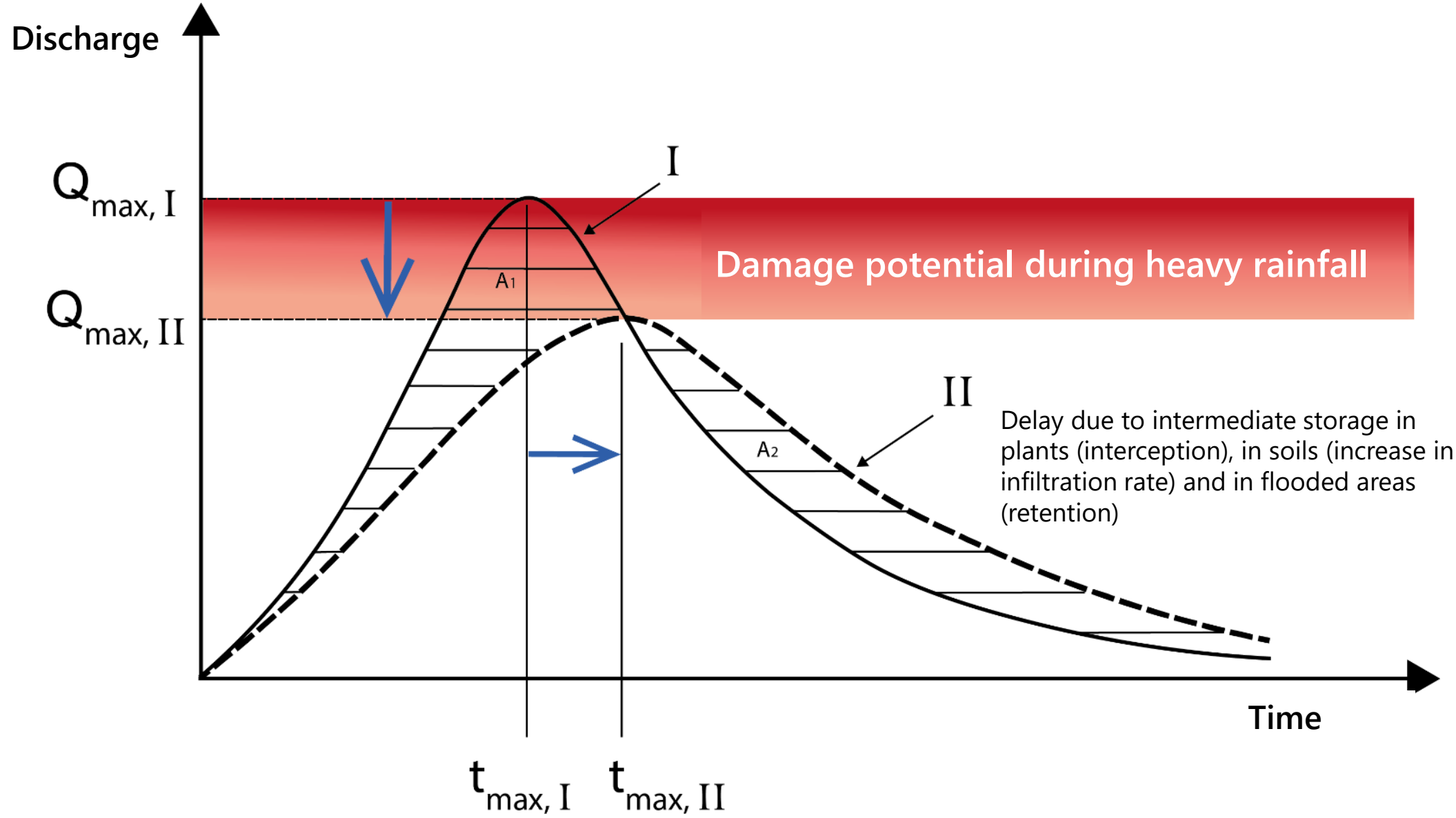
= Evolution of agriculture

AGROFORESTRY - A QUESTION OF RURAL DEVELOPMENT

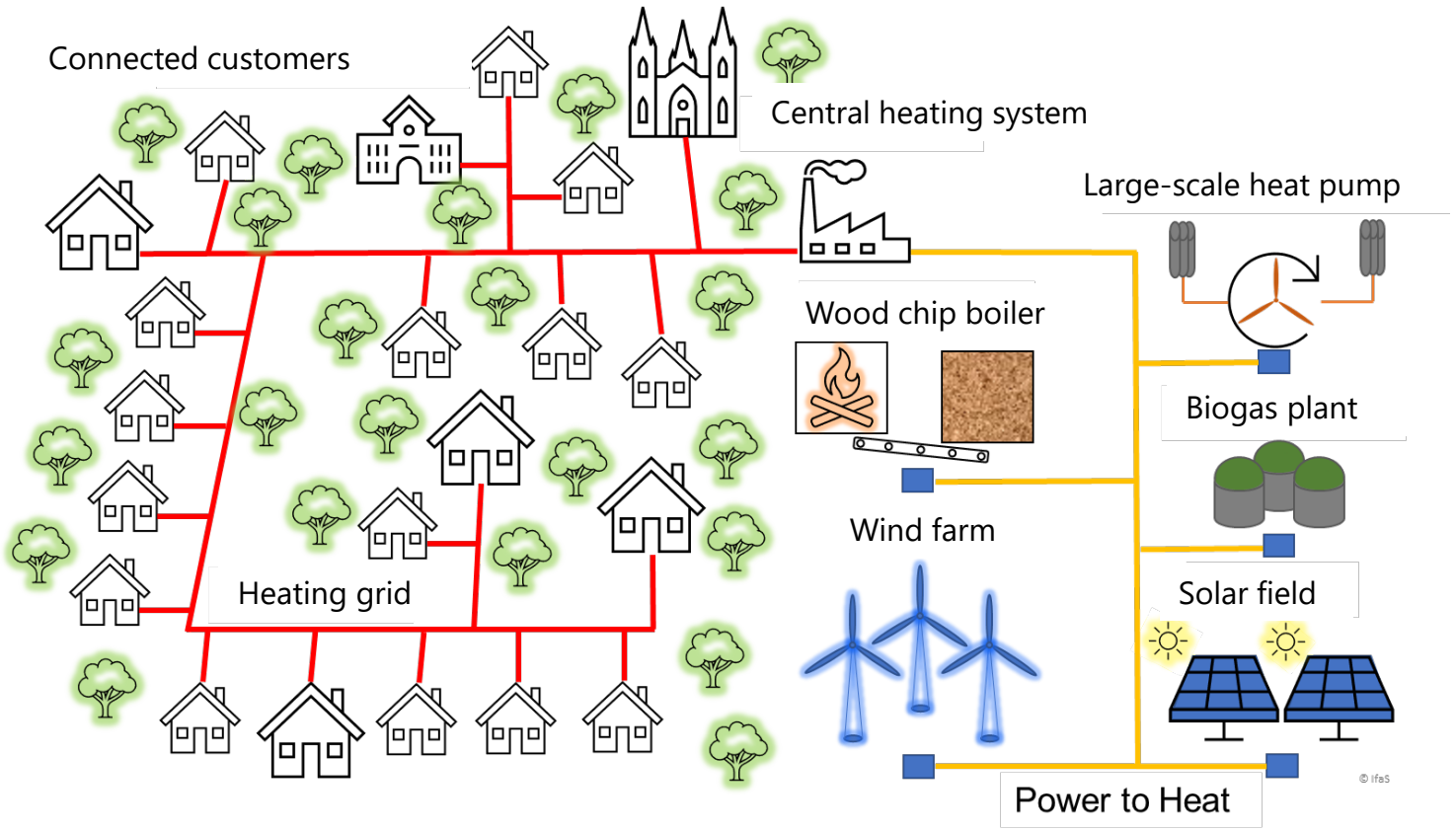


- Modern agroforestry systems must be integrated in a rural development strategy
- They are multifunctional
  - Securing the food supply
  - Supply energy and raw materials
  - Strengthen the water balance
  - Contribute to adaptation to climate change
  - Provision of habitats
  - Additional income for farmers
  - Creation of local recreational value

Damage potential during heavy rainfall



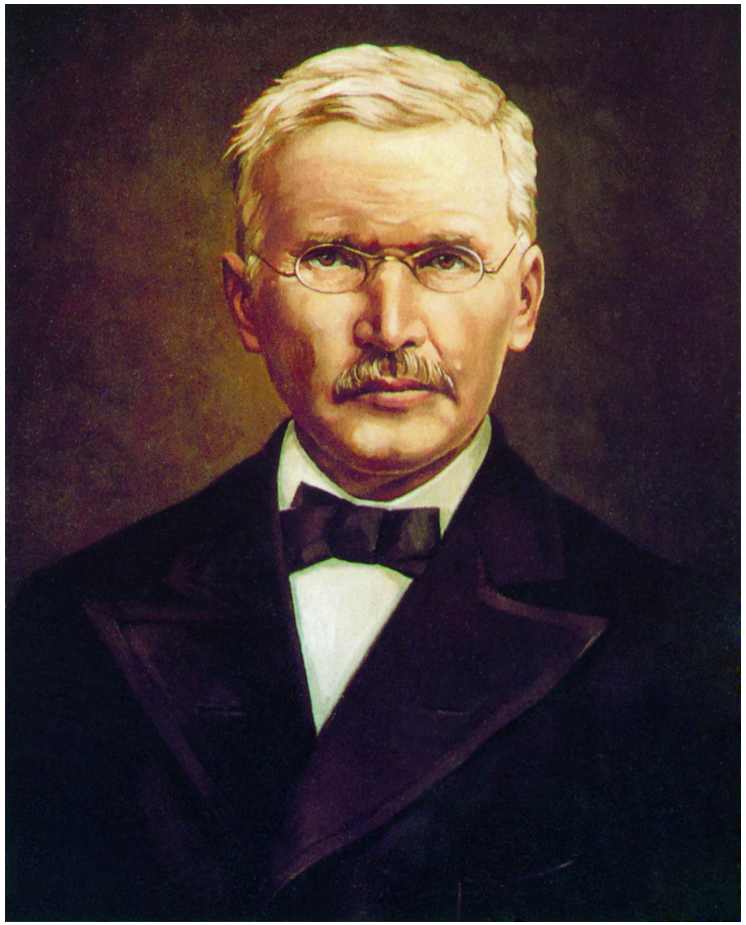
Resilience through heat transition in renewable energy municipalities



- Decentralized supply structures lead to resilience against
  - market distortions,
  - rising prices,
  - supply bottlenecks, and
  - create local jobs
- The use of agroforestry systems leads to resilience against climate change and leads to
  - flood,
  - nature, and
  - water protection

Opportunities: Regional economy = long tradition

The village's money to the village!



Prompted by the plight of the rural population in the 19th century, Friedrich Wilhelm Raiffeisen, as **mayor** of Weyerbusch (Westerwald), founded the "Verein für Selbstbeschaffung von Brod und Früchten" (Association for self-procurement of bread and fruit) during the hunger winter of 1846/47.
With his initiative, he realized the idea of **people helping themselves in a solid community** for the first time in a modern form: the **cooperative idea** was born.

http://www.raiffeisen.de/der-drv/drv-historie/

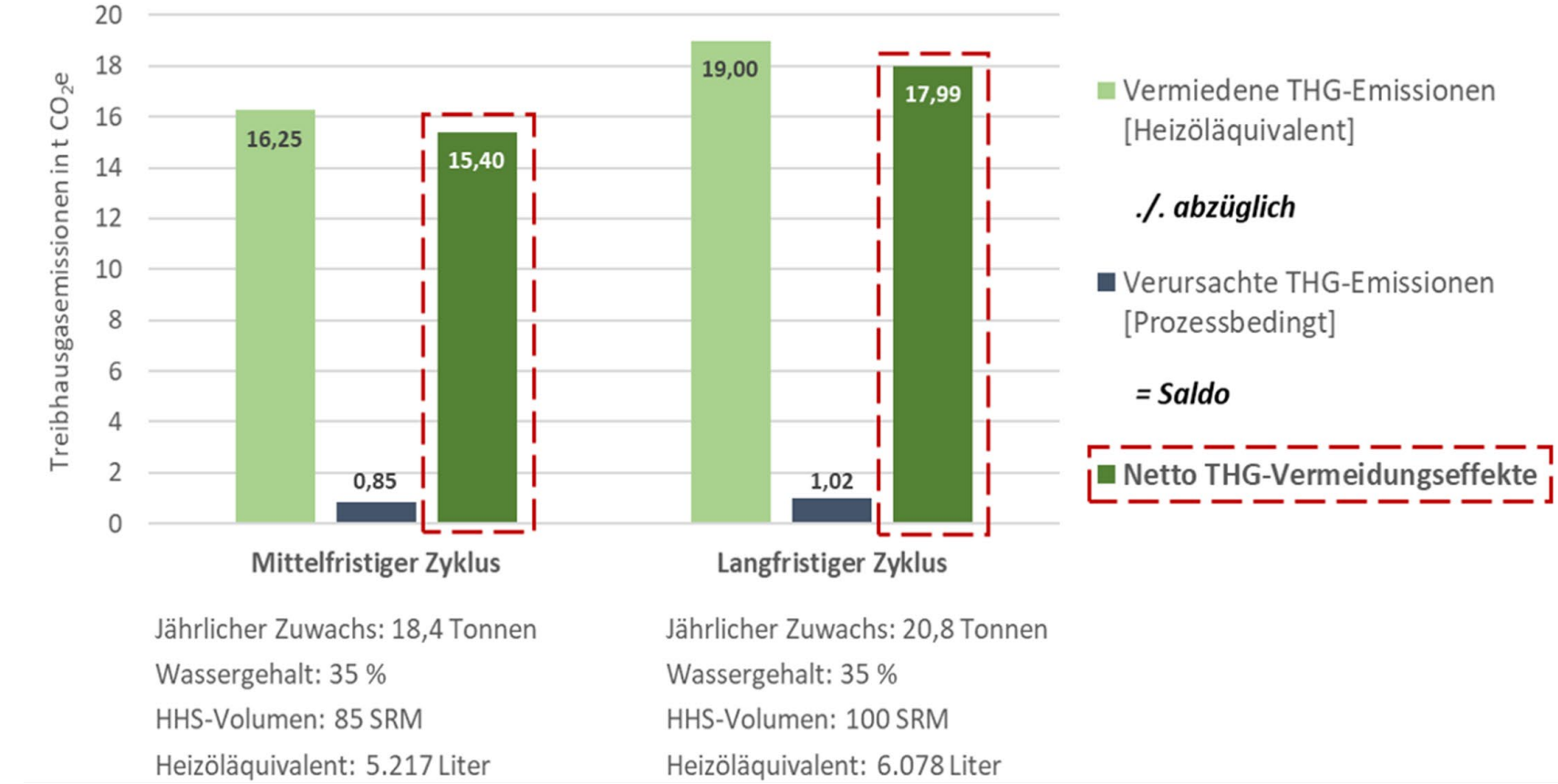
Friedrich Wilhelm Raiffeisen (1818 - 1888)

Safeguarding & increasing biodiversity & biotope network

Abbildung 1: Eine sehr artenreiche Vogelwelt umfasst u.a. Feldlerche, Grauammer, Mäusebussard und Wiesenschafstelze (von links nach rechts, Fotos: Ralf Krechel).

Abbildung 1: 8 Fledermausarten nutzen den neu gepflanzten Agrarholzstreifen. Dies zeigt, dass die Fledermäuse begonnen haben, diese Struktur in ihre Flugrouten zu übernehmen (Fotos: © Dietmar Nill).

Climate impact of 1 ha of agricultural timber: carbon farming strategy in practice

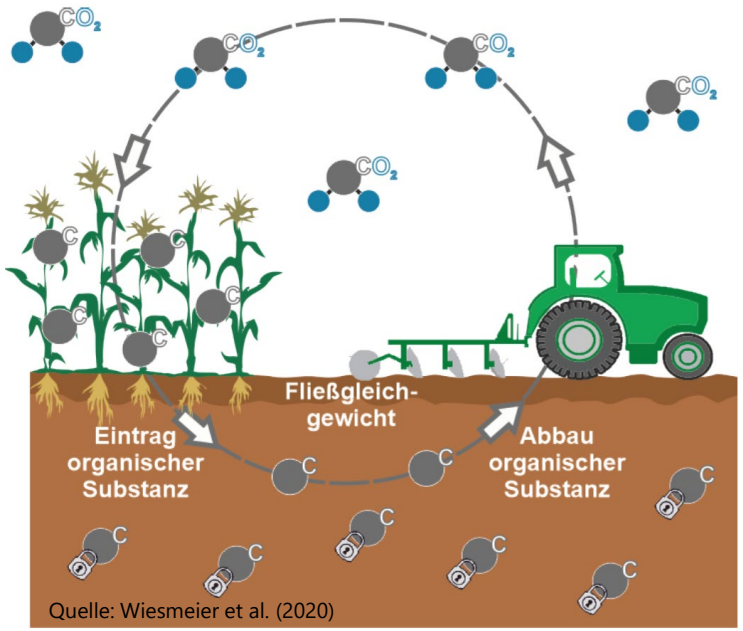


Average C_{org} build-up in the soil through agroforestry systems

(Cardinael et al, 2017; Cardinael et al, 2019; De Stefano & Jacobson, 2018; Shi et al, 2018; from Wiesmeier et al, 2020)

0.68 t C_{org} ha $*a^{-1-1}$

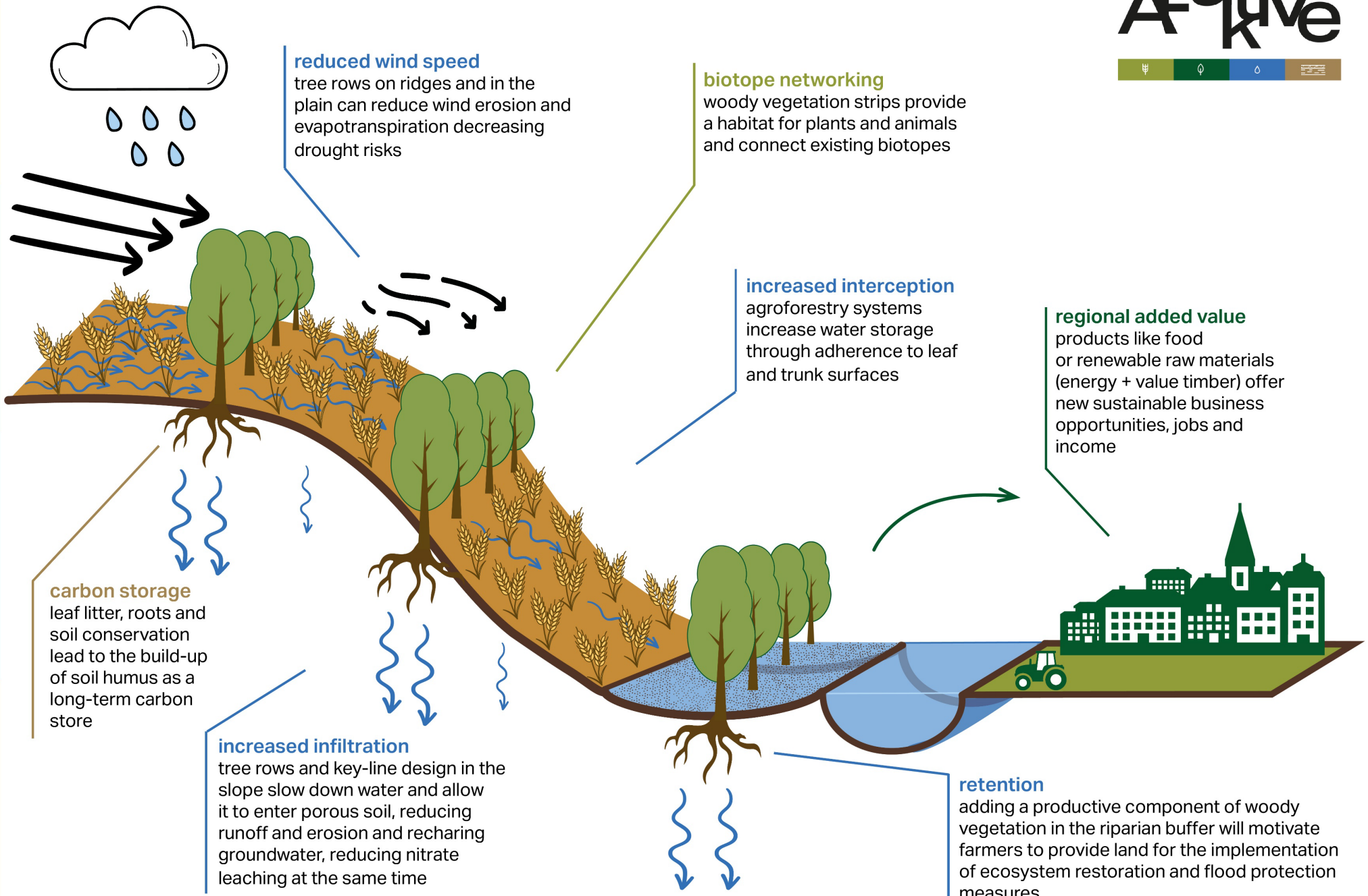
≈ 2.5 t*ha $*a^{-1-1}$ CO -equivalents$_2$



Output per year ≈18 t+2.5 t = 20.5 t CO_2 -equivalents (CO_2e)

Immediate measure suitable for reducing the climate emergency

Agroforestry systems & water management



reduced wind speed
tree rows on ridges and in the plain can reduce wind erosion and evapotranspiration decreasing drought risks

biotope networking
woody vegetation strips provide a habitat for plants and animals and connect existing biotopes

increased interception
agroforestry systems increase water storage through adherence to leaf and trunk surfaces

regional added value
products like food or renewable raw materials (energy + value timber) offer new sustainable business opportunities, jobs and income

carbon storage
leaf litter, roots and soil conservation lead to the build-up of soil humus as a long-term carbon store

increased infiltration
tree rows and key-line design in the slope slow down water and allow it to enter porous soil, reducing runoff and erosion and recharing groundwater, reducing nitrate leaching at the same time

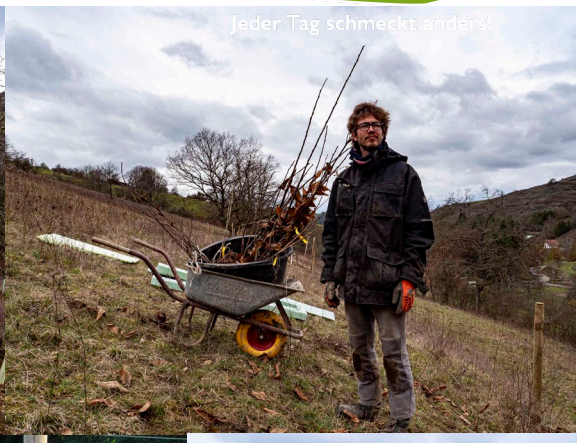
retention
adding a productive component of woody vegetation in the riparian buffer will motivate farmers to provide land for the implementation of ecosystem restoration and flood protection measures

5 | Development of modern agroforestry systems in Germany

= Adaptation in current economy

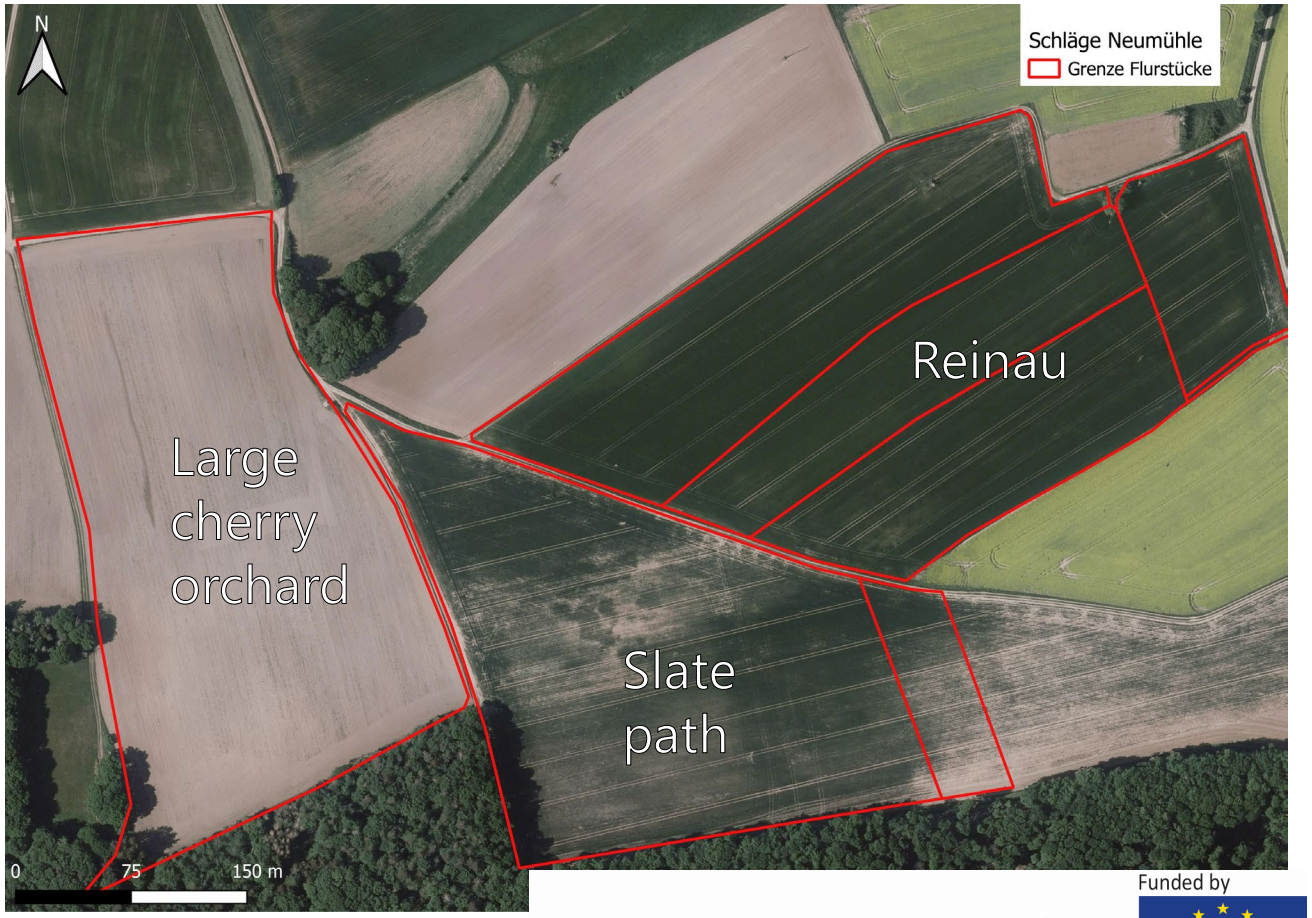
Planting Keyline concept Bannmühle

- Problem:
  - Abandonment of marginal land,
  - conversion to forest
  - loss of biodiversity
- Solution:
  - New agroforestry systems
  - similar to a wood pasture
  - Adapted to the hill contours lines
  - With fences



Teaching and research farm for livestock farming Hofgut Neumühle

Location	Shale clay, sand shale, red sandstone at higher altitudes
Altitude	250 - 350 m above sea level
Soil type	clayey loam (tL) to sand (S)
Ground value	22 - 60
Precipitation	680 mm Ø / year
Temperature	8.6 °C Ø / year



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Teaching and research farm for livestock farming Hofgut Neumühle

- Basic data

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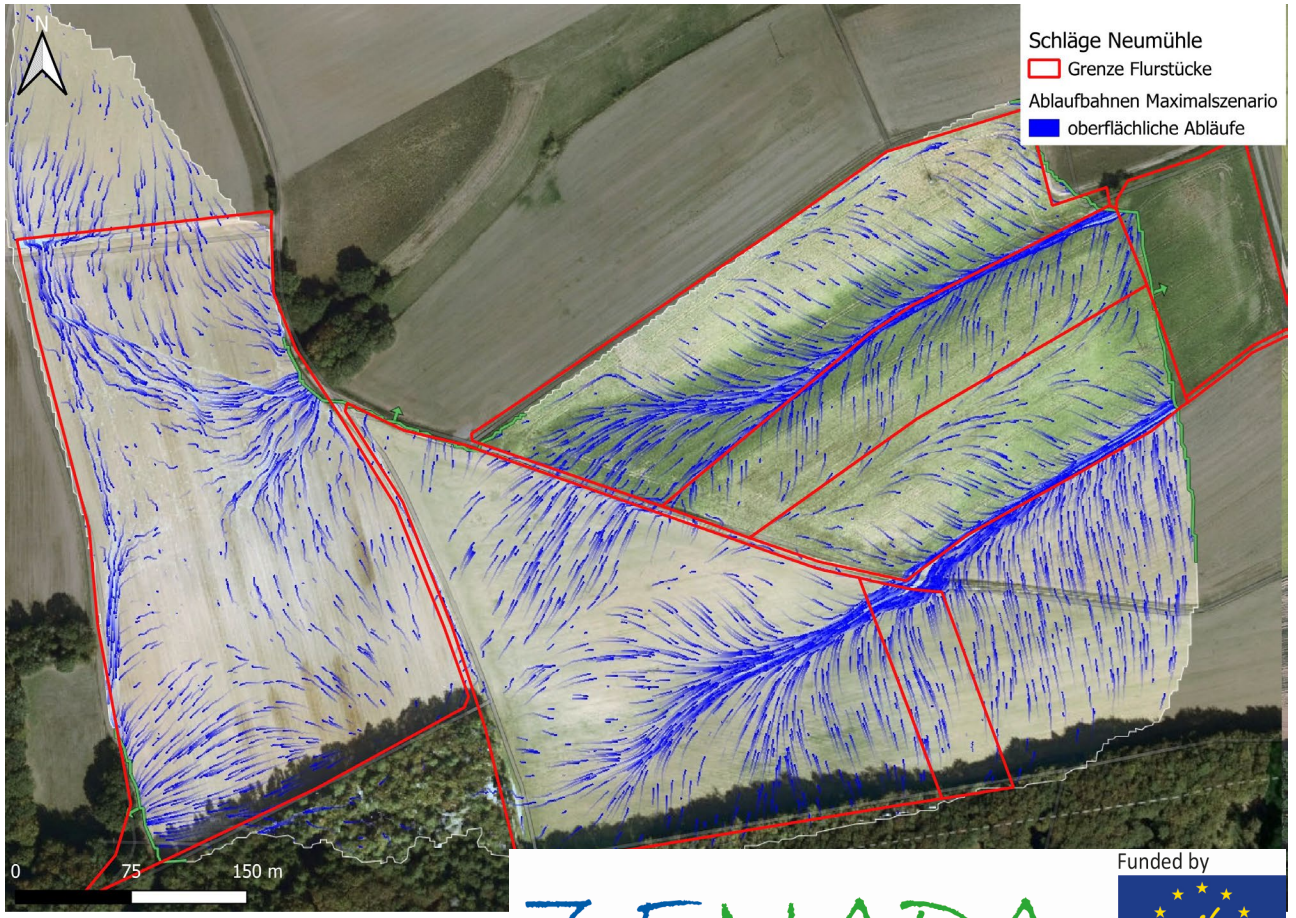

Large cherry orchard

- 7.2 ha
- Slope inclination <5 - 10 %
- Crop rotation:
  - Silage maize - winter barley - silage maize - winter barley - silage maize - winter rye
- 0.99 ha wooded area
- 1701 Poplars 6 varieties

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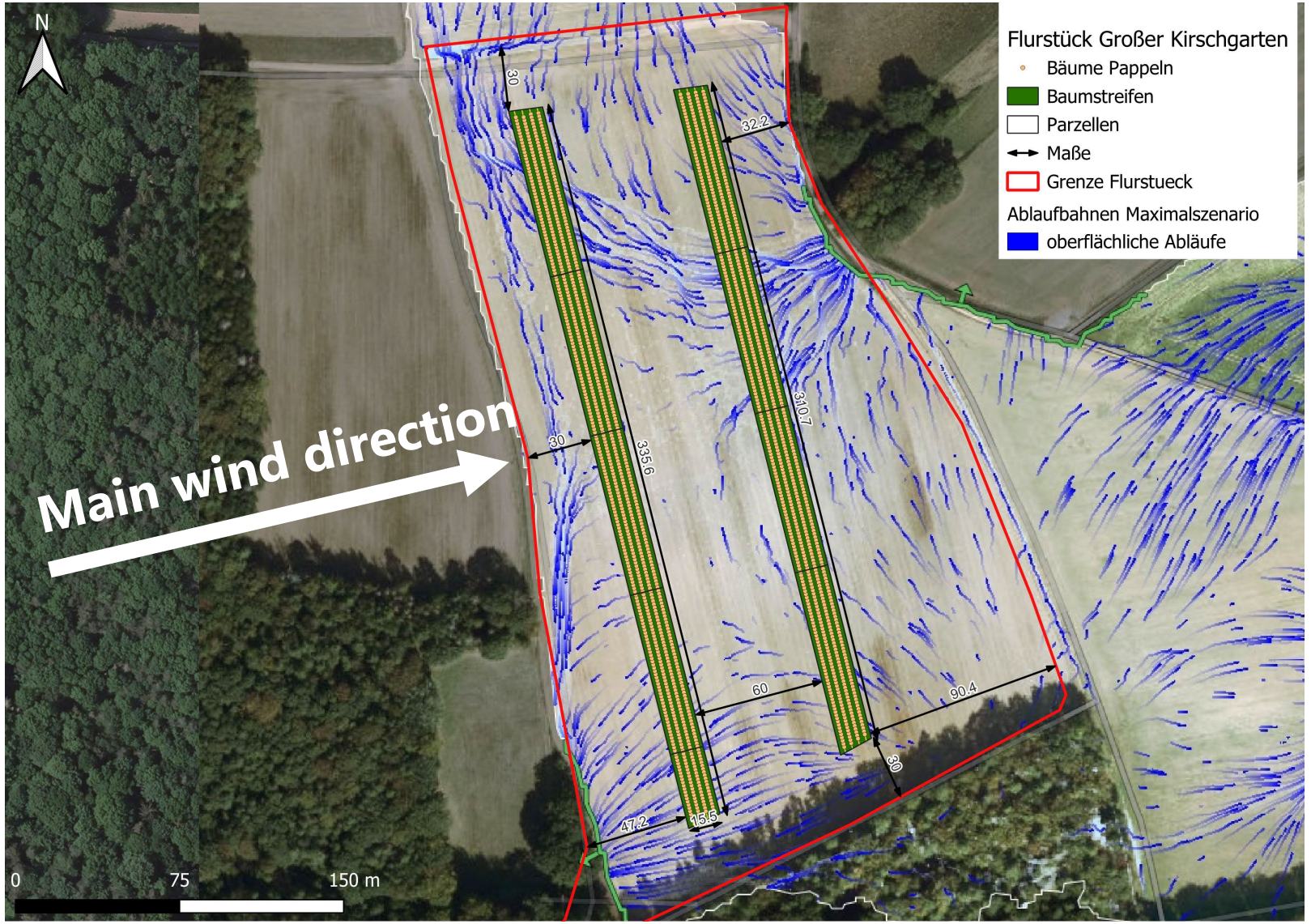

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Teaching and research farm for livestock farming Hofgut Neumühle

- Agroforestry system on 25.72 ha
- With 1.97 ha of wooded area
- Distributed over 3 strokes
- Agricultural wood strips with 2 to 5 rows of trees
- 3,082 trees
  - 6 types of poplar: 2,922 pieces
  - 9 types of valuable timber: 162 pieces
- Plant spacing in the row 1.5 m
- Between the strips 20 - 60 m
- Wood is used to heat the farm and guest houses

Poplar	
wiss. Designation	**Variety**
Populus maximowiczii x *trichocarpa*	Matrix 11
P. trichocarpa x *maximowiczii*	Bakan
P. trichocarpa x *maximowiczii*	Skado
P. deltoides x (*P. trichocarpa* x *maximowiczii*)	Dender
P. deltoides x (*P. maximowiczii* x *trichocarpa*)	Brand
P. deltoides x *nigra*	Vests

Valuable woods	
Sc. Designation	**German name**
Prunus avium	Bird cherry
Quercus cerris	Turkey Oak
Quercus pubescens	Downy oak
Quercus petraea	Sessile oak
Sorbus aria	Whitebeam
Sorbus torminalis	Service tree
Corylus colurna	Tree hazel
Tilia cordata	Winter lime tree
Acer pseudoplatanus	Sycamore maple

Practice: Cooperation Wurzener Land-Werke & Böhlitzer Agrar e.G.

- ✓ Contract: Agreement on the planting, maintenance and management of an agroforestry system at Tauchnitzgraben
- ✓ Agrargenossenschaft e.G. Böhlitz
- ✓ Wurzener Land-Werke GmbH

Data rounded:

- 77 ha field size
- 17 ha agroforestry (22%)
- 58.5 ha arable land (76%)
- 0.5 ha set-aside (1.6%)
- Planting spring 2025
- **31,500 trees**
- Investment planting 100.000,- €
- 1st harvest from winter 2031/2032

Planning values and connecting them with the village

- Additional wood-based heating grid with **1 MW heating capacity** is currently planed
  - Construction in the next 6 years
- Until then,
  - actual harvest volumes are known
  - Additional areas can be incorporated if required
- 26.2 ha of agricultural woodland provide a yield of
  - 12.5 t Atro woodchipps in a staggered use for the provision of
  - 2,000,000 kWh heating energy =
  - Energy for 133 houses (15,000 kWh/a consumption per house)
- After 12 years, the crop is harvested every 6 years

Start of harvest	Harvest year	Required area in ha	BCM
Harvest after 6 years	6	5.3	2,439
rolling system	7	4.6	2,439
	8	4.0	2,439
	9	3.6	2,439
	10	3.2	2,439
	11	2.9	2,439
	12	2.7	2,439
Required area in ha		26.2	


Life
wurzener Land-Werke
Gemeinsam für eine Region.

6 | Knowledge sharing
= Basis for further activities

Knowledge & information

IfaS

Practical guide

- Guide for municipalities and project developers (also for smaller systems)
- Innovative approaches in Germany
- Provision of knowledge for action

Reference: https://mediathek.fnr.de/leitfaden-ee-kommunen.html

Further information

- DeFAF e.V. was founded by more than 80 people in Berlin on June 25, 2019.
- IfaS is a founding member.
- https://agroforst-info.de/

DeFAF
Deutscher Fachverband für Agroforstwirtschaft

What shapes the cultivated landscape?

Sustainable cultivated landscape development is increasingly hindered by sectoral and competing laws and administrative action.

+ … The economy of innovation shapes the cultivated landscape?
+ … The economy of the cultivated landscape shapes innovation?
+ How to maintain values?
+ What hinders developments?

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Climate protection, biodiversity and bioeconomy,
a question of the local/regional
Commitments

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