Land Consolidation and its Contributions to Landscape and Water Management

ECAP – Nitra Training Visit
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BOKU Vienna

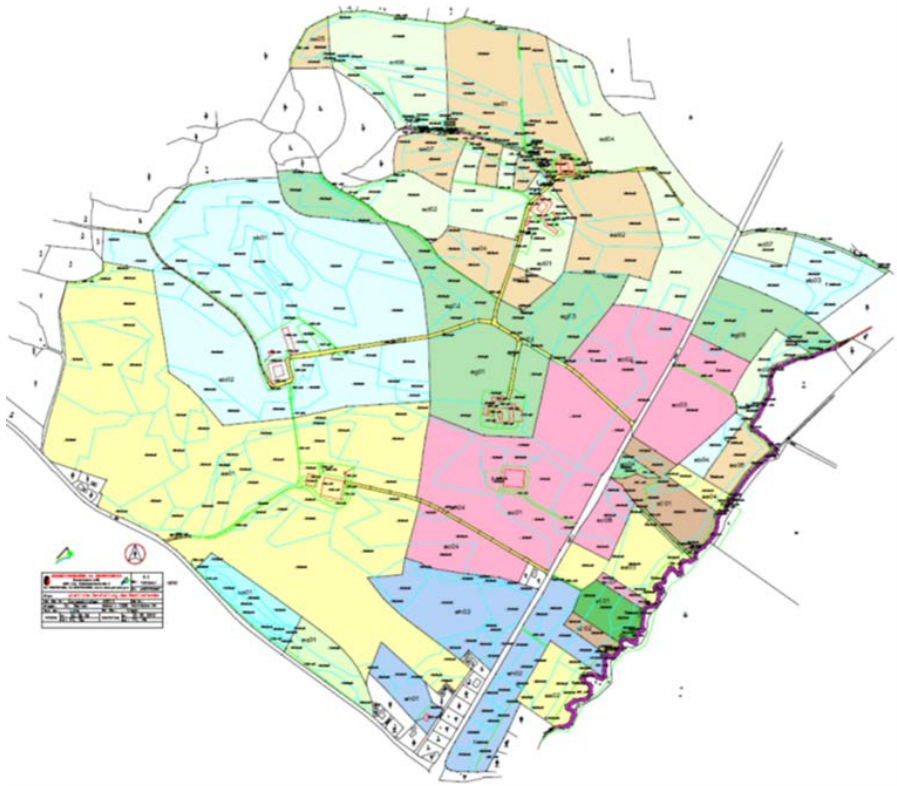
Land Consolidation

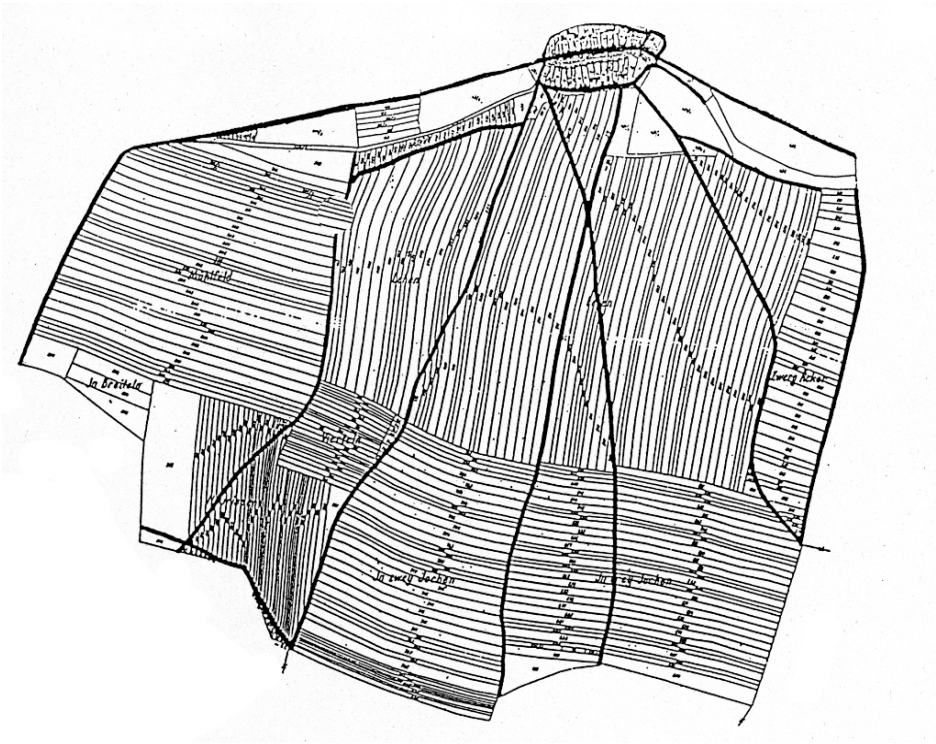
- Land consolidation (LC) is a tool to adjust the **structure of agricultural holdings** in order to optimize conditions for agricultural production.
- In LC schemes landowners allow their holdings to be restructured into **larger and more convenient land parcels** that are more or less equivalent to the value and size of their original holdings.
- LC is often initiated by individual landowners and is normally based on voluntary participation.

Williamson et al., 2010

Structure of Agricultural Holdings

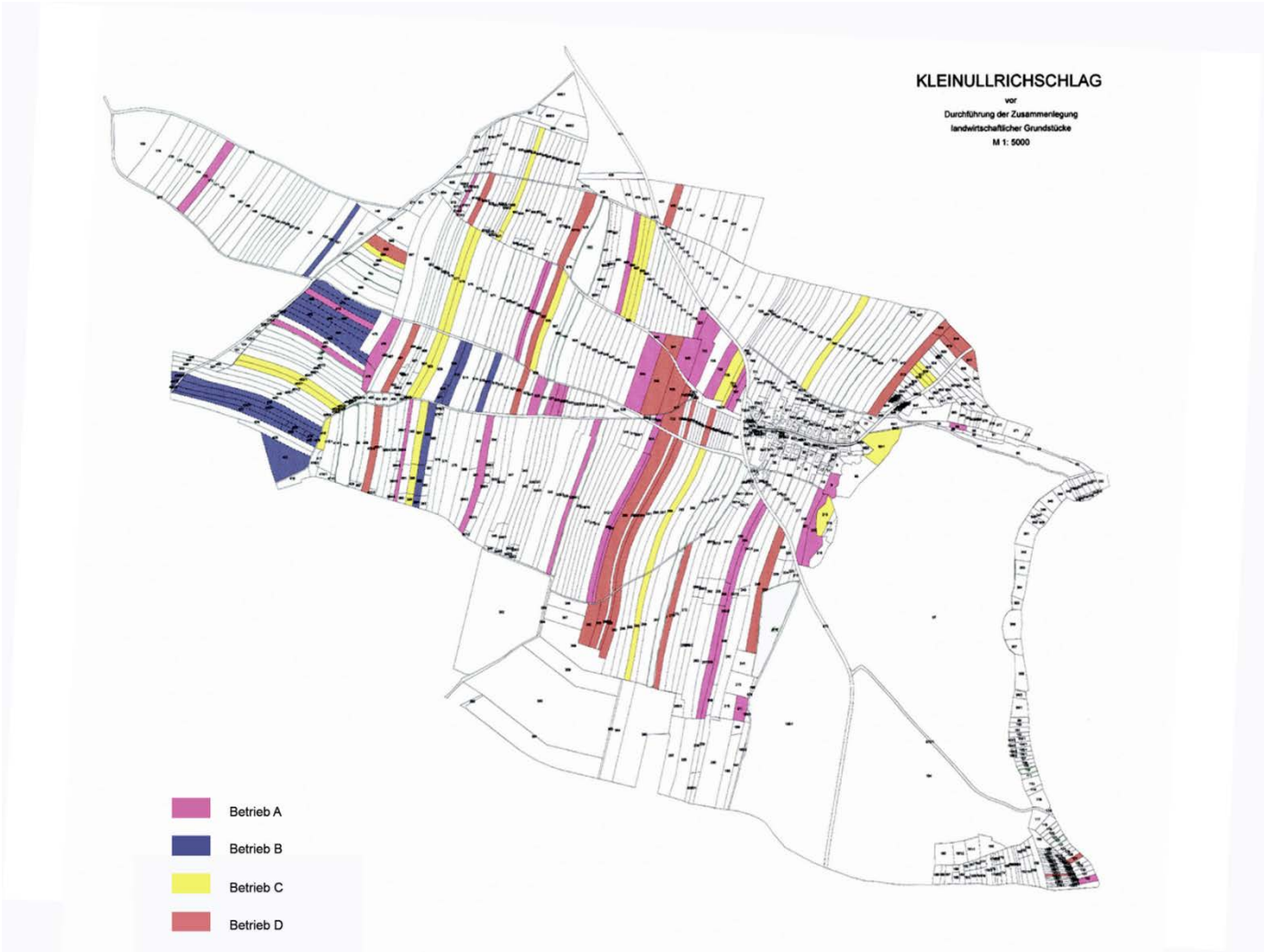
Structure of agricultural holdings is understood as **agricultural land use structures**





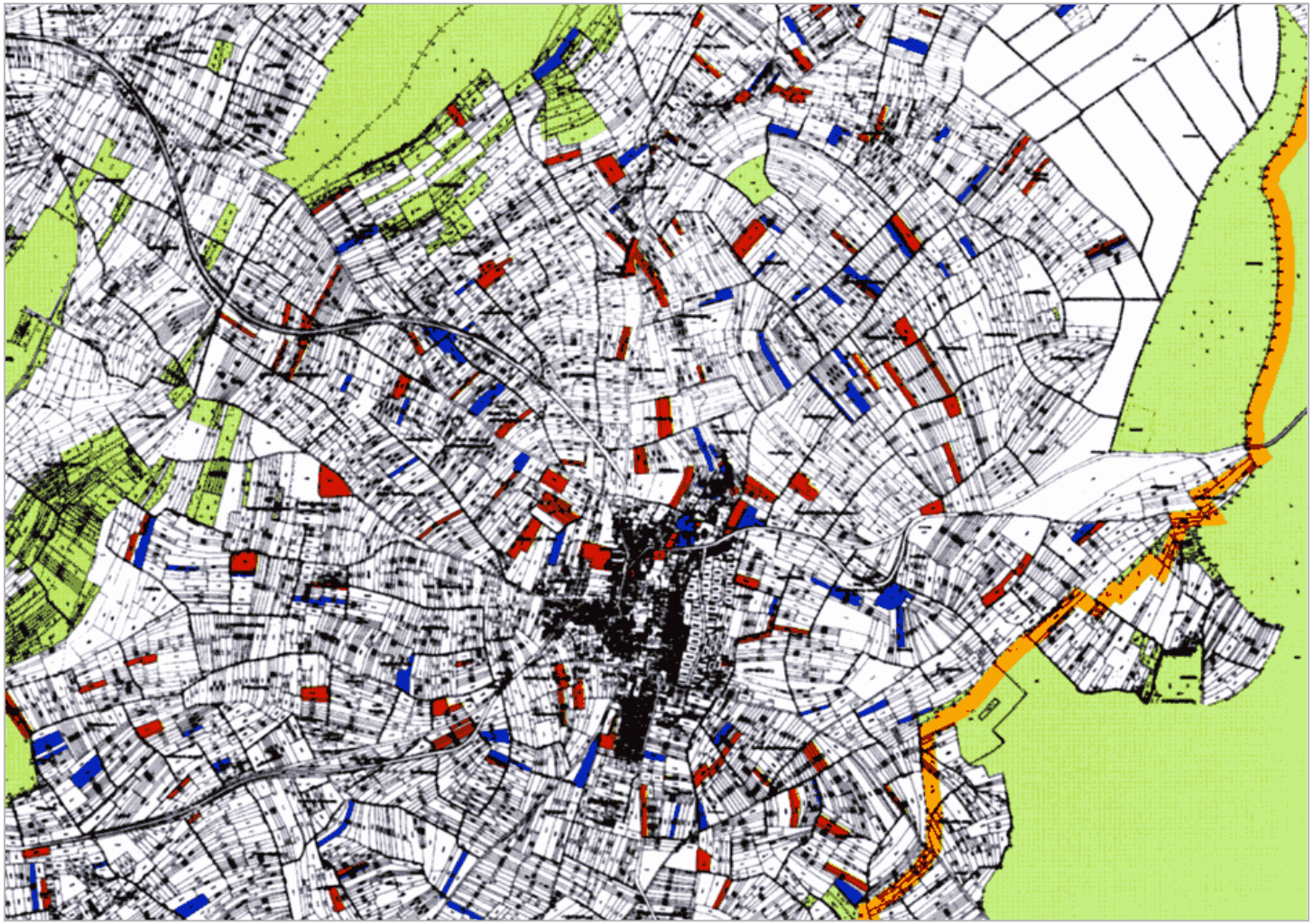
Sources: Land Consolidation Authority of Upper Austria; IRUB

Small Scaled Parcels, Land Fragmentation



Source: IRUB

Land Fragmentation



Source: ARGE Landentwicklung, 1999

Land Consolidation

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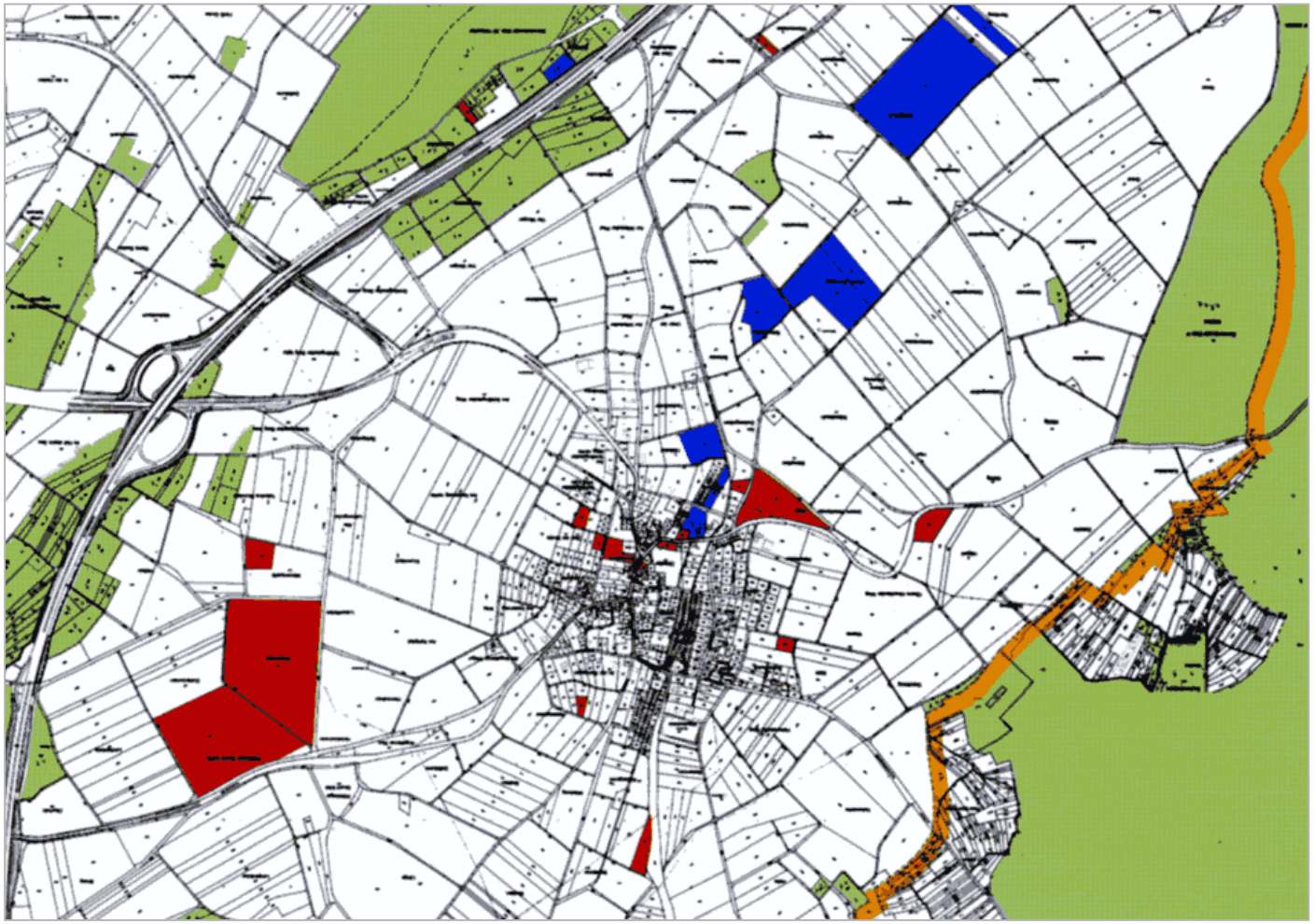
Improvement of agricultural land use structures by LC



Source: ARGE Landentwicklung, 1999

Rural Infrastructure

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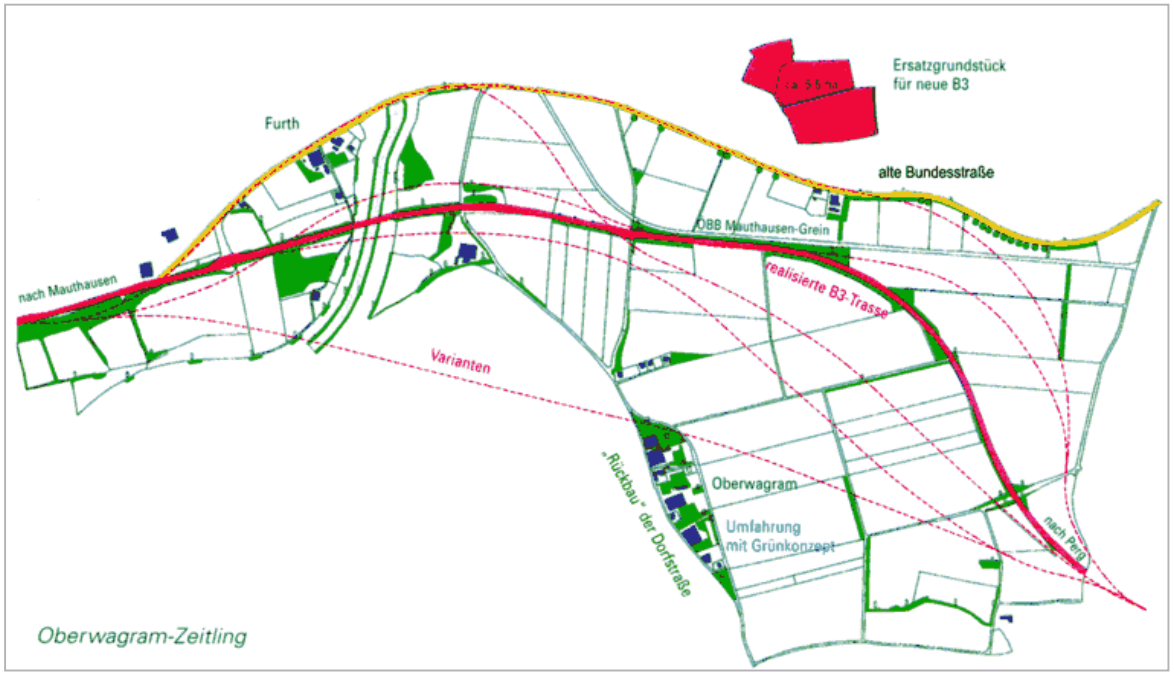
Realising rural infrastructure in LC schemes

Source: IRUB

Land Consolidation

LC may also be used for adjusting the structure of agricultural holdings **to implement (traffic) infrastructure projects, flood protection or conservation and landscape management plans.**



Source: Land Consolidation Authority of Upper Austria, 2001

Land Consolidation

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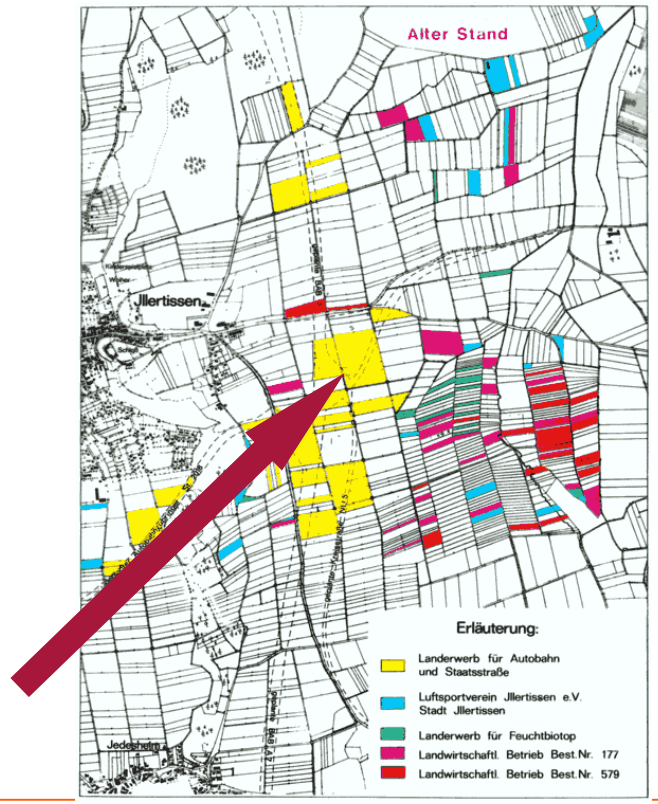
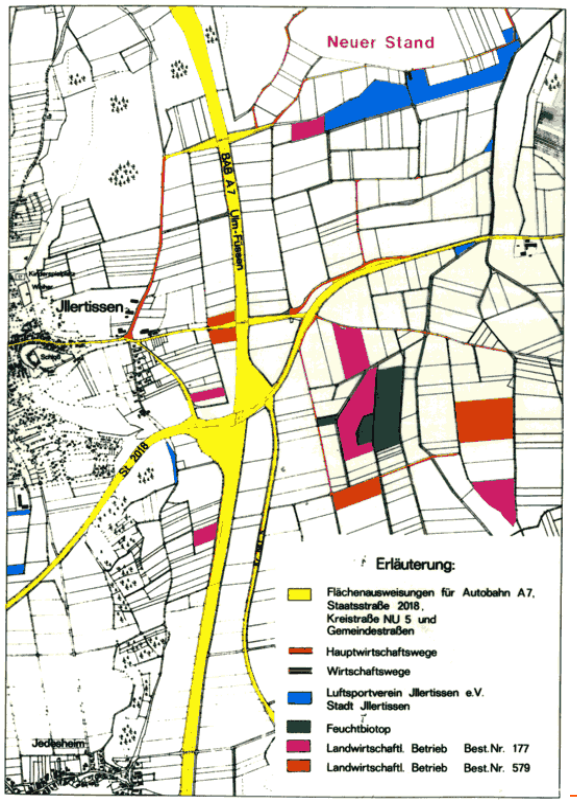
Land consolidation is able to facilitate the implementation of public projects by providing **mobility of land**.





Source: STMELF Bayern, s.a.

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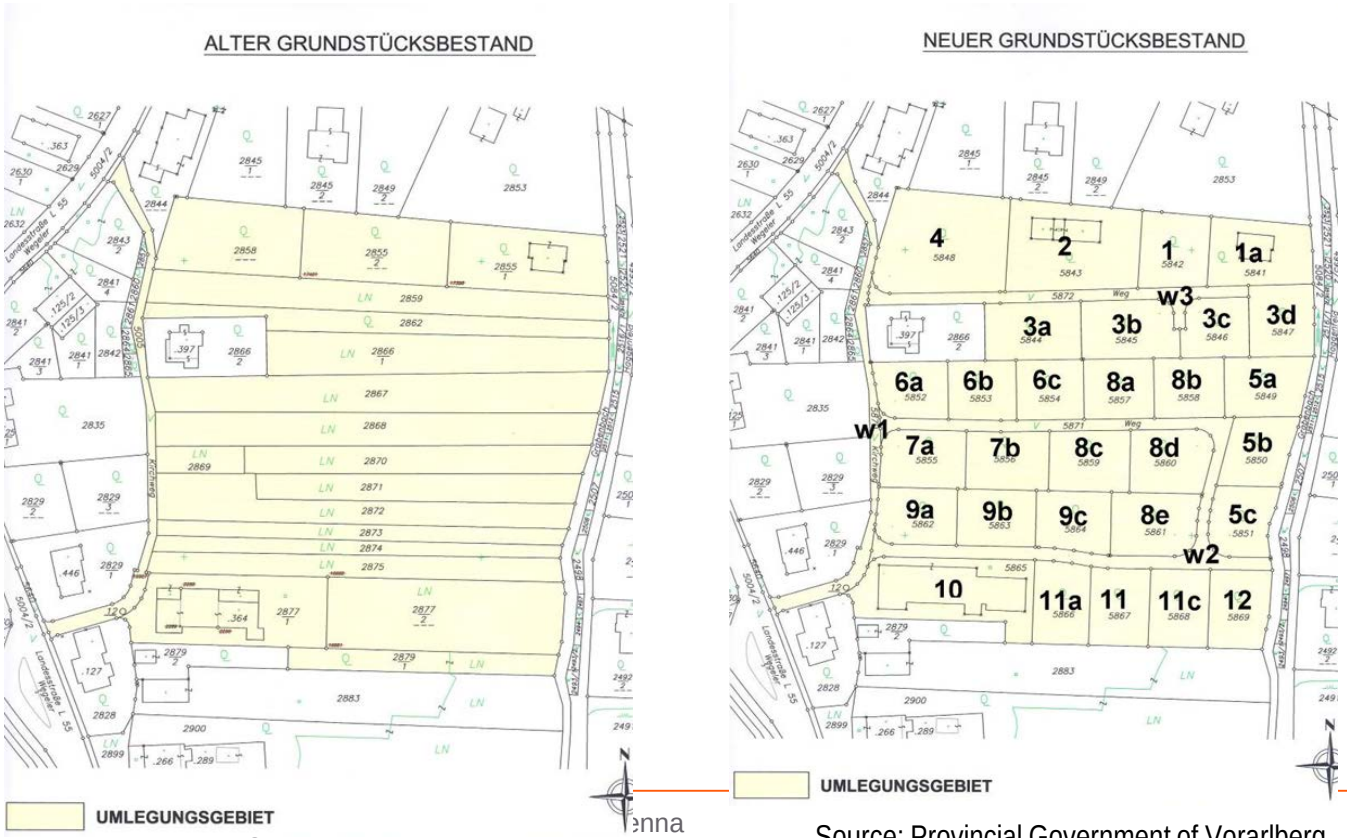
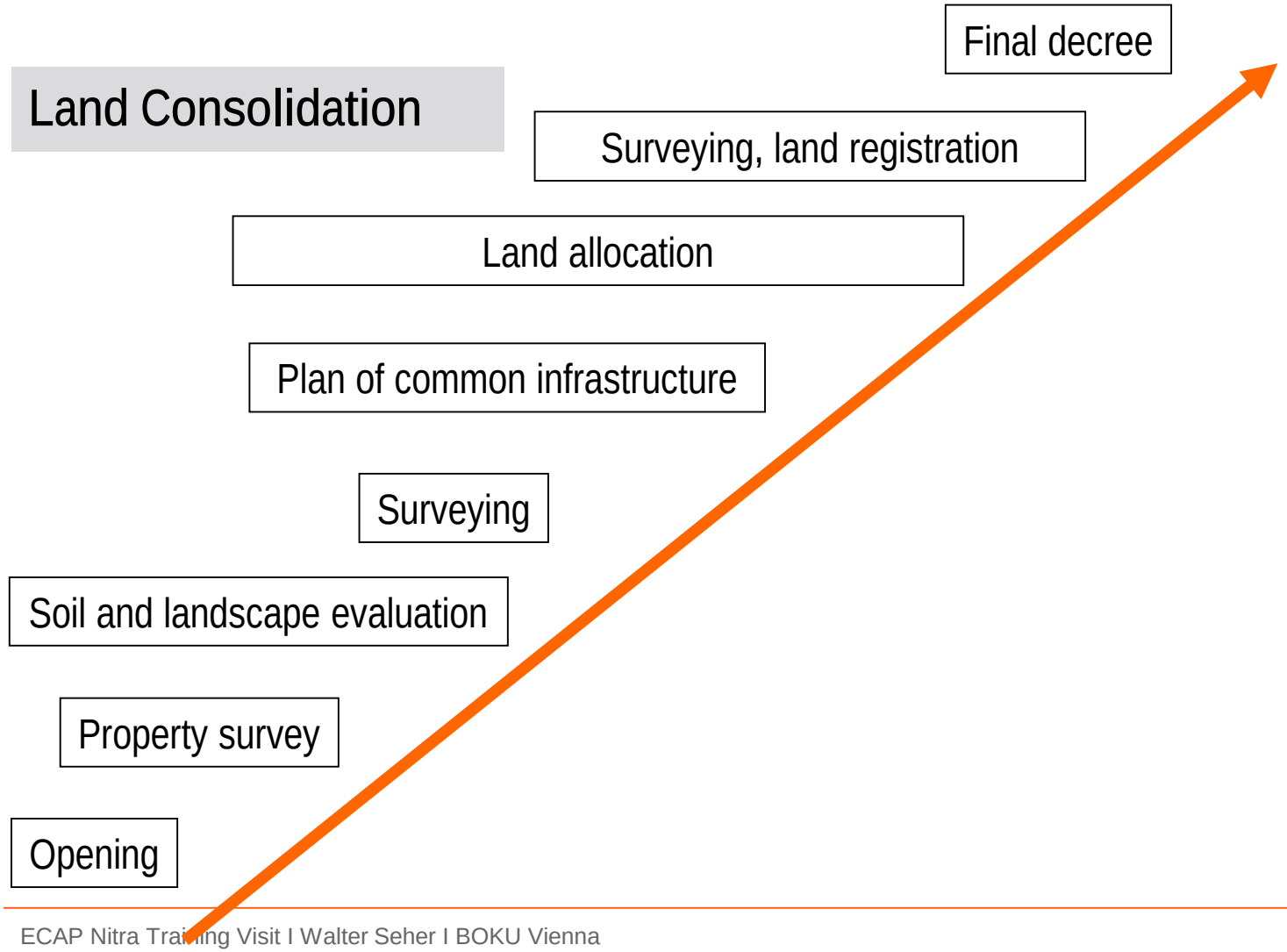
Land Consolidation is also used to facilitate urban development (restructuring housing plots). In this case the process is referred to as **land readjustment.**



Source: Provincial Government of Vorarlberg

Land Consolidation Scheme in Austria



Land Consolidation and Landscape Management

- According to the legal background of land consolidation in Austria ecology and landscape management are **equal planning goals** compared to optimizing conditions for agricultural production.

- **Landscape related problems** like nature conservation issues, biodiversity losses, soil erosion or increased surface water runoff **can be dealt with in land consolidation.**

- Potential impacts of consolidation on biodiversity, landscape image, erosion or water balance have to be compensated by measures of landscaping, water management or erosion control.

Land Consolidation and Landscape Management

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- **Ambivalent relationship** between land consolidation and (landscape) ecology
- Adaptation of laws and consolidation procedures in reaction to environmental challenges
- **Evaluation of existing landscape elements** and **soil erosion assessments** are common procedural steps in Austrian land consolidation schemes providing a basis for integrating landscape management into planning the new parcel structure.

Source: IRUB

Landscape Elements

Elements of cultivated landscapes **not used** or just **extensively used by agriculture**, like hedgerows, trees, bushes, natural slopes, grass stripes, wetlands and others

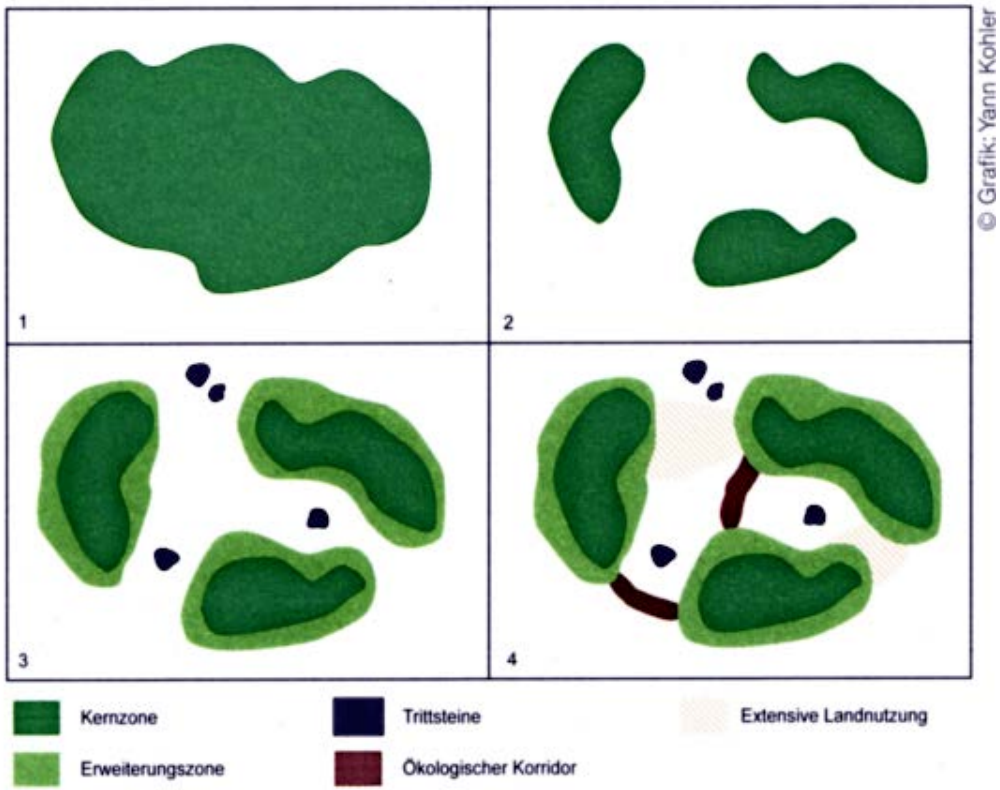
Source: IRUB

Habitat Network Concept

- The **habitat network concept** is the **guiding principle of landscape management in land consolidation schemes.**
- Network of habitats not necessarily with direct links. Species should be able to overcome those distances: consequences for the **density of the network** and the **intensity of cultivation.**

Source: Kohler, 2009

Habitat Network Concept



Source: Kohler, 2009

Four elements of a habitat network:

- Large habitats (core zones)
- Small stepping stone habitats
- Linear corridors
- Extensive cultivation between habitats

Functions of Habitat Networks

= **Ecosystem services** of habitats in agricultural landscapes

- **Biodiversity**: providing diverse habitats in agricultural landscapes
- **Agricultural ecology**: habitats are living spaces for beneficial species (predators of pests); particular importance for organic farming

Functions of Habitat Networks

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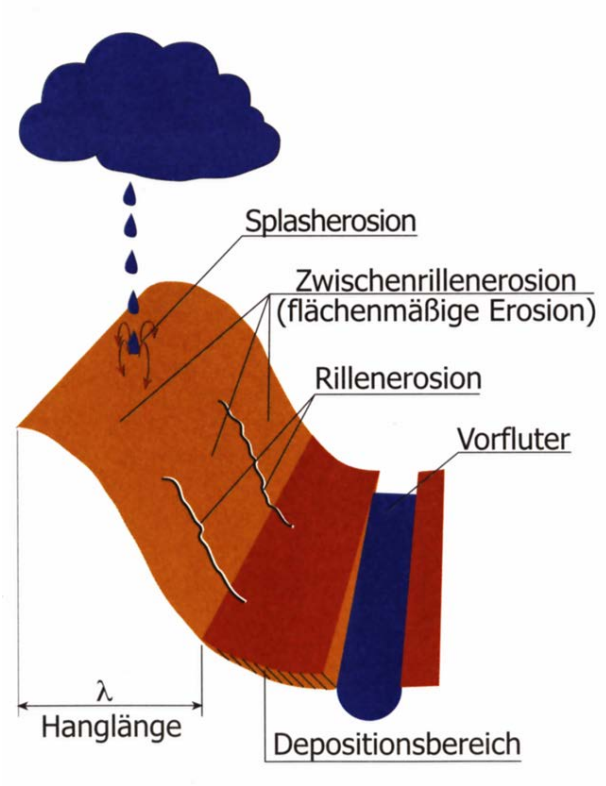
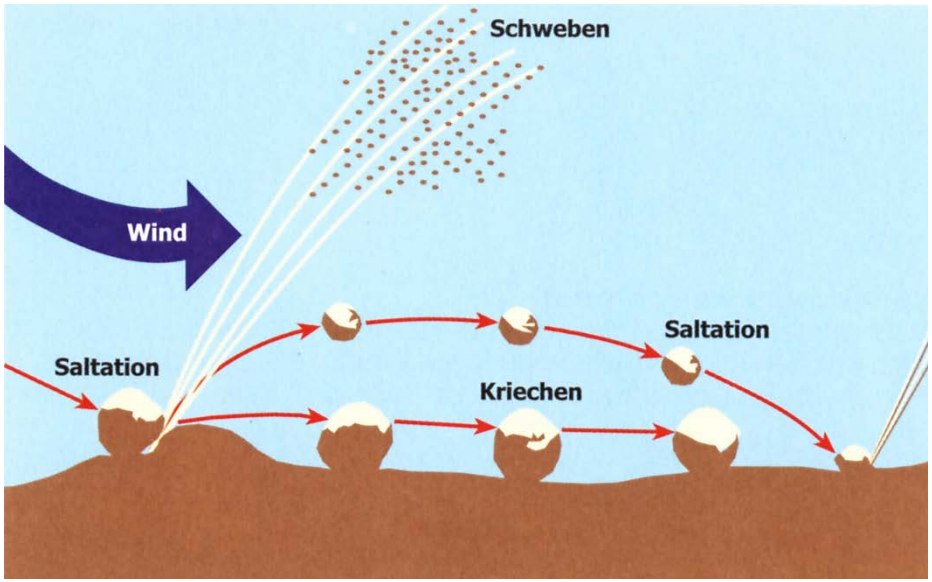
= Ecosystem services of habitats in agricultural landscapes

- Protection against soil erosion and reduction of surface runoff

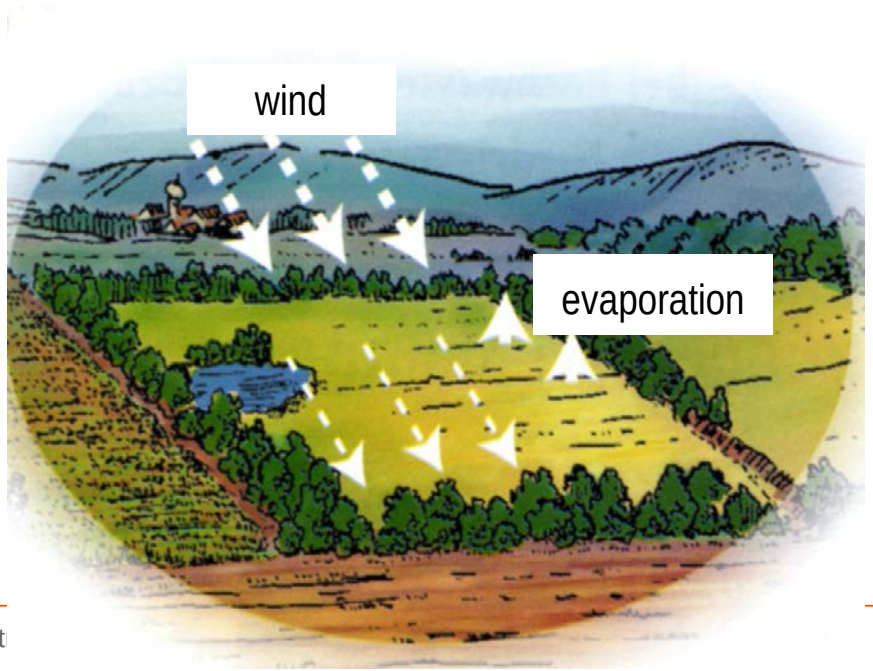




Source: Klik, Hebel, Rosner, o.J.

Functions of Habitat Networks

- Microclimatic effects
  - Reduction of extreme temperatures
  - Improvement of water balance by reduction of evaporation (increased soil humidity)



Source: Solagro et al., 2000

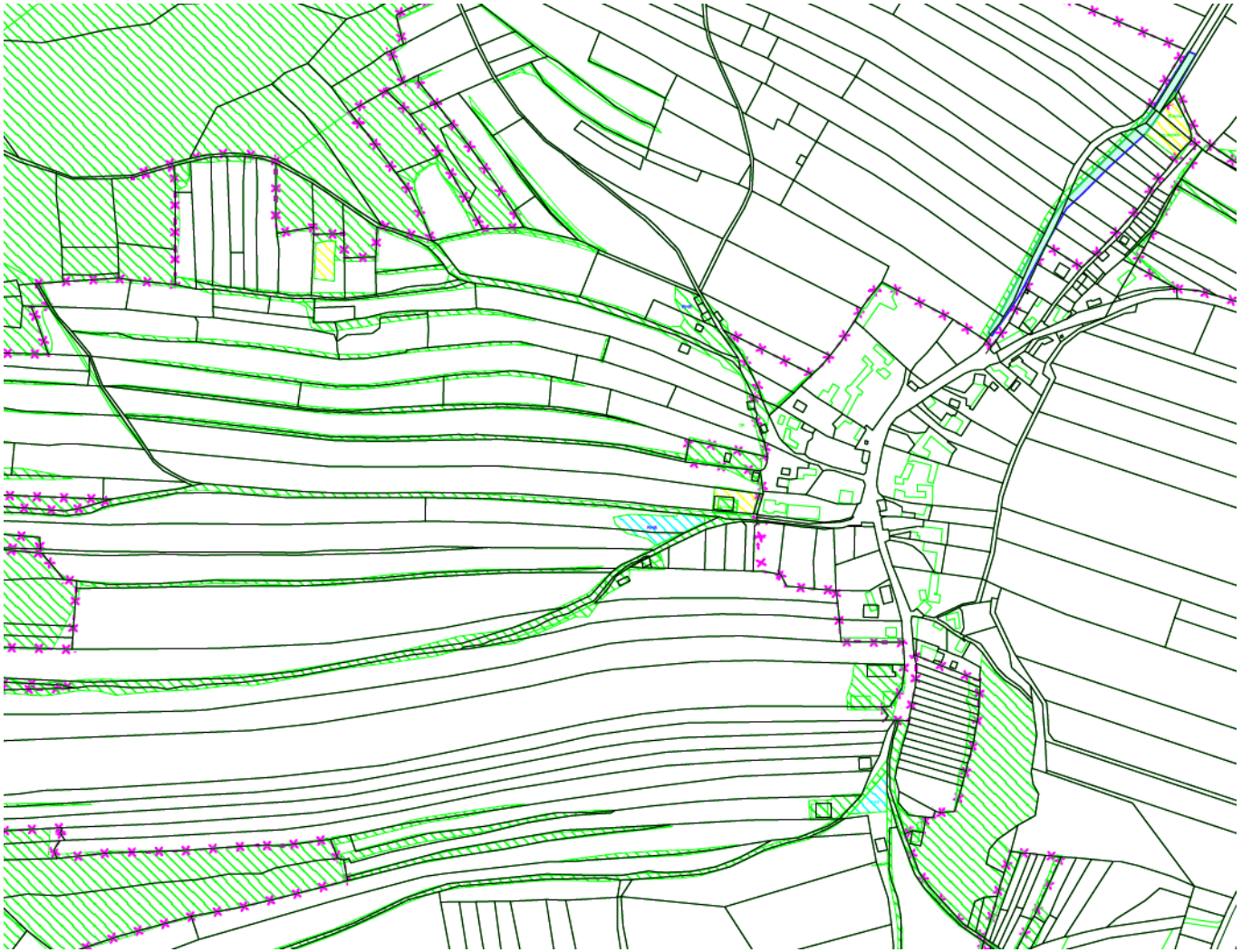
Functions of Habitat Networks

= **Ecosystem services** of habitats in agricultural landscapes

- Important contribution to **characteristic landscape images**

Source: IRUB

Landscape Evaluation in LC Schemes



Source: Land Consolidation Authority of Lower Austria, 2009

Landscape Evaluation in LC Schemes

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Source: IRUB

Land Consolidation – Landscape Management

- LC provides **advantages** for realising measures of landscape management
- 1st: **Land required for landscaping measures** has to be **provided** to a certain amount **by the landowners** involved in the LC scheme
  - Land for 'common infrastructures' (i.e. agricultural roads, ditches, field windbreaks or other landscape elements
  - Additional land for landscaping can be bought by the LC board, frequently funded by agri-environmental programmes

Land Consolidation – Landscape Management

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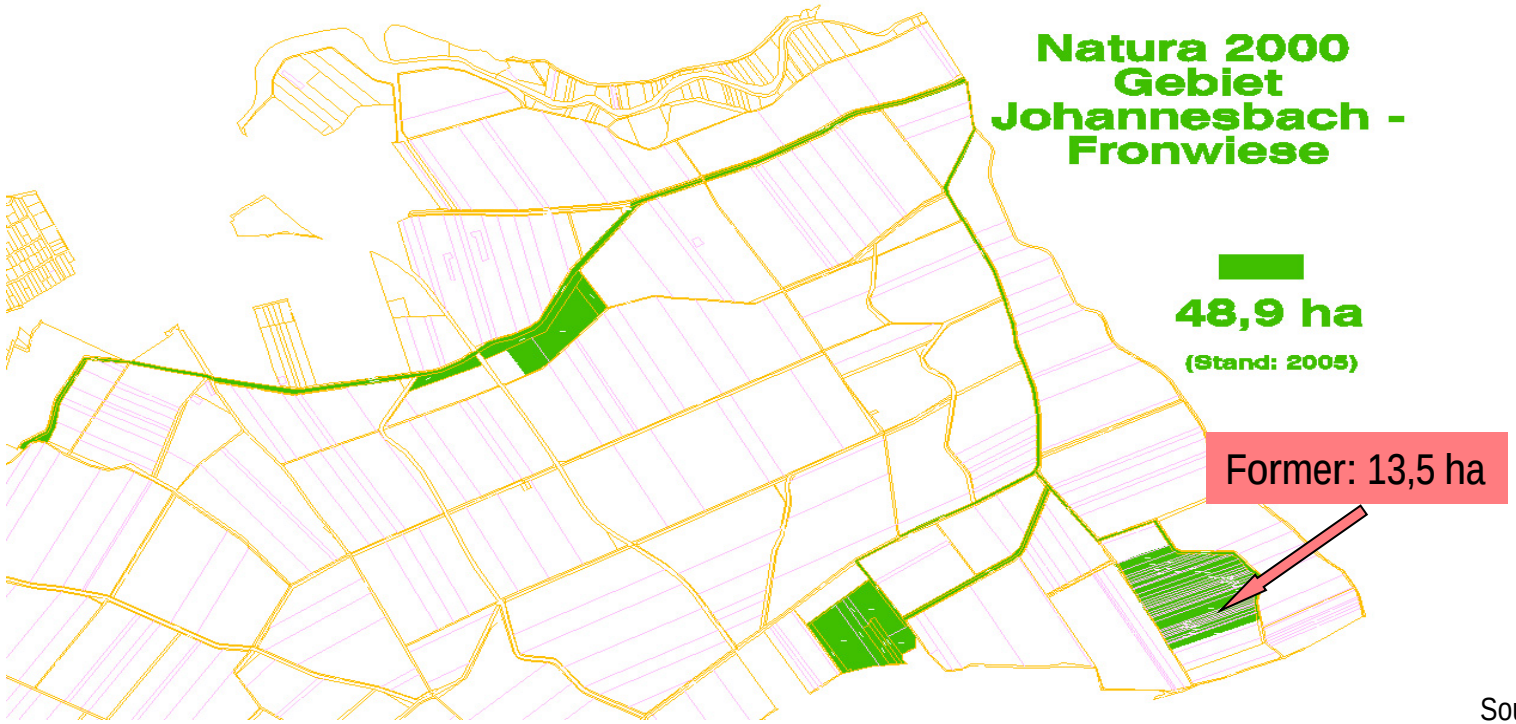
Land Consolidation Leithaprodersdorf / Burgenland

Field windbreaks and buffer zones
Extension of the existing conservation zone to the Nature 2000 area Fronwiese - Johannesbach - New: 48,9 ha



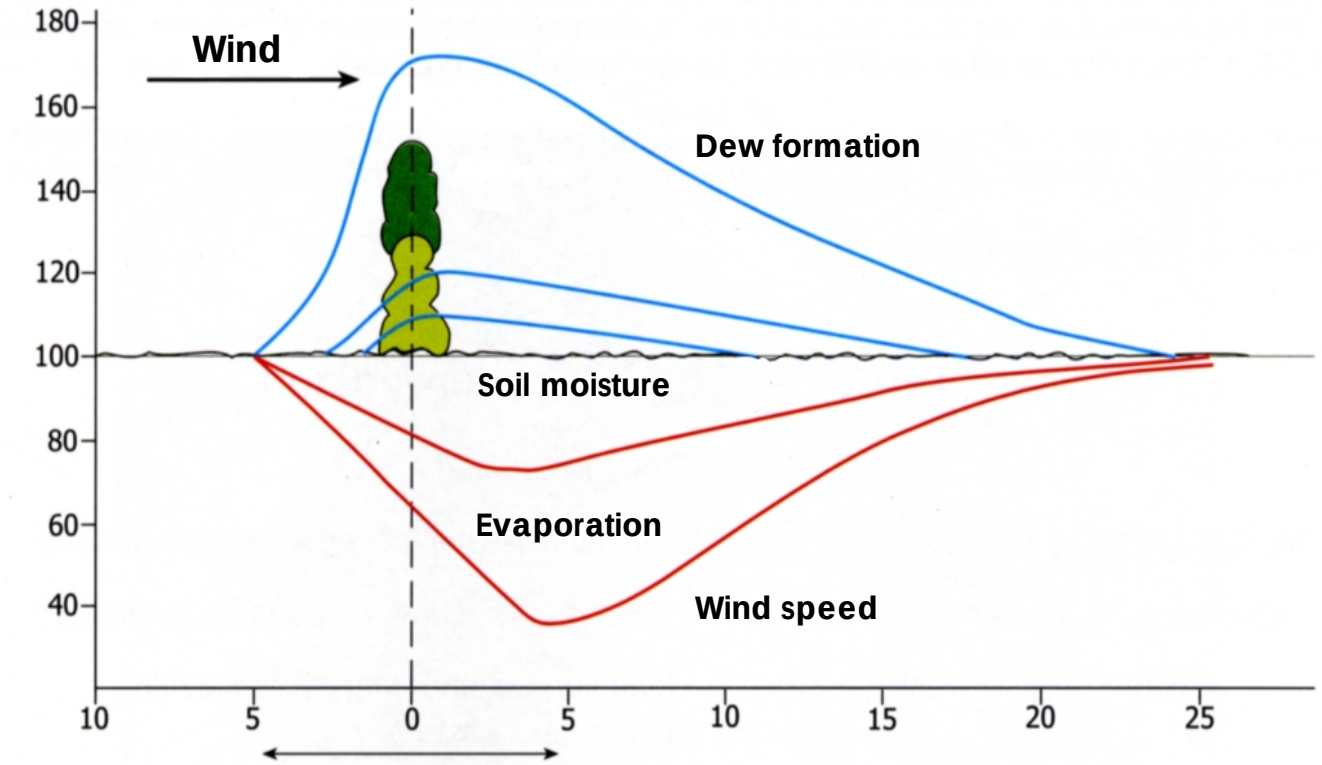
Source: Pelikan, 2007

Land Consolidation – Landscape Management

Landscaping measures in land consolidation Leithaprodersdorf

Source: IRUB

Land Consolidation – Landscape Management



Effects of a field windbreak

Source: Klik, Hebel, Rosner, o.J.

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Source: IRUB

Field windbreaks

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Erosion control by terraces and hedgerows

Source: Solagro et al., 2000

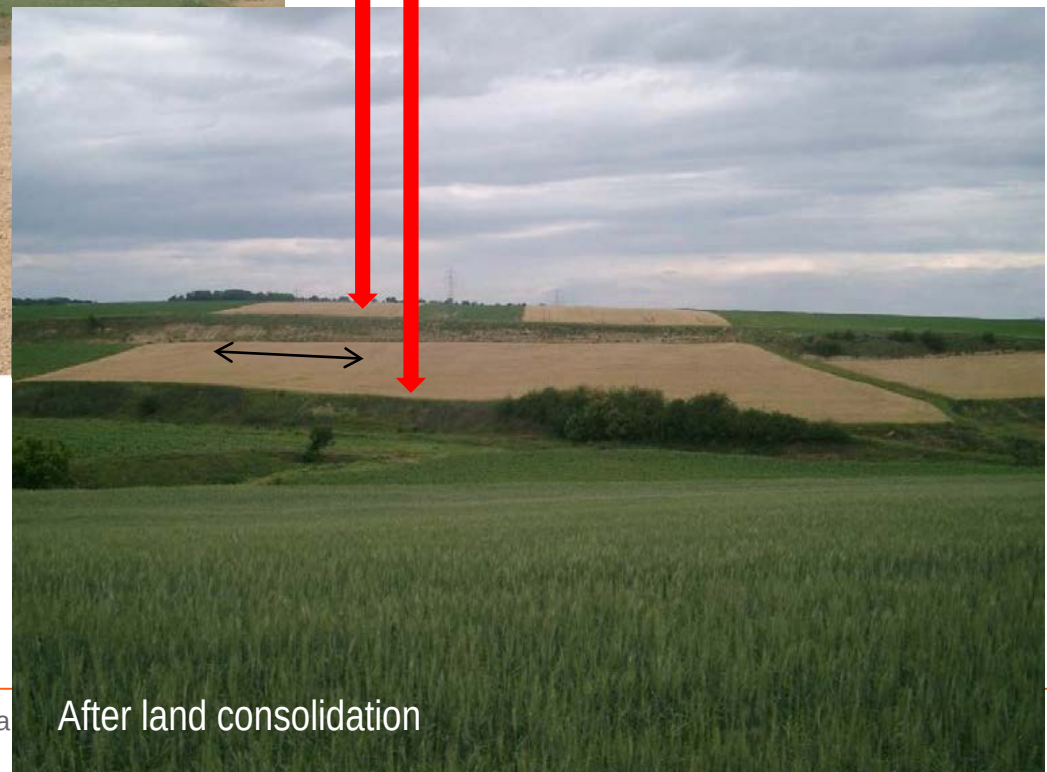
Land Consolidation – Landscape Management

- 2nd: The **planning process** of LC itself is able to **facilitate landscape management**:
  - by designing plot sizes and plot configurations, the direction of cultivation and the layout of the agricultural road network
  - by raising awareness amongst the farmers for landscape management and sustainable farming practices.

Land Consolidation – Landscape Management

Before land consolidation

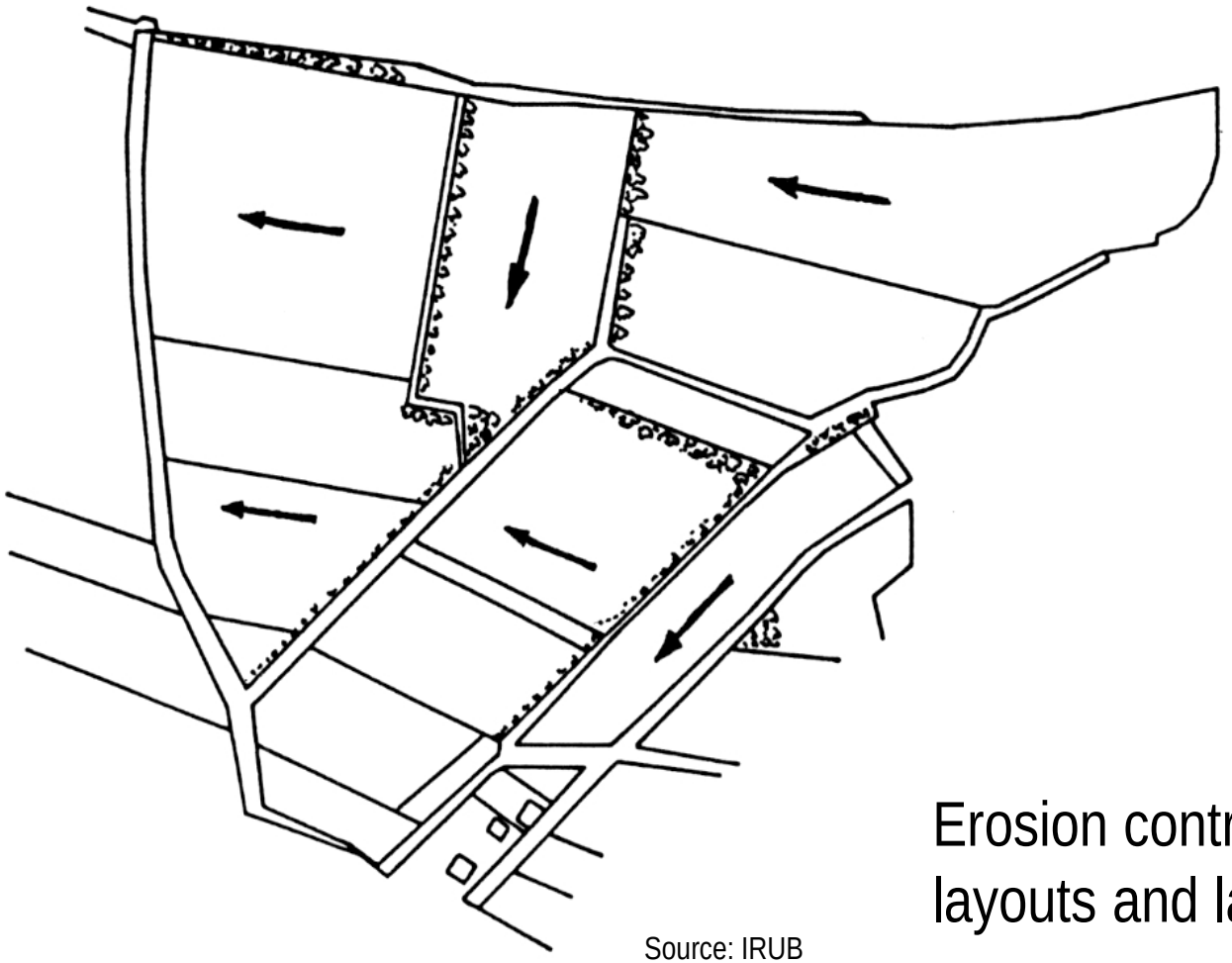
Terracing and change of cultivation direction



After land consolidation

Source: Land Consolidation Authority of Lower Austria, 2013

Land Consolidation – Landscape Management



Source: IRUB

Erosion control by changing plot layouts and landscaping

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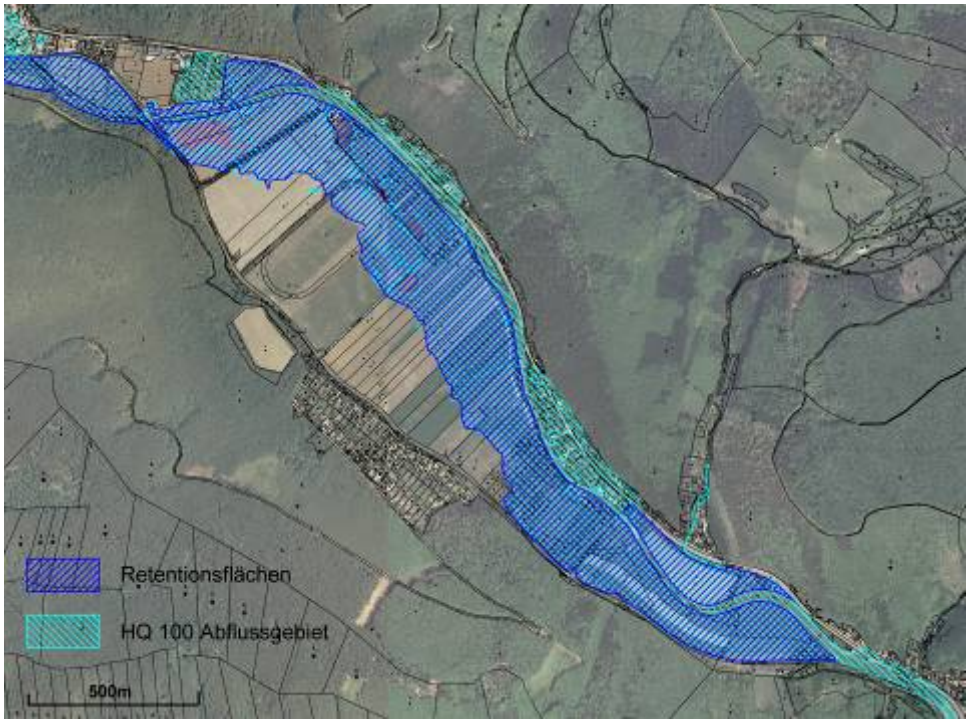
*"Wether it comes up to structural flood protection, to flood retention or to river restoration, the decisive question is about **availability of land**."*

(A water engineer during a FloodRisk II project workshop)



Source: IRUB

Land Consolidation – Water Management

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- EU Flood Directive: paradigm shift from flood protection to integrated **flood risk management**, focus on **preventive** rather than structural **measures**:
  - building bans in highly flood-prone areas
  - reclamation of retention areas at catchment level ("more space for rivers")
- **Acquisition of land for flood prevention** often depends on the agreement of the affected land owners

Source: IRUB

Land Consolidation – Water Management

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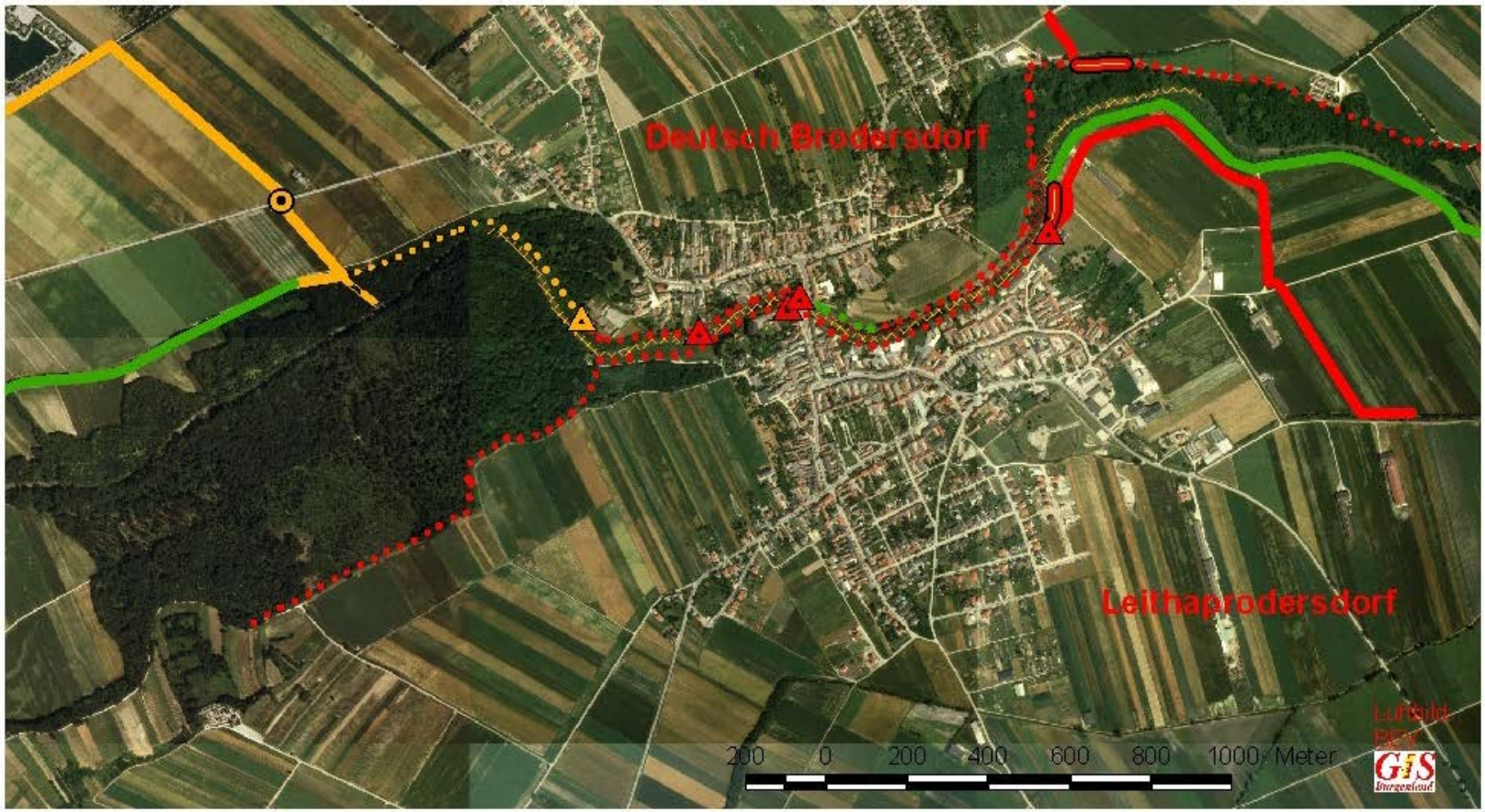
Land consolidation turned out to be a suitable tool to **facilitate land acquisition** for flood plain restoration



Source: Pelikan, 2007

Land Consolidation – Water Management

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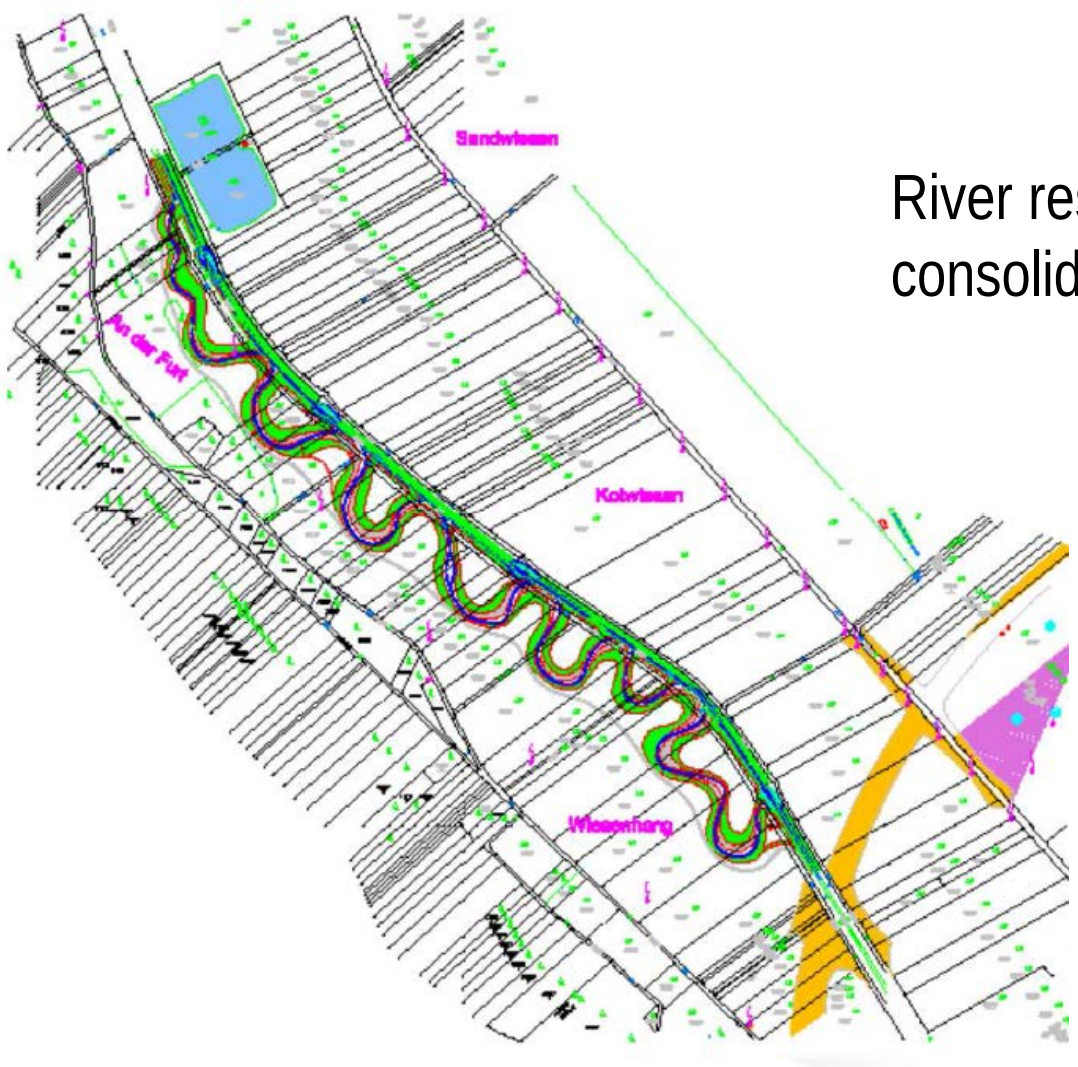
Land consolidation and rural development along the river Lafnitz (Burgenland, Styria)

Sources: Land Consolidation Authority of Burgenland; IRUB

Land Consolidation – Water Management



River restoration in land consolidation

Source: Wild, 2014

Land Consolidation – Water Management

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River restoration and river widening in land consolidation schemes

Source: IRUB

Land Consolidation – Water Management

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Flash floods caused by local heavy rainfall

Source: Haider, 2013

Land Consolidation – Water Management

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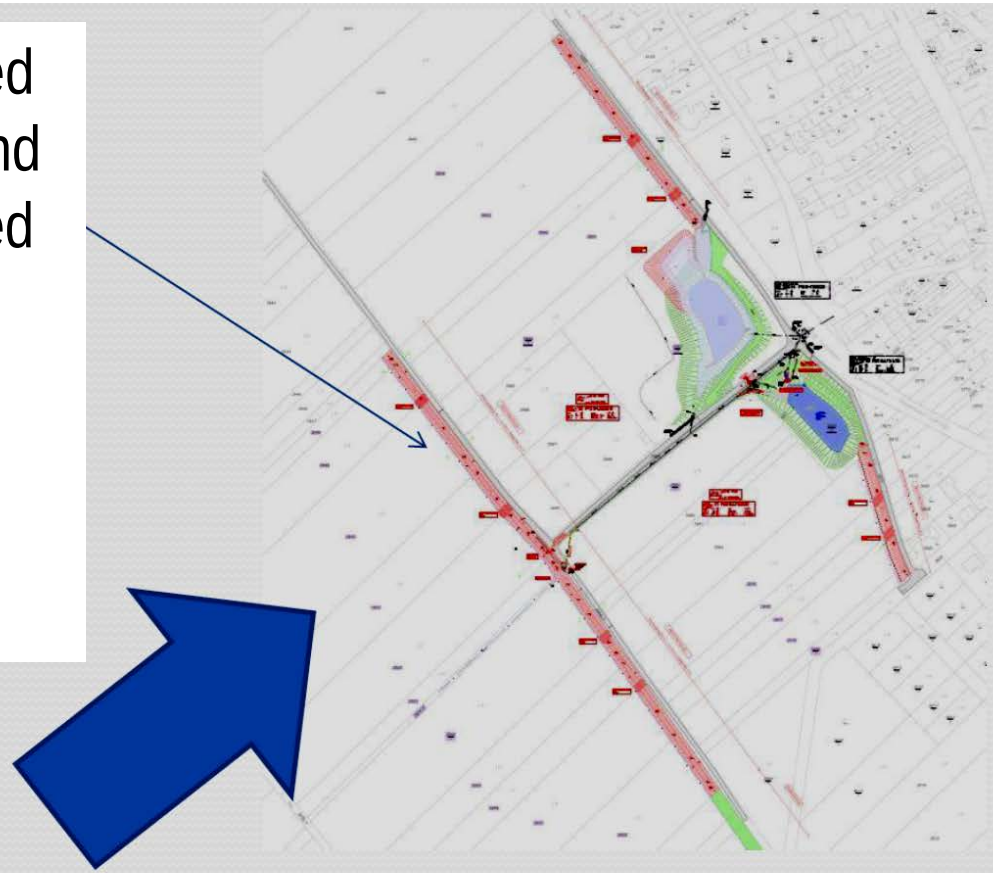
Local, decentralised retention basins and grass strips realised in a land consolidation scheme



Source: Maier, 2016

Land Consolidation – Water Management

Source: IRUB

Land Consolidation – Water Management

- Land consolidation facilitates land acquisition for floodplains and retention basins (Seher and Beutl, 2004) by:
  - increasing mobility of land
  - enabling contiguous floodplain areas
  - socialising land losses and thus increasing the acceptance of land owners affected
  - accelerating land acquisition by concentrated competences in land consolidation procedures
  - synergies concerning cadastral operations and land registration
  - raising awareness for an extensive cultivation of floodplains.
- Essential requirement: land is **available** for floodplain restoration

Restriction: Land Availability

Flooplain restoration or

production of renewables?

Sources: Weinviertel Management, 2007; IRUB

Conclusions

- Land consolidation is able to substantially contribute to landscape and water management.
- **Land mobility** and **instruments to resolve land use related conflicts** as substantial strengths
- Need for **coordination with strategic planning approaches** (e.g. water management, land use planning)
- Land consolidation is a **tool for integrated land management** both for agricultural and public interests.

Thank you for Attention!

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