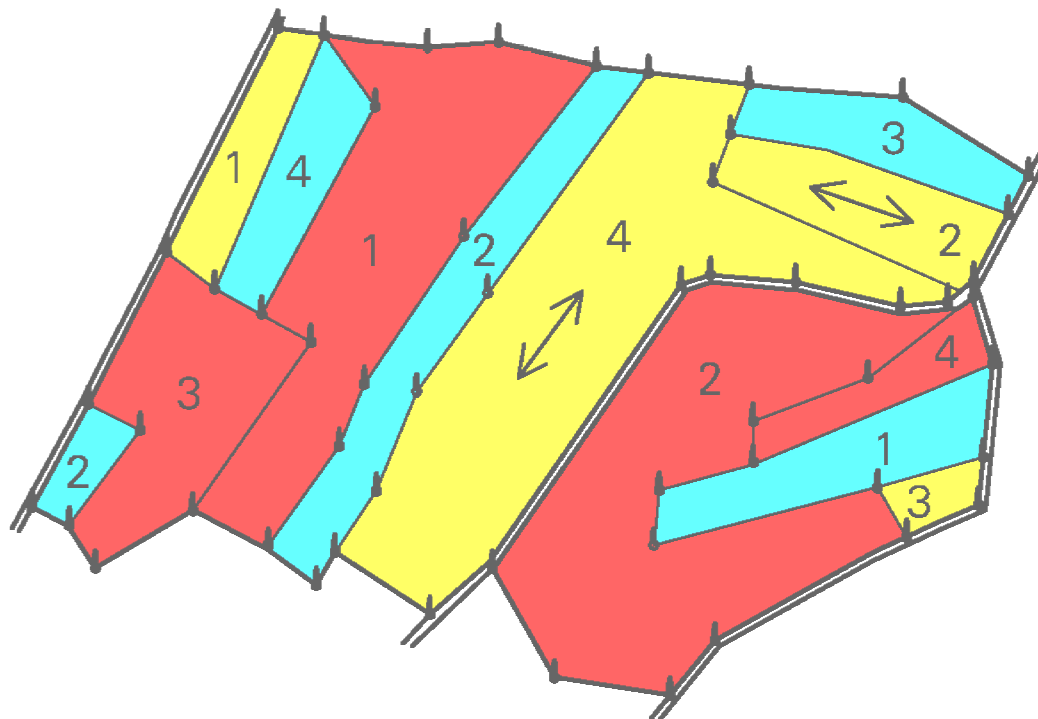


Transborder Farming

- an intelligent approach to more successful farming -



Prof. em. Dr.
Hermann Auernhammer
Freising-Weihenstephan
Germany

J.S.A.M Symposium 2011
July 8, 2011
Obihiro
Japan

Agenda

1. Agriculture in change
2. Large-scale farming versa small-scale farming *
3. Improvements in small-scale farming
4. Transborder farming systems in Germany
 - Zeilitzheim (Theory proof by research)
 - Ulsenheim (Neighborhood)
 - Ettleben (Farming alone)
 - Riedhausen (Social challenge)
5. Evaluation and comparisons
6. Conclusions

Today it would be even better to use an extended differentiation, e.g. field sizes:

< 1 ha

farming

> 100 ha

Micro-scale farming

10 – 100 ha Large-scale farming

Large-area farming

1 – 10 ha Small-scale

Farming today and tomorrow

Main influences to farming in general:

- **Decreasing land resources** (climate change, urbanization, road-based mobility, ...)
- **Increasing world population** (more food, better distribution, reduction of hunger, ...)
- **Food to Fuel discussion** (ethanol, palm oil, ...)
- **Bio energy versa fossil energy** (bio gas, ...)
- **Crude-oil based chemistry in the move to bio-chemistry** (plastics, ...)

Consequences to available land:

- **Enhancement in value**
- **Increasing leasing rates**
- **Increased interest by financial institutions**
- **Land speculation**
- **Land grabbing**
- **...**

Change in farm households

Japan: Three types of farm households developed:

Those engaging exclusively in agriculture (**14.5 %** of the 4.2 million farm households in 1988, down from 21.5 % in 1965);

those deriving more than half their income from the farm (**14.2 %** down from 36.7 % in 1965);

and those mainly engaged in jobs other than farming (71.3 % up from 41.8 % in 1965).

As more and more farm families turned to nonfarming activities, the farm population declined (down from **4.9 million** in 1975 to 4.8 million in 1988). The rate of decrease slowed in the late 1970s and 1980s, but the average age of farmers rose to **51 years** by 1980, twelve years older than the average industrial employee

Source: [Source: http://en.wikipedia.org/wiki/Agriculture,_forestry,_and_fishing_in_Japan](http://en.wikipedia.org/wiki/Agriculture,_forestry,_and_fishing_in_Japan)

Germany: Statistically only two types are recorded:

Those engaging exclusively in agriculture (**45 %** of the 350,134 farm households in 2007, farming 8,907 million ha out of 11,591 million equal to 76.8 % with an average farm size of **51.8 ha**);

and those deriving more than half their income from the farm (**55 %**, farming 23.2 % of the land with an average farm size of **13.4 ha**).

As more and more farm families turned to nonfarming activities, the farm population declined (down from **2.7 million** in 1970 to 1.6 in 1990 and to 1.0 million in 2007). The rate of decrease slowed since the 1970s, but the average age of farmers rose from 47 years by 1995 to **49 years** in 2007.

Source: Stat. Jahrbuch ELF, Bremerhafen 2009

→ But Hokkaido with 6.743 farms, average farm size 38 ha by 2005 (Hokkaido Government, 2009) is different to the whole of Japan and well comparable to Germany

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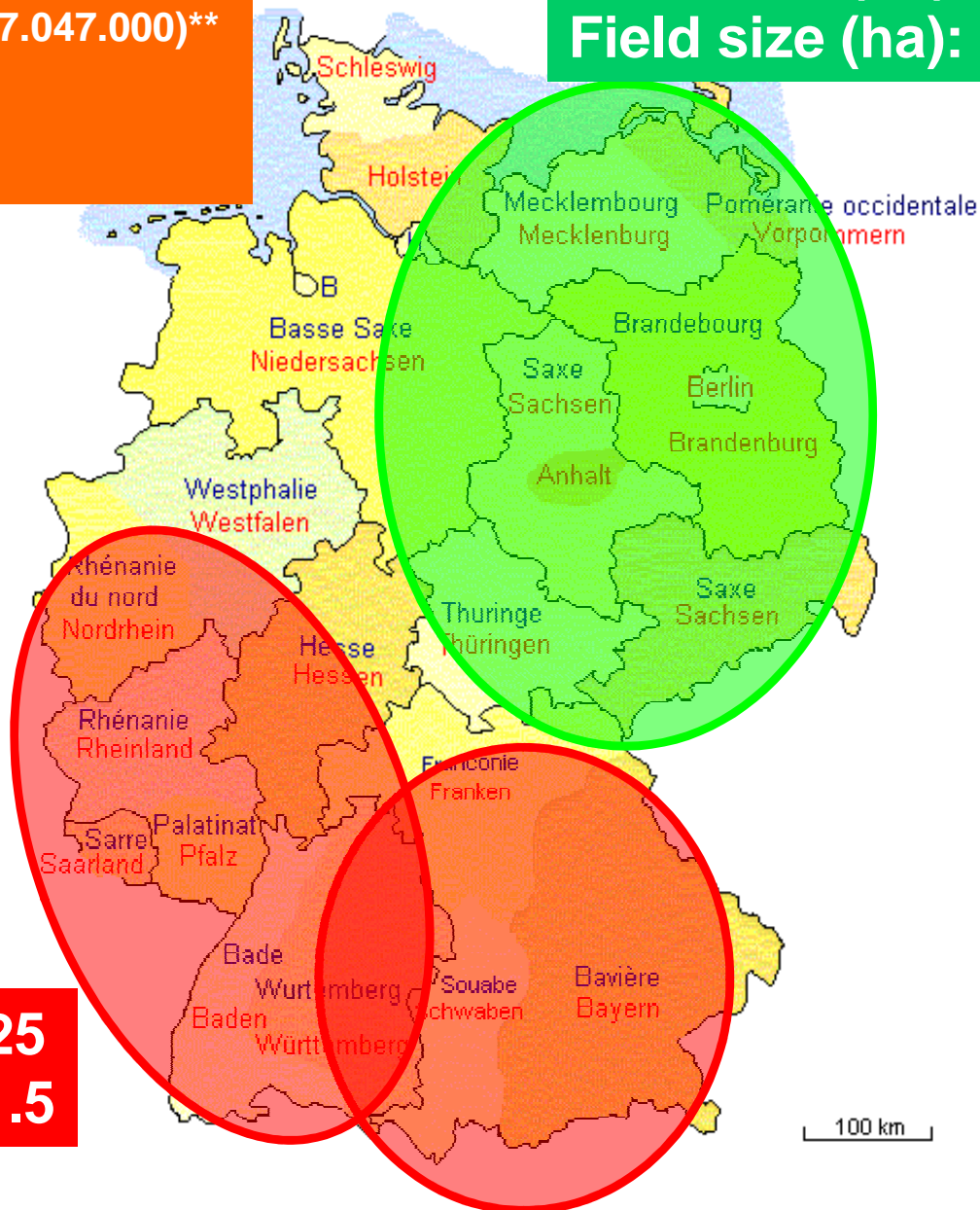
Germany with its large- and small-scale farming

Farms: 349.038* (374.514)**
Farm land (ha): 16.923.000* (17.047.000)**

Farm size (ha): 48.5*

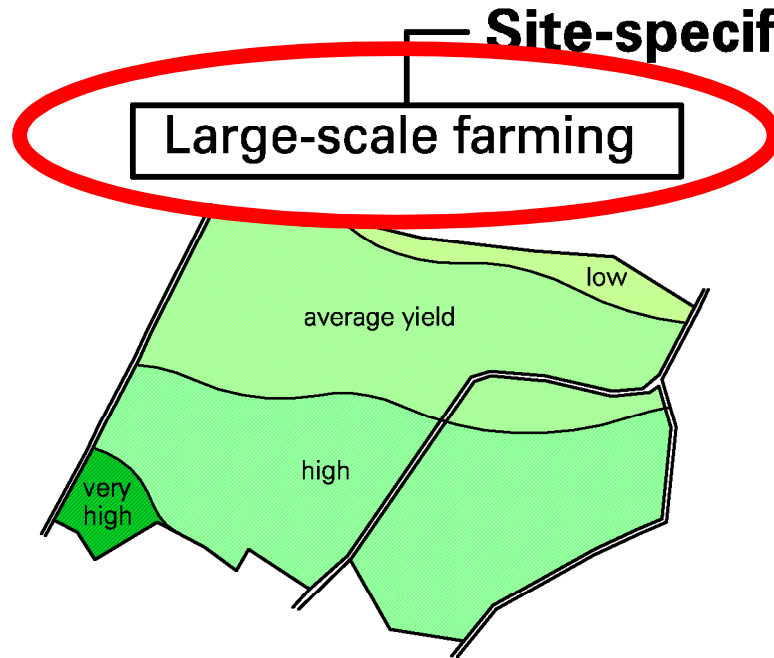
* Farms > 2 ha; ** all farms; 2007

Farm size (ha): ~ 300
Field size (ha): > 30



Farm size (ha): ~ 25
Field size (ha): ~ 1.5

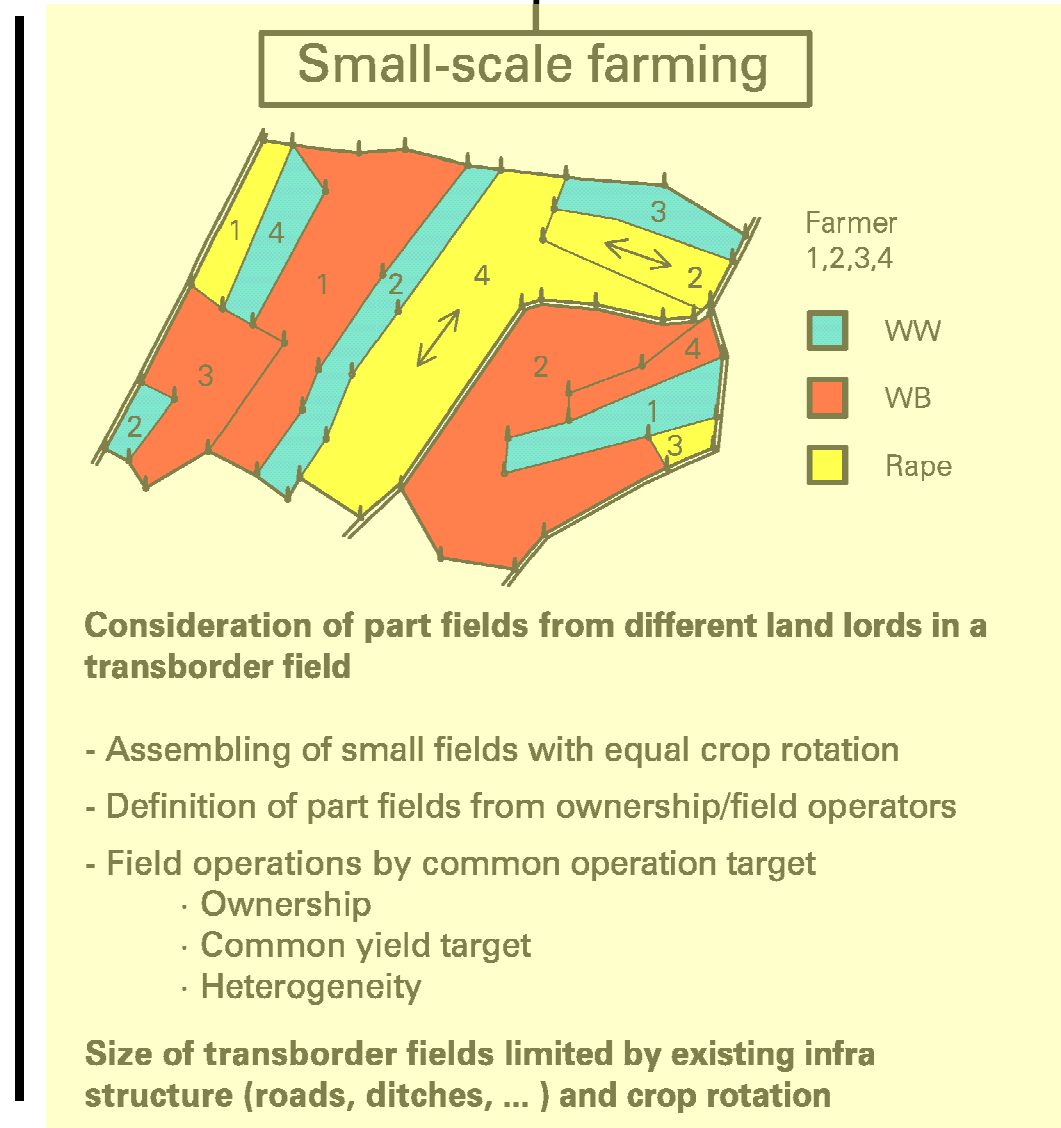
The two ways of Site-specific Part Field Management



Derivation and determination of homogeneous partfields

- Determination of heterogeneities
- Determination of management zones (same yields) under consideration
 - Technical differentiation
 - Economical efficiency
 - Ecological efficiency

Part field determination by minimum field sizes
(> 3 ha to > 10 ha)

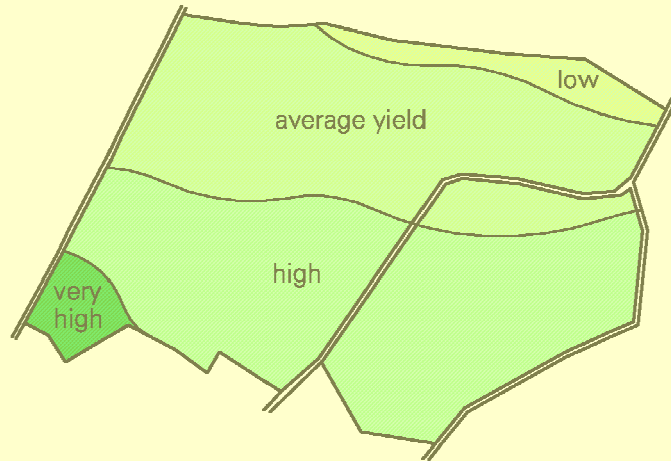


The two directions of Site-specific Part Field Management

It is estimated that **2.6 billion people or 40 percent** of the world's population are small farmers. The large majority of them cultivates **less than five acres of land**. (<http://www.greenpeace.org/usa/en/campaigns/genetic-engineering/our-vision/small-scale-farming/>)

Site-specific crop management

Large-scale farming

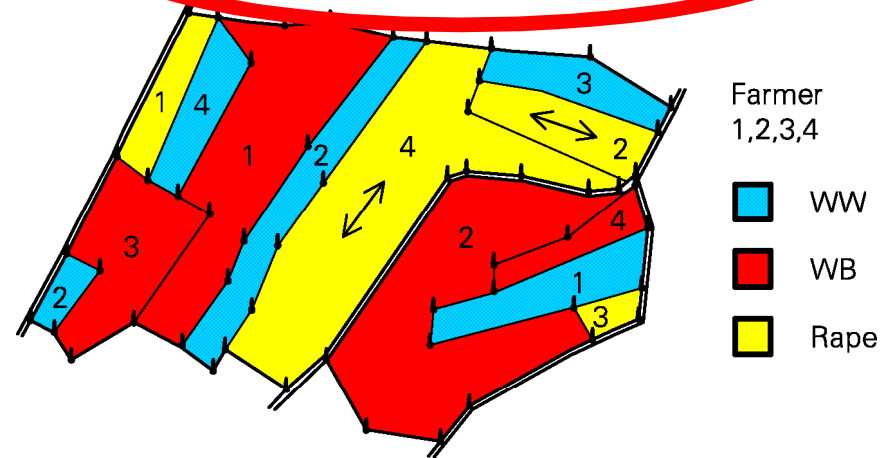


Derivation and determination of homogeneous partfields

- Determination of heterogeneities
- Determination of management zones (same yields) under consideration
 - Technical differentiation
 - Economical efficiency
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Part field determination by minimum field sizes
(> 3 ha to > 10 ha)

Small-scale farming



Consideration of part fields from different land lords in a transborder field

- Assembling of small fields with equal crop rotation
- Definition of part fields from ownership/field operators
- Field operations by common operation target
 - Ownership
 - Common yield target
 - Heterogeneity

Size of transborder fields limited by existing infra structure (roads, ditches, ...) and crop rotation

Situation in small-structured landscapes

In agriculturally small-structured regions (as well as in other small diversified enterprises), many farmers have competitive disadvantages due to small-sized fields and a multitude of single plots resulting in

- Long travel times on roads (farm to field, field to field)
- Low effective working time within the operation time of a field
- Many overlapping areas with fixed implement working widths in all operations along the year (tillage, fertilizing, spraying, harvesting)
- High relative share of headland area
- Increased use of fuel, fertilisers and plant protection agents
- Ineffective use of large, expensive machinery (e.g. harvesters)

➤ **Increased environmental / soil damage**

➤ **High share of “inefficient labour input”**

➤ **High average costs per unit**

Field enlargement – Expected changes

- ↓ Decrease in work and road times
- ↓ Decrease in soil compaction (and erosion ?)
- ↓ Decrease in labour and variable machinery costs
- ↑ Increase in crop yields with decrease of resource use
- ↑ Increase in gross margins per hectare

The question of today and tomorrow:

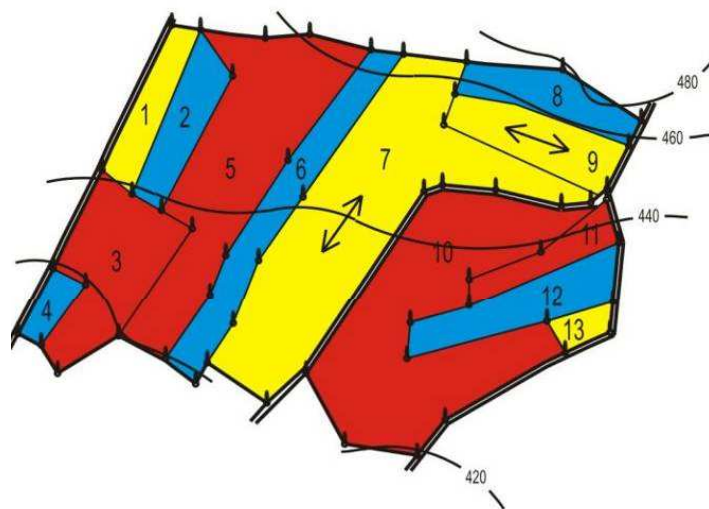
- Do we still need traditional land consolidation measures,
even when we use today and tomorrow **intelligent farm machinery ?**

Agenda

1. Agriculture in change
2. Large-scale farming versa small-scale farming
- 3. Improvements in small-scale farming**
4. The theory of transborder farming
5. Transborder farming systems in Germany
 - Zeilitzheim (Theory proof by research)
 - Ulsenheim (Neighborhood)
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Restricted field sizes – What's to do ?

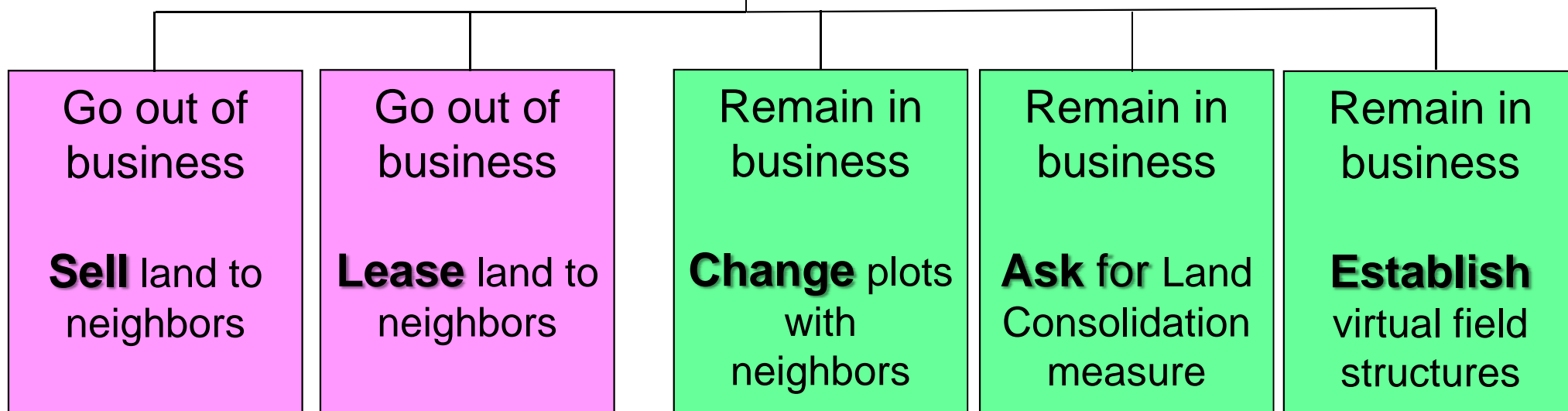
Existing Structure
(taken from a real site at Alfalter village 1997)



| | | |
|----|----|------|
| WW | WG | Rape |
|----|----|------|

| | | | | |
|--------|---|-----|----|----|
| Farmer | A | 12 | 5 | 1 |
| " | B | 4;6 | 10 | 9 |
| " | C | 8 | 3 | 13 |
| " | D | 2 | 11 | 7 |

What's to do for improvement?



New field structures – Traditional versus smart approach

Land consolidation measure

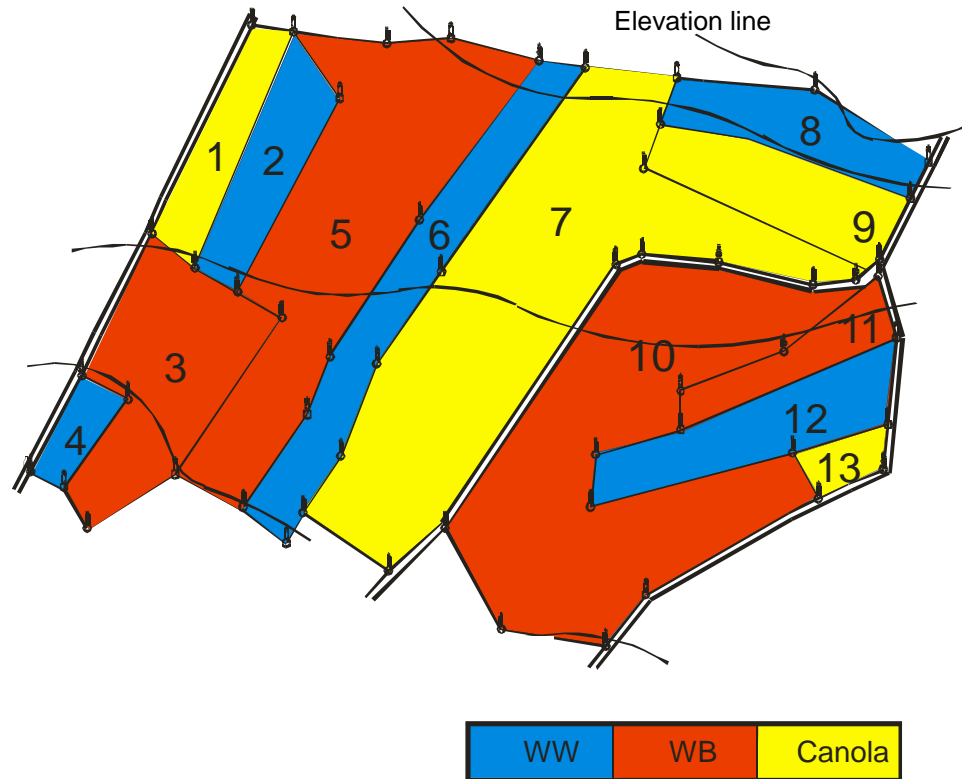
- Initiated by request of farmers in a village (community) or by a society related measure (new highway / bypass crosses the field mark, others)
- All farmers take part (by law)
- **Ownership of land is changed**
- Complete new infrastructure
- Consolidation factor below 3 (restricted through the so called quality compensation in shares of soil quality and non-arable land)
- Large financial input through society
- **Project time around 10 years** (by the end of the measure the world has strongly be changed)

Virtual Land consolidation

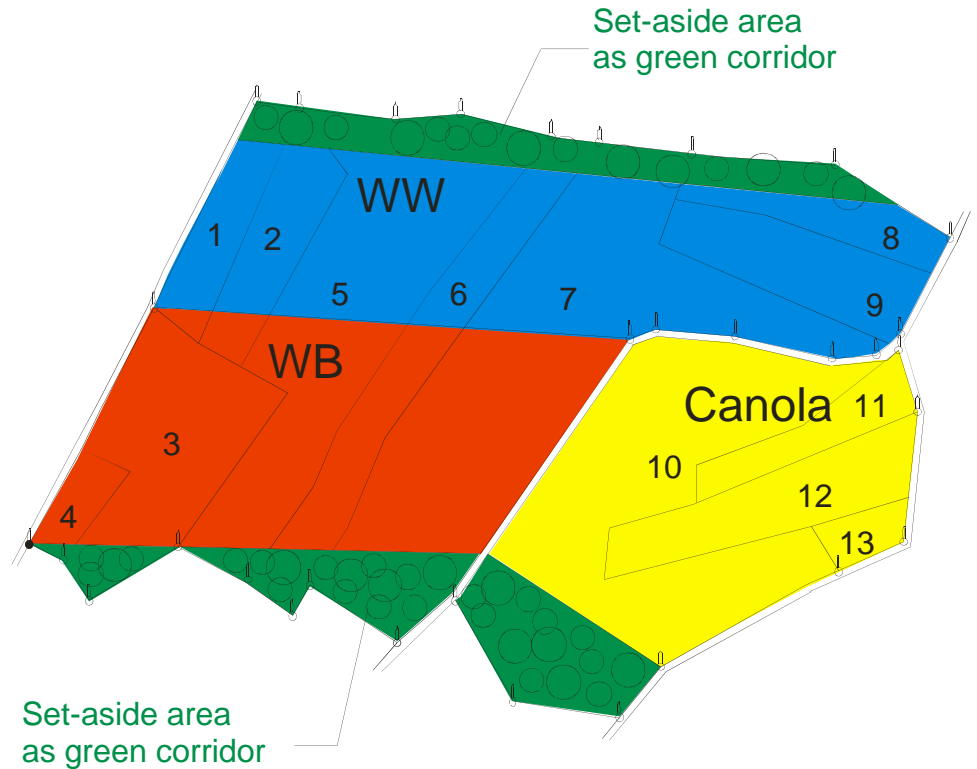
- Initiated by future-oriented farmers
- **Ownership remains untouched**
- Use of intelligent technology
- Cooperation through agreement of interested farmers
- **Fast realization (within one year)**
- Consolidation factor depends on farmers willingness
- Investment in new technology by the cooperation
- System can be changed by demand
- Fast reaction to new requirements
- **Re-establishment possible**

Transborder Farming → A first attempt

Small single fields



Joint Transborder Fields



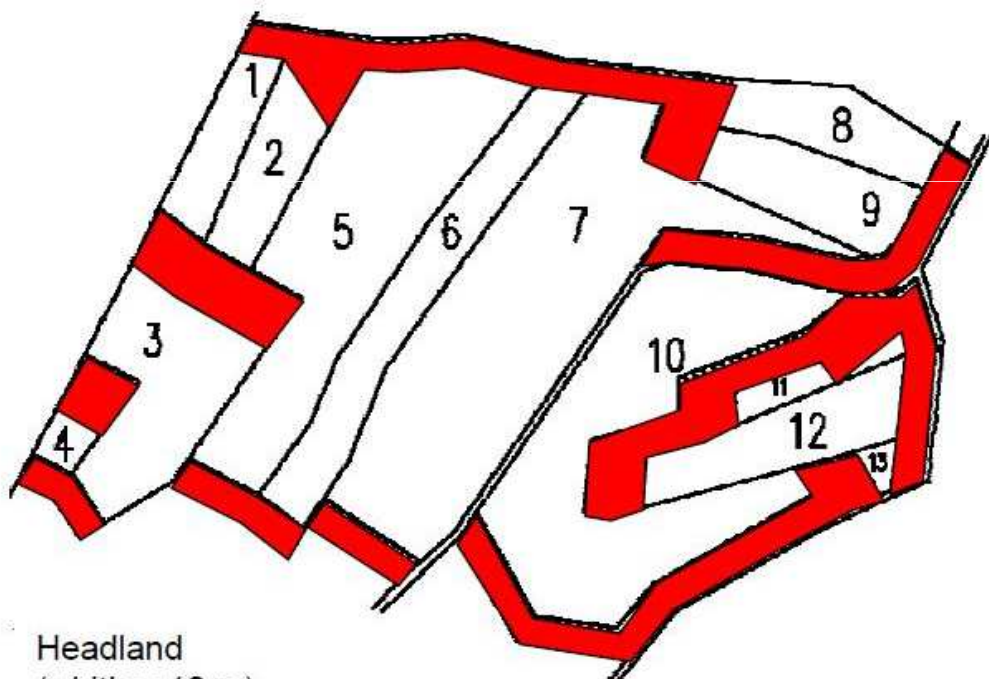
Existing structure

Still existing ownership, but:

- Enlarged field structures
- Common crop rotation
- Changed shares of crop/farmer
- (*Landscape improvements possible*)

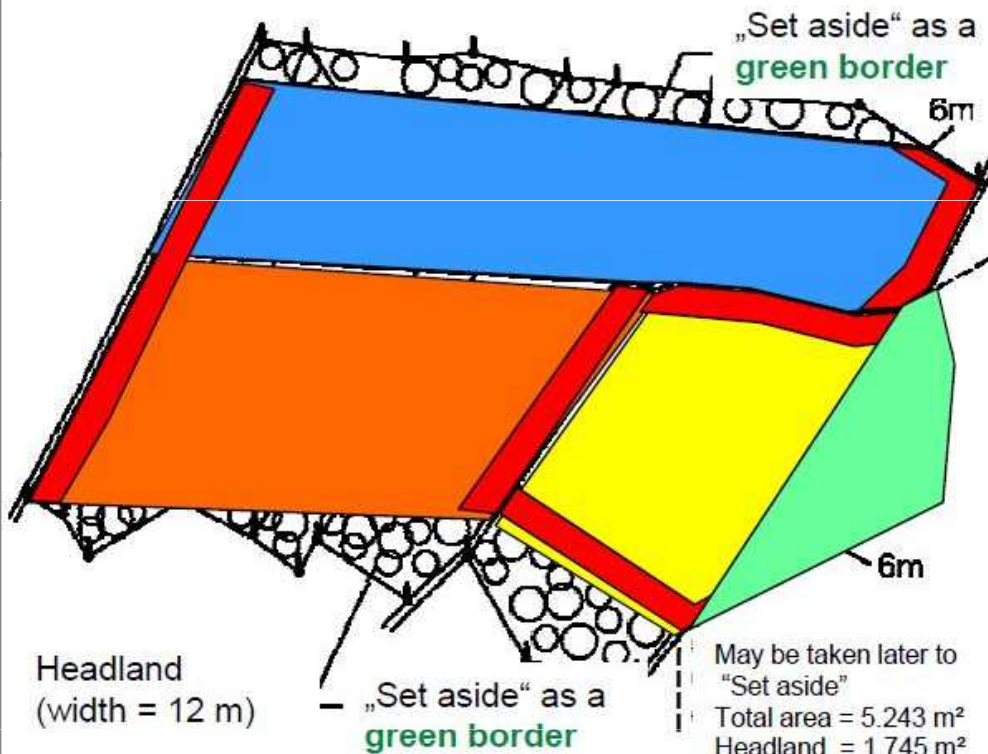
Calculated reductions – Headland, field traveling

Small single fields



Headland
(width = 12 m)

Joint Transborder Fields



Headland
(width = 12 m)

– „Set aside“ as a
green border

May be taken later to
„Set aside“
Total area = 5.243 m²
Headland = 1.745 m²

Total area = 72.097 m²
Headland = 16.471 m² → **22,85 %**

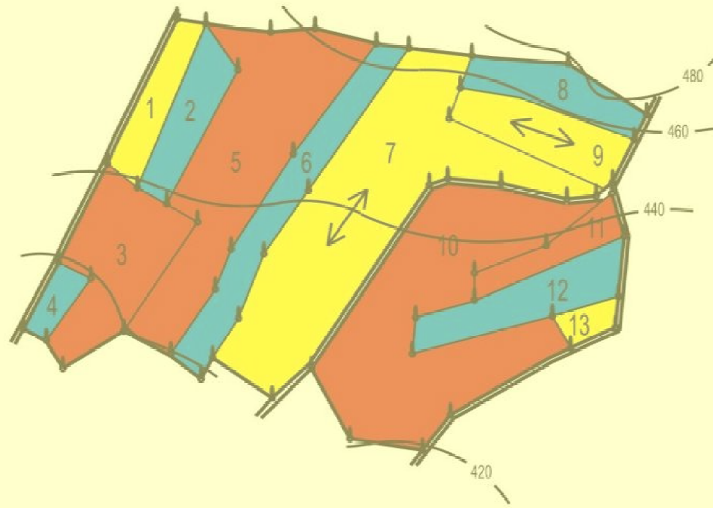
Total area = 61.056 m²
Headland = 8.743 m² → **14,32 % (12.5%)**

104 rides/a; 208 km/a; 10.4 Mh/a
(8 rides/field and year; Ø 20 km/h; 1 km farm-field distance)

4 rides/a; 48 km/a; 2.4 Mh/a
→ **-74 %**

Transborder Farming- Targets and types

Existing structure

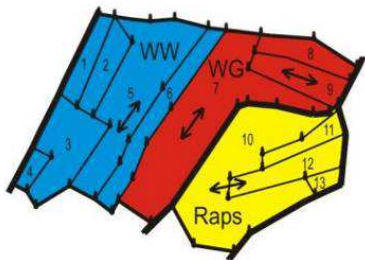


| | WW | WG | Raps |
|--|----|----|------|
|--|----|----|------|

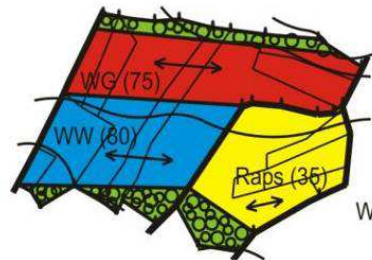
| Farmer | | WW | WG | Raps |
|--------|--|-----|----|------|
| A | | 12 | 5 | 1 |
| B | | 4;6 | 10 | 9 |
| C | | 8 | 3 | 13 |
| D | | 2 | 11 | 7 |

Possible structures

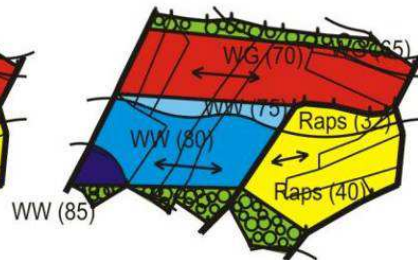
Managed by yield target
(driven by economics)



Owner yield target

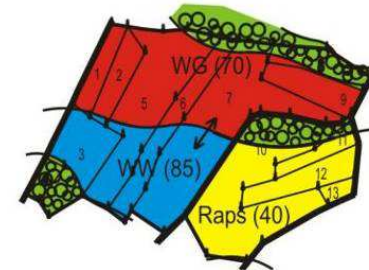


Common yield target

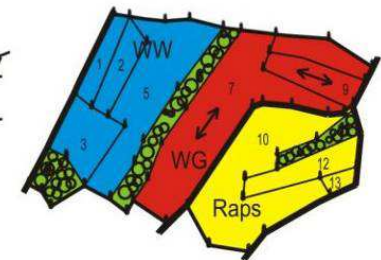


Part field yield target

Managed by environmental targets
(driven by environment protection)



Reduction / avoidance of erosion



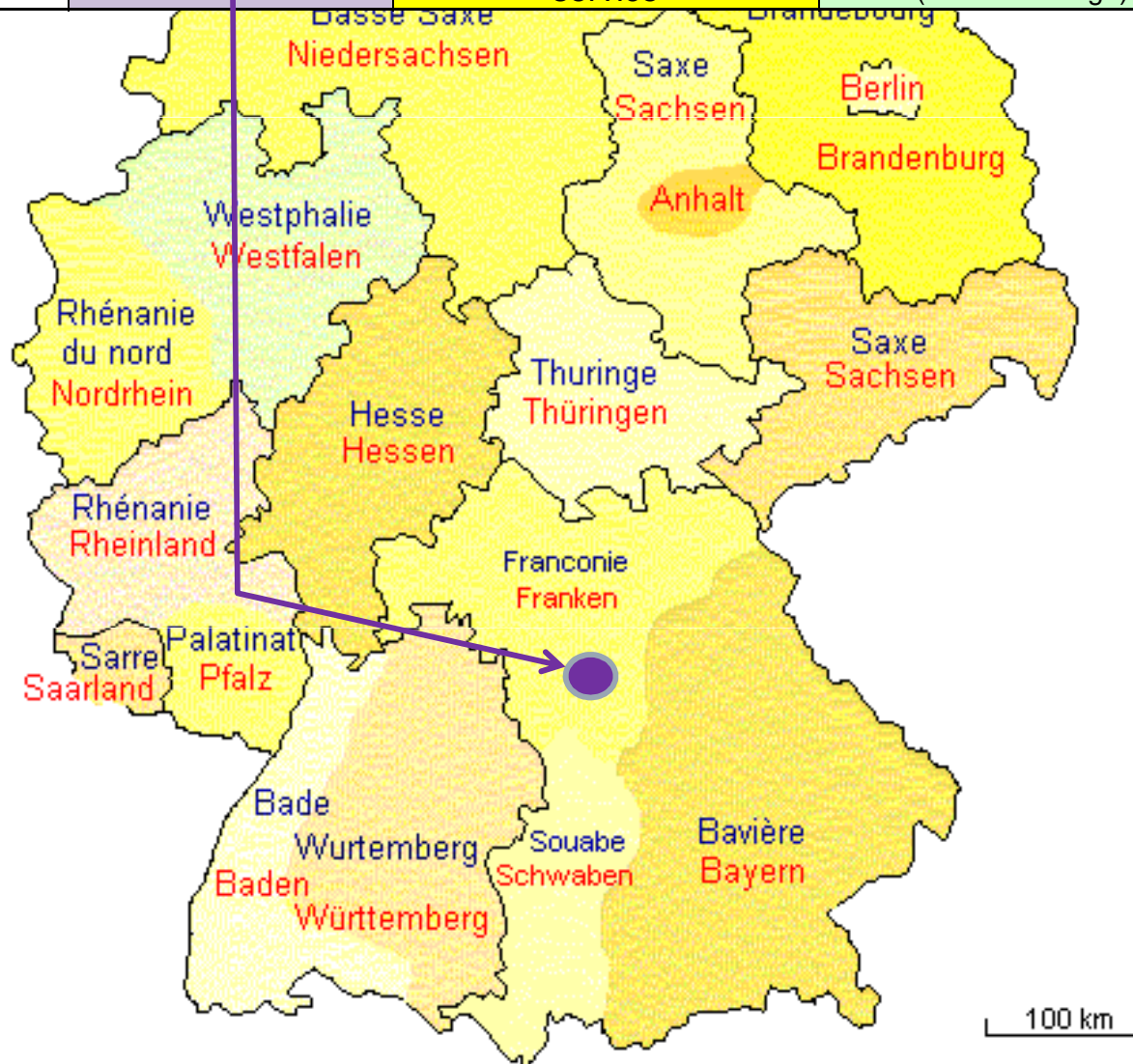
Conservation of landscape

Agenda

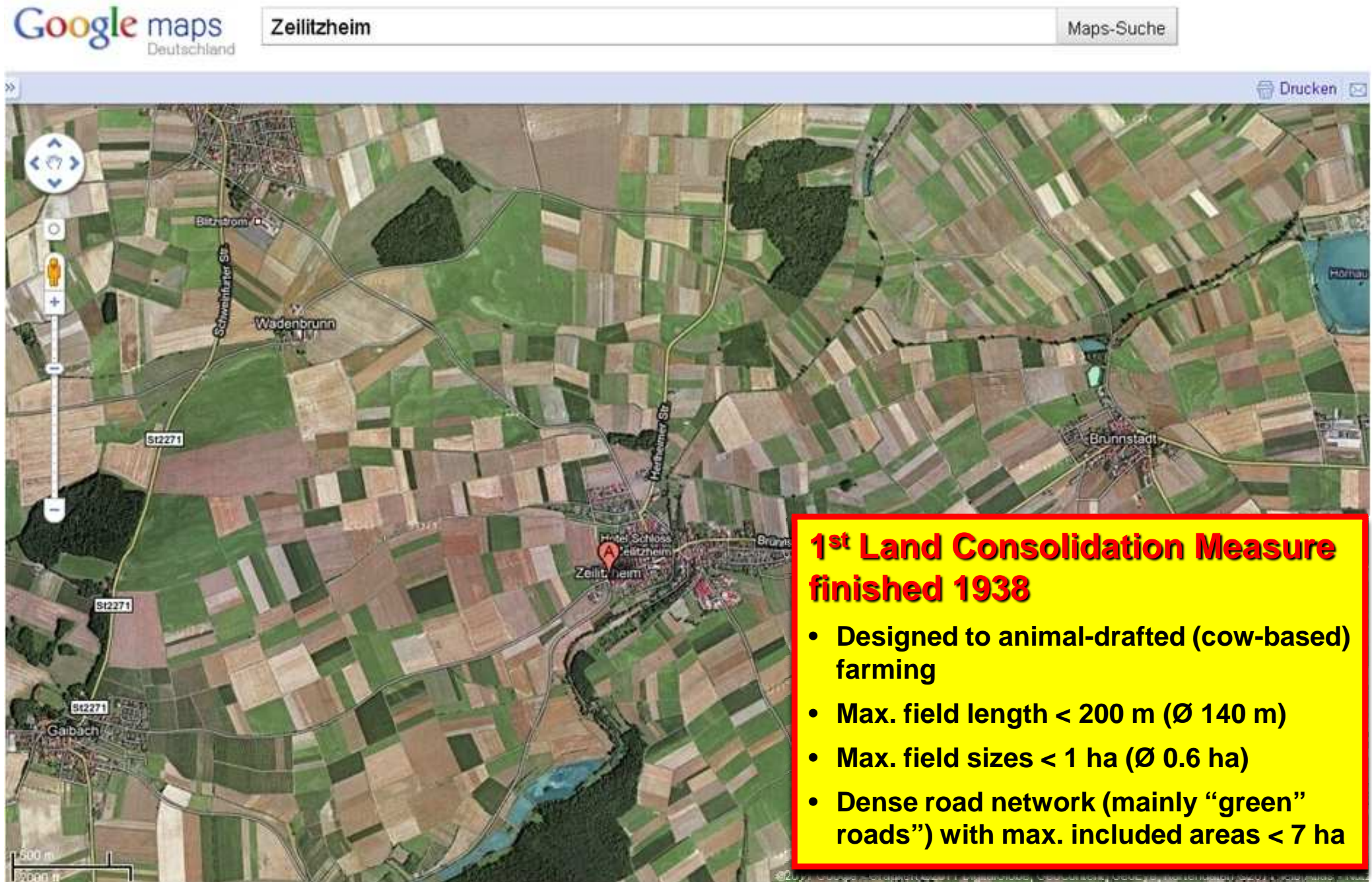
1. Agriculture in change
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Transborder farming – Realizations in Germany

| Item | Zeilitzheim | Ulsenheim | Ettleben | Riedhausen |
|--------------|----------------------|-------------------------------|--------------------------------------|---------------------|
| Initiated in | 2002 | 2003 | 2000 | 2002 |
| Initiated by | Research Institution | 3 Farmers & Extension service | Farmers only (all of the village) | 1 Farmer & Retailer |



Zeilitzheim – Location and field structures

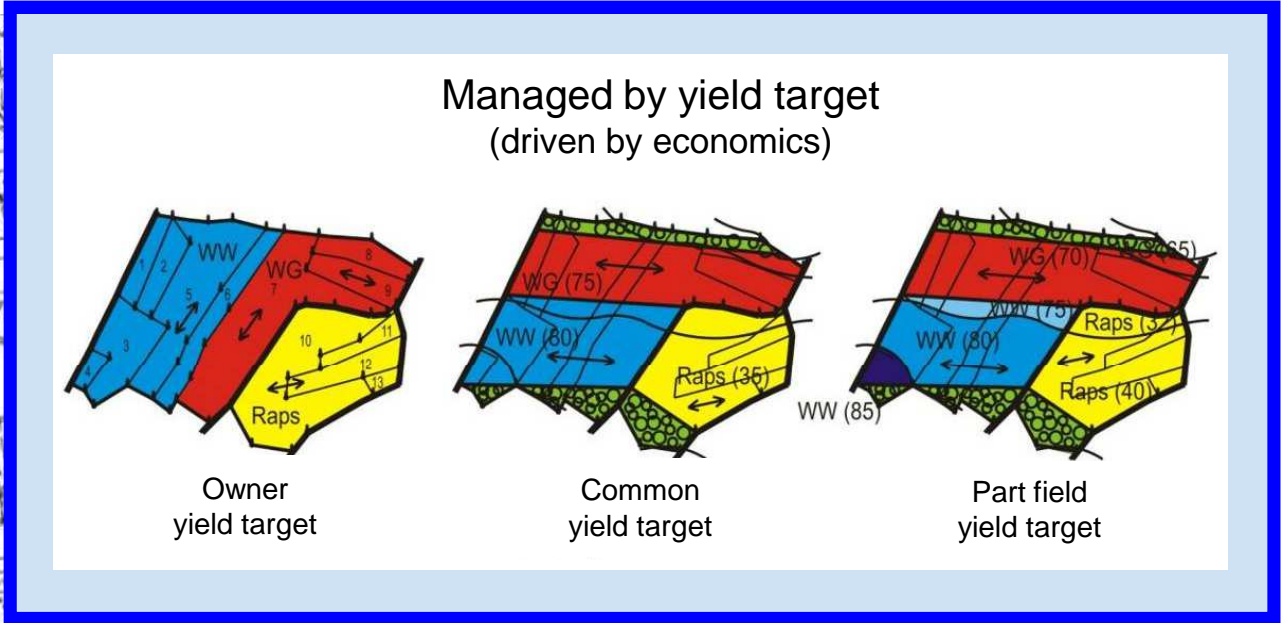
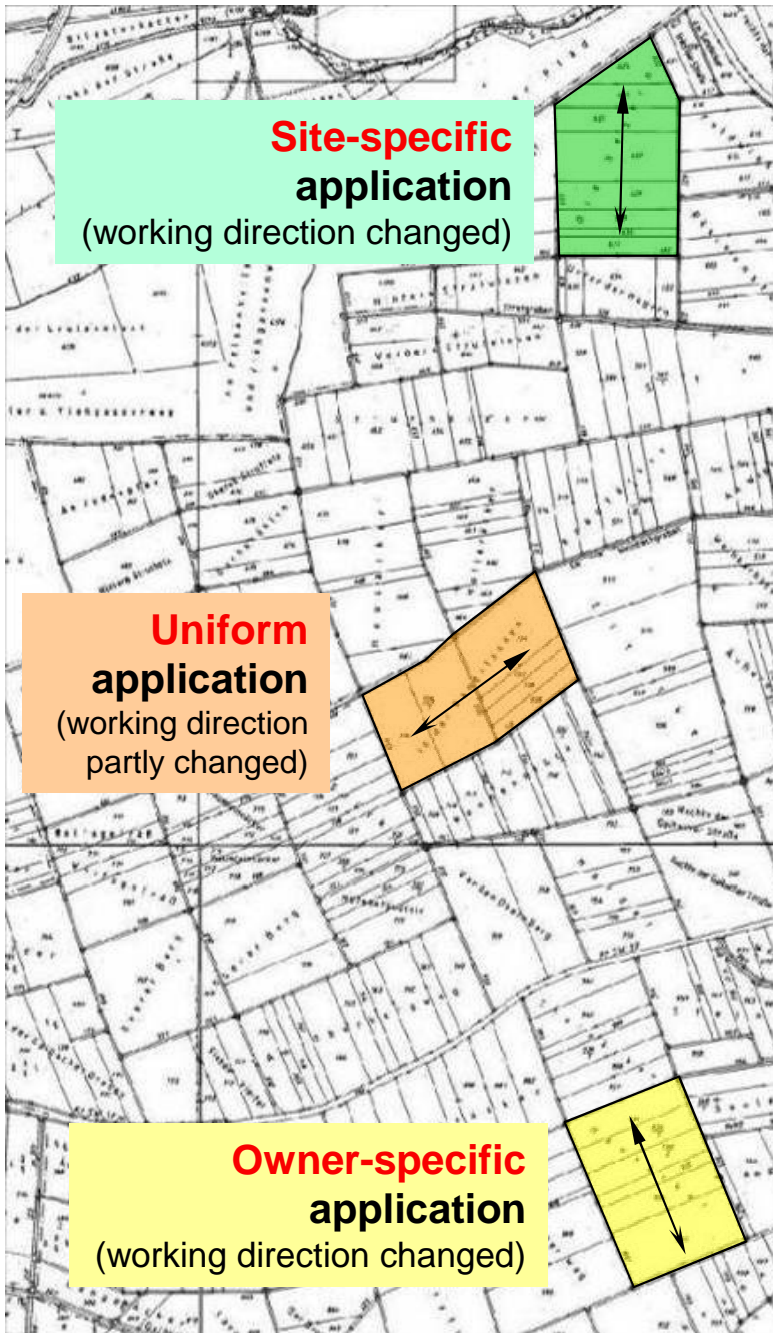


Zeilitzheim – Project initiation and coordination

Initiated by a research unit (*Prof. Auernhammer*) after two failed attempts (1997 Village Alfalter, 1998 Village Aicha) and by the manager of the existing machine corporation (Maschinenring [MR]) Zeilitzheim (*Mr. Kukoll*)

- 1st meeting in Zeilitzheim (all 23 farmers of the village were invited, only 8 interested ones took part),
 - presentation of the idea “Transborder farming”
 - advertising for at least 3 transborder fields
 - explanation of scientific interests (dissertation)
 - explanation of possible funding from the government within the “*pre agro Project*”
- 2nd meeting in Zeilitzheim with MR-manager and 5 interested farmers with intensive discussions
 - location of the required 3 transborder fields with “no” road removal
 - crop rotation
 - operational targets of each transborder field (working direction, yield targets, machinery usage, documentation, collective purchase and sales, accounting, ...)
- Installation of additional electronics for yield detection, spot fertilizing and spraying and automatic data acquisition based on GPS
- First field operation across field borders with following operations

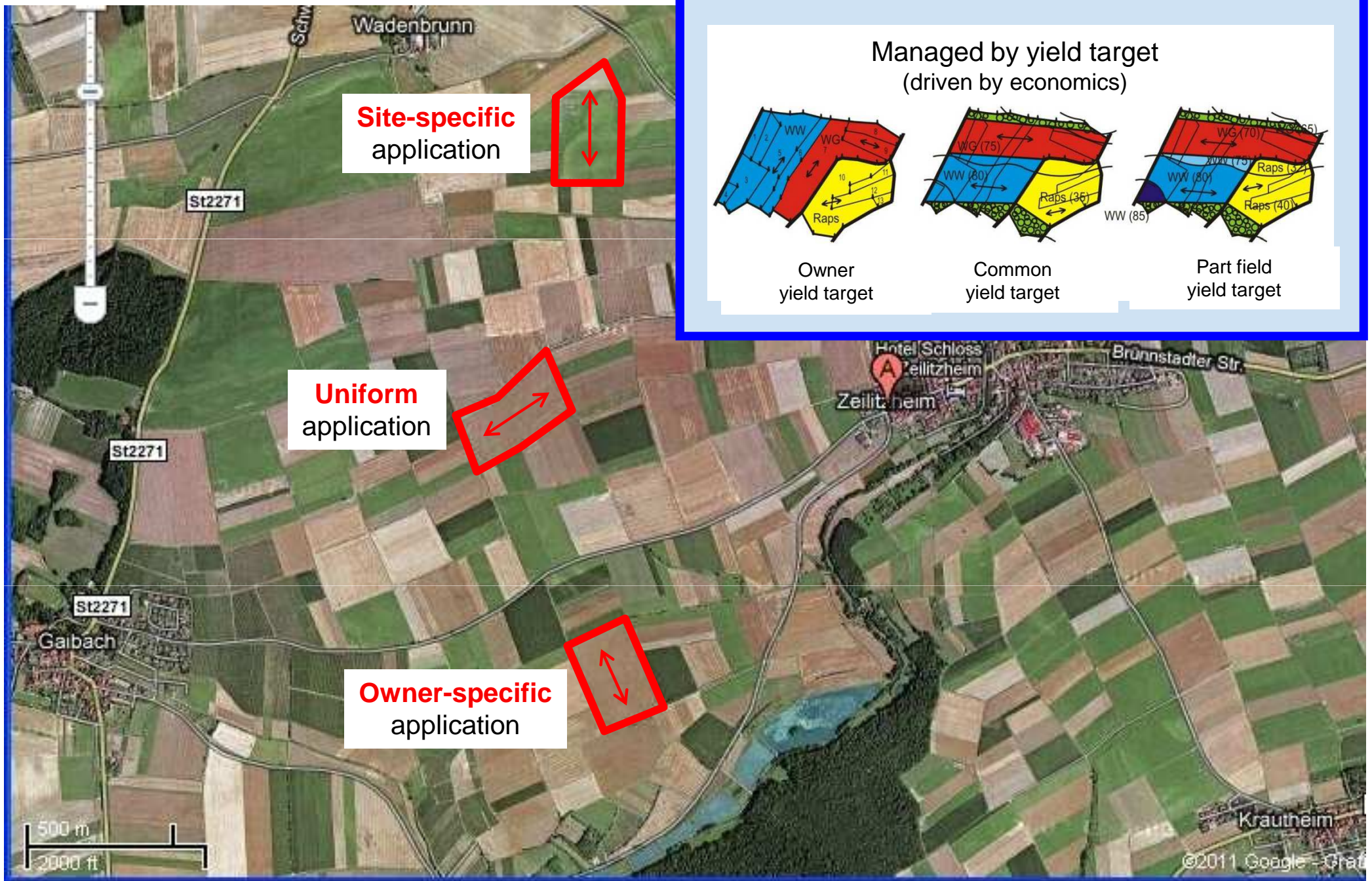
Zeilitzheim – Types of transborder fields



20 single fields from **5** different farmers were taken into **3** transborder fields

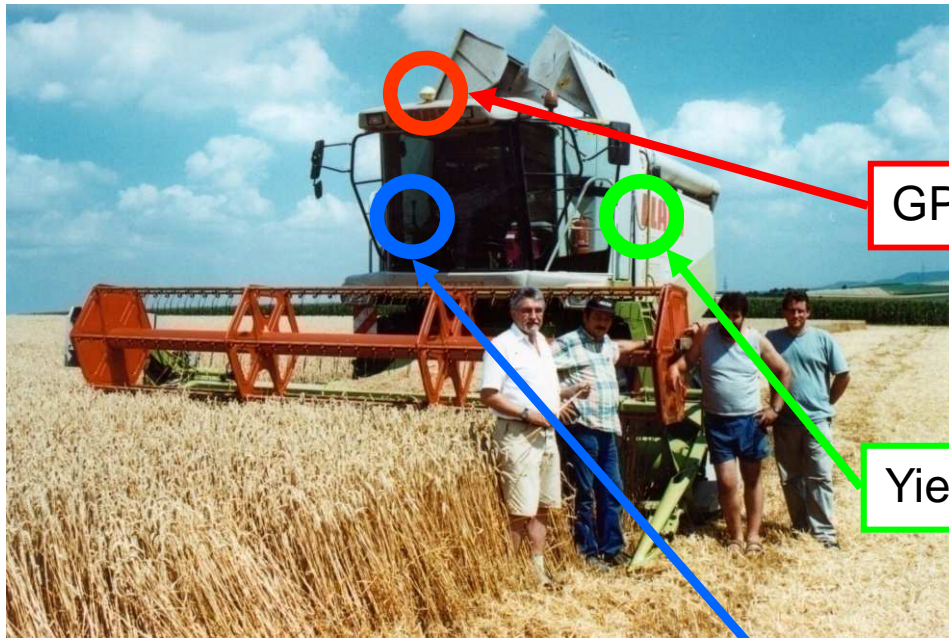
Consolidation factor was **7:1**

Zeilitzheim – Field trials (Germany 2002 - 2005)



Zeilitzheim – GPS-based yield sensing (grain and sugar beets)

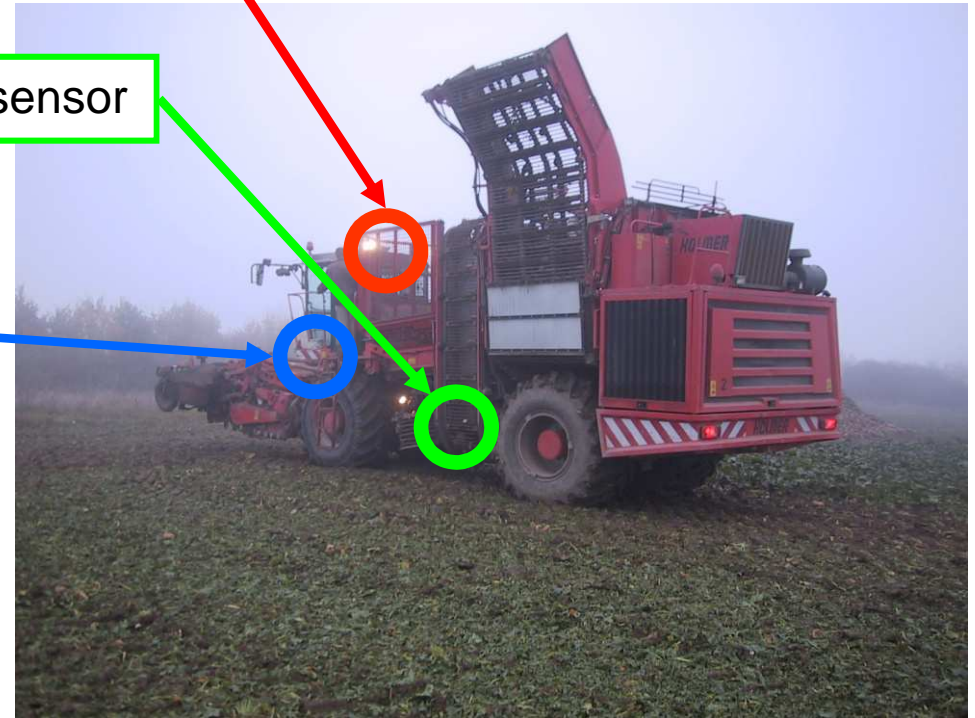
Combine harvester (contractor)



GPS antenna and receiver

Yield sensor

Data logger



Sugar beet harvester (machine cooperation)

Zeilitzheim - Data processing and management

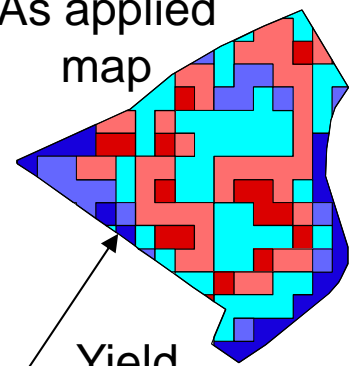


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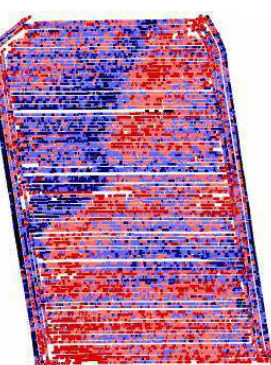
Maps are nice to have,
but we need to work with the data in databases !

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As applied map



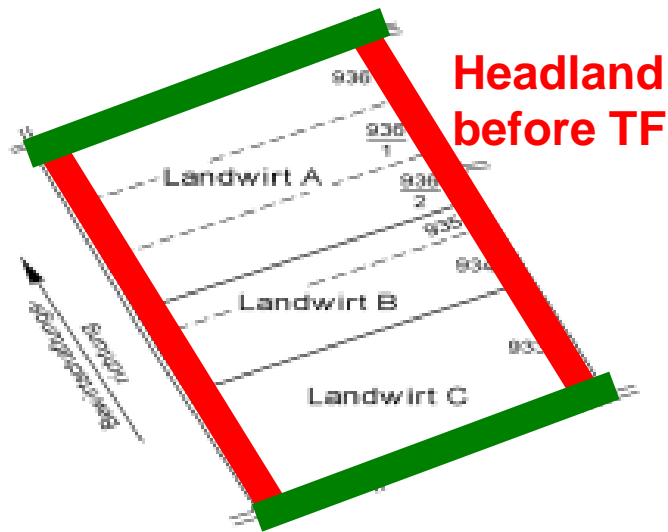
Yield map



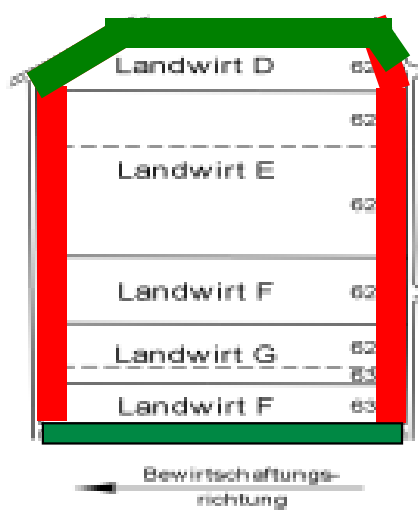
Yield map

Zeilitzheim - Headland area before and after TF-design

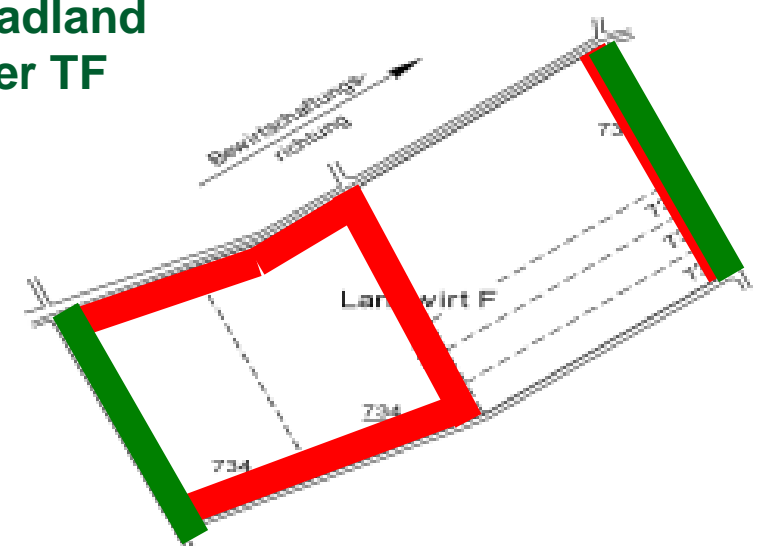
| Transborder field | Hausaecker | | | Hegern | | | | Bandstauden | | | | | | |
|-------------------|------------|---|---|--------|---|----|---|-------------|----|----|----|----|----|----|
| Farmer | A | B | C | D | E | F1 | G | F2 | F3 | F4 | F5 | F6 | F7 | F8 |



Gewanne 1 "Hausaecker"
Größe: 6,95 ha



Gewanne 2 "Hegern"
Größe: 6,72 ha

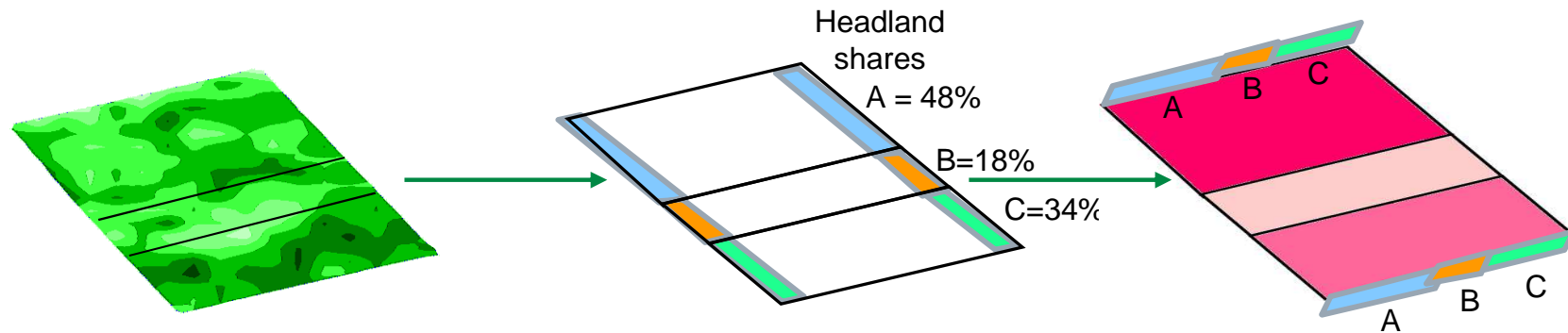


Gewanne 3 "Bandstauden"
Größe: 7,21 ha

Ratio [new/old*100]



Zeilitzheim- Headland working time adjustment



$$t_{k_i} = t_{a_i} + A_i \sum_{i=1}^n t_{w_i} + t_{u_i}$$

| | Farmer A | Farmer B | Farmer C | Sum |
|-----------------------|----------|----------|----------|------|
| Operating time(h) | 1.53 | 0.67 | 1.22 | 3.42 |
| Working time (h) | 1.36 | 0.66 | 0.91 | 2.93 |
| Turning time (h) | 0.11 | 0.00 | 0.18 | 0.29 |
| Standing time (h) | 0.06 | 0.01 | 0.12 | 0.19 |
| Time to account (h) | 1.57 | 0.81 | 1.04 | 3.42 |
| Avg. draft force (kN) | 51.2 | 49.3 | 49.3 | |

n = number of part fields

i = part field index

A_g = area of transborder field

A_i = area of part field

t_{k_i} = corrected operating time of part field

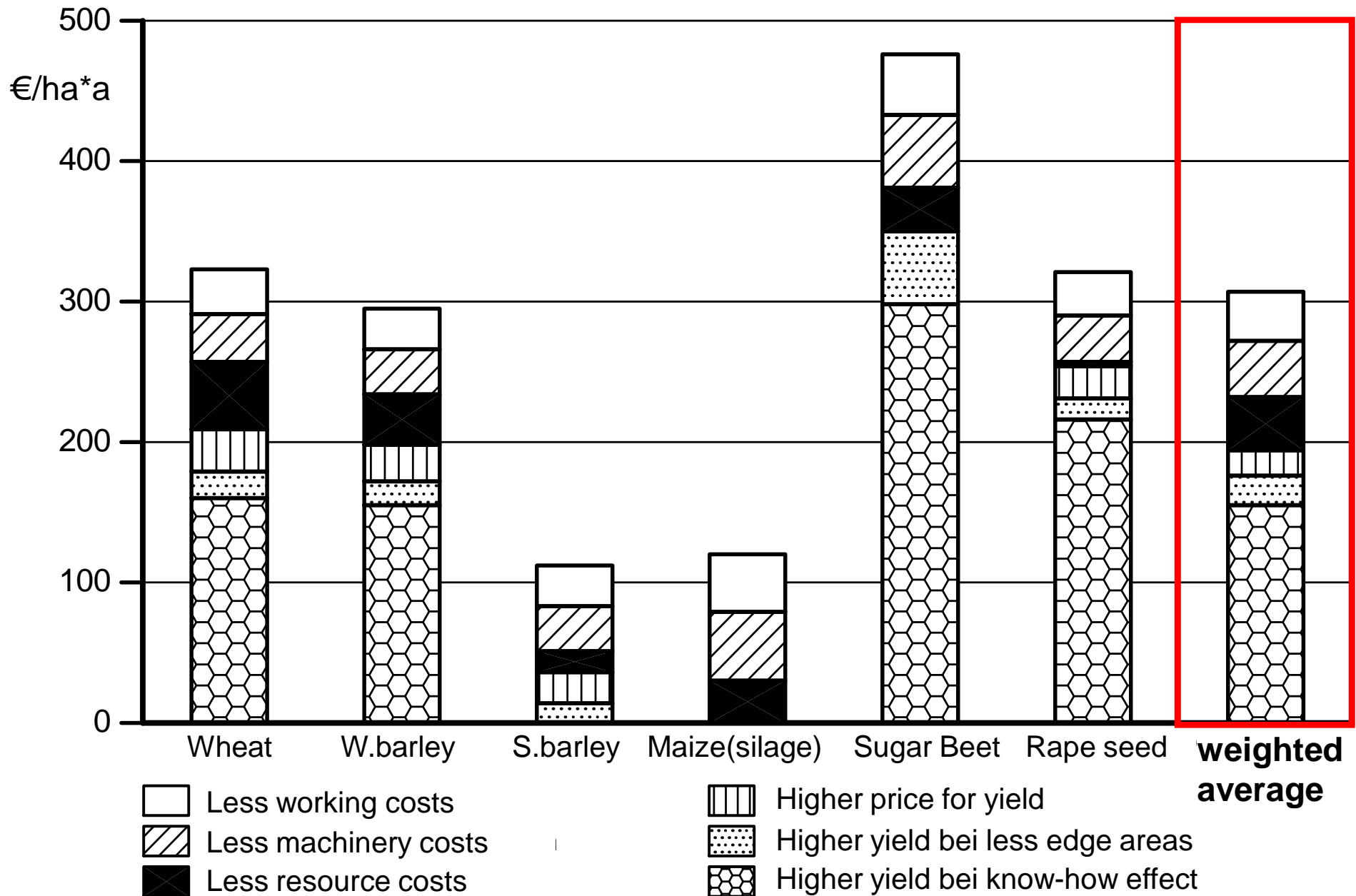
t_{a_i} = working time of part field

t_{w_i} = turning time of part field

t_{u_i} = standing time of part field

Whenever the working direction is changed, headland shares have to be adjusted !

Zeilitzheim- Economical effects at end of project

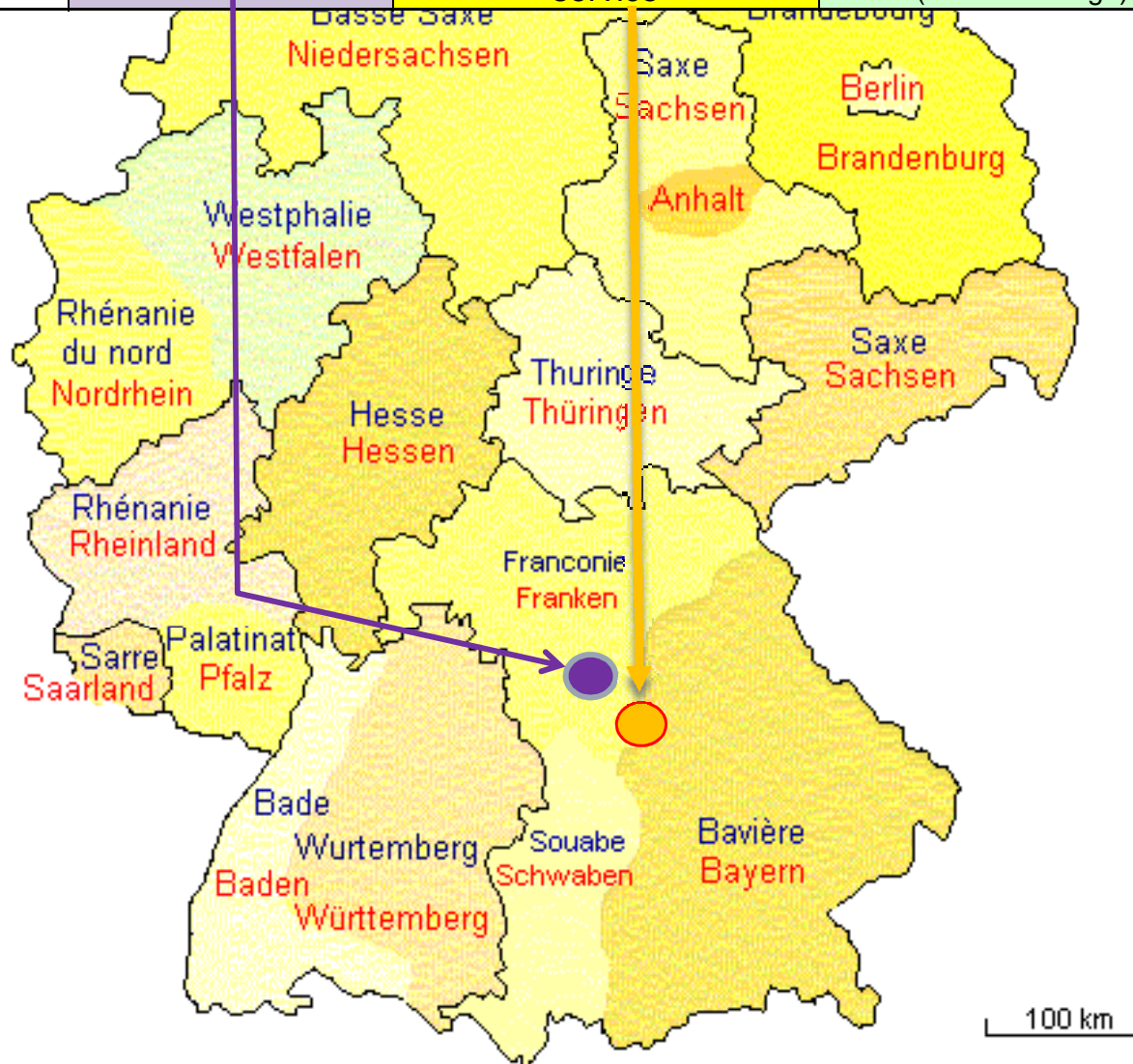


Zeilitzheim- Project assessment

| Items | Assessment | Rating |
|---|---|--------|
| Project targets | Verification of transborder field theory Test of adjusted technology Development and test of required software tools | ++ |
| Transborder field (TF) design | Adjusted to given situations Well in shape (parallel sides, length : width) All working directions changed | ++ |
| Additional transborder field actions | Non, as most border stones already removed | ++ |
| Available farm machinery | Partly used Partly worthless | +/- |
| Installed new technology | Expensive with extra maintenance requirements Latest technology used Part field technology enabled Old inefficient implements replaced | ++ |
| Required investment | High due to part-field technology High due to automatic data acquisition | -- |
| Field operations | Done from members with best know how | ++ |
| Common purchase and selling | In both, used material and produced products | ++ |
| Member inter-activities | Improved Positive influences to social life in the village | + |
| Expected enlargement | Non, as one of the initiators is out of project (end of research project) | -- |

Transborder farming – Realizations in Germany

| Item | Zeilitzheim | Ulsenheim | Ettleben | Riedhausen |
|--------------|----------------------|-------------------------------|--------------------------------------|---------------------|
| Initiated in | 2002 | 2003 | 2000 | 2002 |
| Initiated by | Research Institution | 3 Farmers & Extension service | Farmers only (all of the village) | 1 Farmer & Retailer |



Ulsenheim – Farm structure in the village in 2003

| Farm | Arable land (ha) | Livestock | Family members |
|-----------|------------------|--|----------------|
| A | 52 | 70 fattening bulls, 20 mother cows, 20 heifers (fattening) | 1.5 |
| B | 38 | 140 breeding sows with weaning | 1.5 |
| C | 92 | 20 fattening bulls, 120 breeding sows, 400 weaning piglets, 900 pig fattening places | 2.0 |
| D | 40 | 27 cows + youngsters, 20 fattening bulls, 1350 places for piglet weaning | 1.0 |
| E | 81 | 55 cows + youngsters, 400 pig fattening places | 2.0 |
| F | 66 | 57 cows + youngsters, 110 pig fattening places, 1350 places for piglet weaning | 1.5 |
| G | 68 | 50 places for breeding sows, 900 pig fattening places | 2.0 |
| H | 69 | 35 cows + youngsters, 440 pig fattening places | 2.0 |
| I | 65 | <i>Main income from other job</i> | 0.5 |
| J | 40 | 100 places breeding sows | 1.0 |
| 10 | 611 | 174 milking cows, 110 bulls, 410 breeding sows, 2770 pig fattening places | 16.0 |

Source: Haag, Landbau 2005

Ulsenheim – Main problems

- Decreasing selling prices for livestock
- Work overload caused by intensive livestock production
- Successors of the farms look for better life or leave the farm
- Too less idle money for investment in new, better and more powerful machinery or enlargement and/or improvement of buildings

But in the same way:

- *Over mechanization in all farm*
- *Old machinery with less capacity*
- *Less or even no time for field work besides livestock husbandry*

**→ Foundation of a machinery corporation
with
Transborder farming by neighborhood !**

Ulsenheim – Machine corporations and associations

- Formation of 5 machine corporations with the basics
 - either new technology or used ones from the corporation members
 - financed by borrowed loans only
 - operated by the farmers themselves
 - repair and maintenance “be done by the user”
 - all technology may be used outside the cooperation members too
 - payment by real costs per ha or by hours
 - chaired and coordinated by “priority lists” from young farmers with more and more specialization in their “special field”
 - common purchase of used fuel, seeds, agents, others
- Corporation “**Land use**” High capacity tillage and seeding
- Corporation “**Slurry**” Powerful slurry transportation and incorporation
- Corporation “**Plant protection**” Wide spreading pull-type sprayers
- Corporation “**Silage maize**” Self propelled forage harvester
- Corporation “**Combine harvester**” Self propelled grain harvester
- Usage of the existing “Self propelled Sugar Beet Harvester Association”

Ulsenheim – Investment in machinery at Farm C (1992 & 2005)

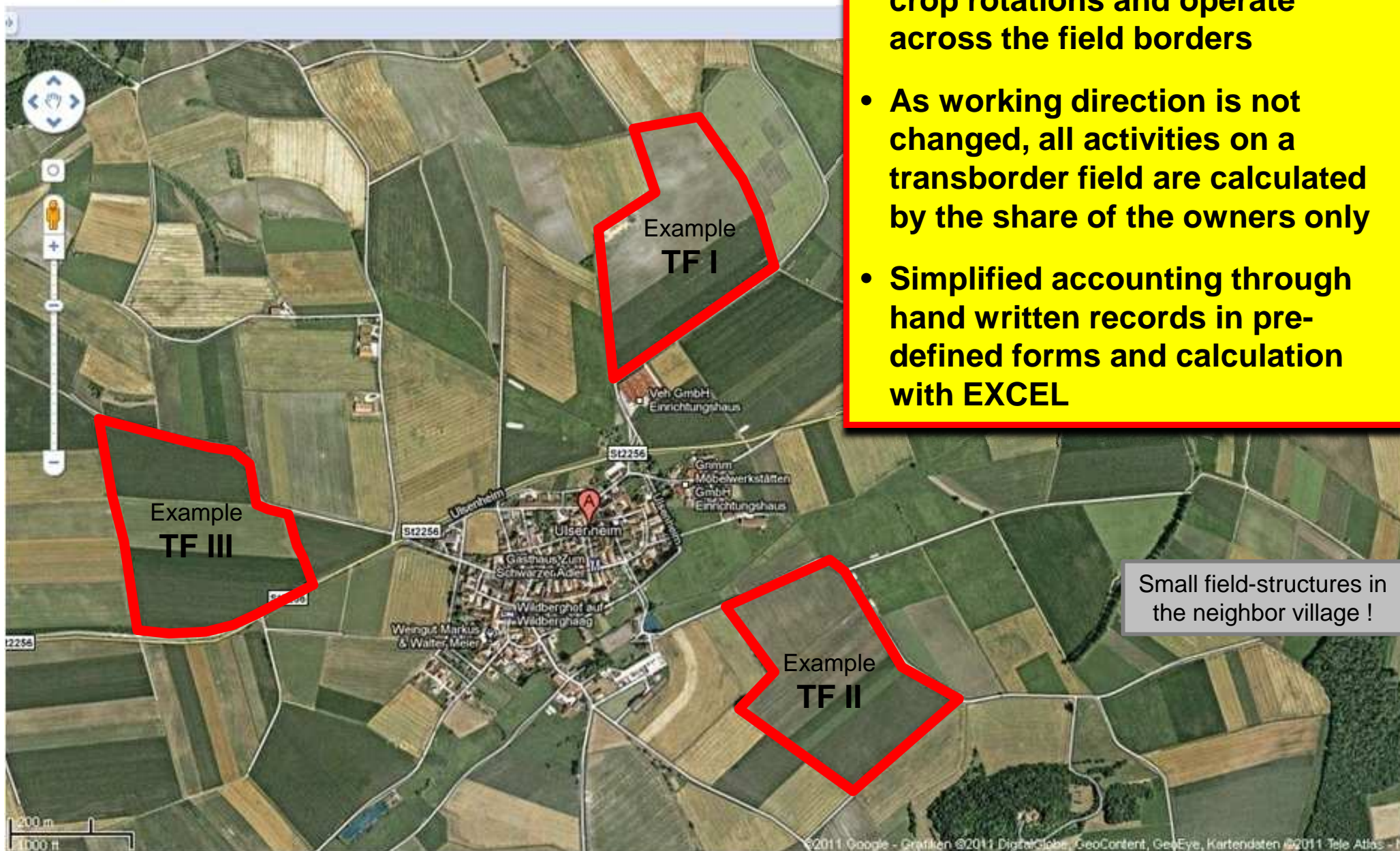
| 1992 | | | |
|--------------------------------|-------|-------------|-------------------|
| Type | Share | Performance | Year of man. |
| Tractor | | 125 hp | 92 |
| Tractor | | 85 hp | 92 |
| Combine harvester | ⅓ | 3 m | 80 |
| Front loader | | | 92 |
| 3-side tipper | | 8 t | 82 |
| 3-side tipper | | 8 t | 64 |
| Plow | ½ | | 82 |
| Rotary harrow | ½ | | 87 |
| Rotary tiller | ⅓ | | 90 |
| Seedbed combination | ⅔ | | 83 |
| Chisel plow | ⅓ | | 78 |
| Seed drill | ½ | | 92 |
| Beet planter | | 12 row | 88 |
| Maize planter | | 8 row | 90 |
| Fertilizer spreader | | | 88 |
| Sprayer | | 15 m | 89 |
| Total investment per ha | | | 3,324 €/ha |

| 2005 | | | |
|--------------------------------|-------|-------------|-----------------|
| Type | Share | Performance | Year of man. |
| Tractor | | 86 hp | 92 |
| Front loader | | | 92 |
| 3-side tipper | | 8 t | 82 |
| 3-side tipper | | 8 t | 64 |
| 3-side tipper | ⅓ | 18 t | 01 |
| Beet planter | | 12 row | 88 |
| Maize planter | | 8 row | 90 |
| Fertilizer spreader | | | 90 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Total investment per ha | | | 620 €/ha |

Ulsenheim – Location and field structures

Google maps
Deutschland

Ulsenheim (origin before Transborder farming)



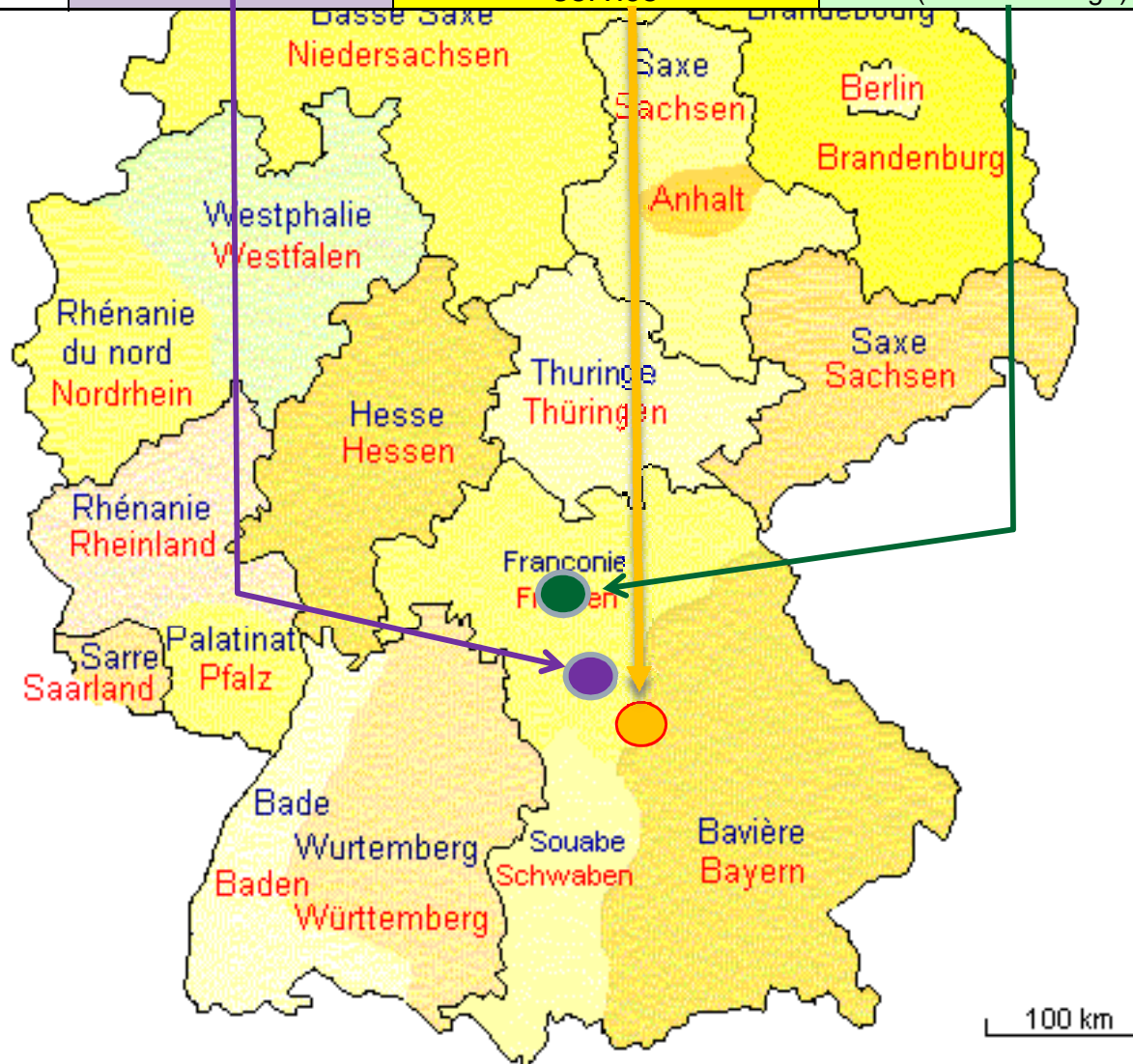
- **Field-neighbors create similar crop rotations and operate across the field borders**
- **As working direction is not changed, all activities on a transborder field are calculated by the share of the owners only**
- **Simplified accounting through hand written records in pre-defined forms and calculation with EXCEL**

Ulsenheim- Project evaluation

| Items | Assessment | Rating |
|-------------------------------------|--|--------|
| Project targets | Reduction of work overload Labor reduction and reduction of farm-own machinery for field work Reduction of machinery costs | ++ |
| Tranborder field (TF) design | Adjusted step-by-step to neighbor fields | +/- |
| Additional TF-actions | Non | ++ |
| Available farm machinery | Fully replaced by machine corporations with powerful field technology Farm-own machinery adjusted to new work organizations | +/- |
| Installed new technology | Five new machine corporations | ++ |
| Required investment | Non for machine corporations (external financing) Farm-specific for livestock technology | ++ |
| Field operations | Done either by farmers themselves or by members of the machine corporation (mainly better know how) or by the "neighbor" | ++ |
| Common purchase and selling | In both, used material and produced products Common maintenance and repair of machinery | ++ |
| Member inter-activities | Improved Positive influences to social life in the village | + |
| Expected enlargement | Step-by-step with other neighbors | +/- |

Transborder farming – Realizations in Germany

| Item | Zeilitzheim | Ulsenheim | Ettleben | Riedhausen |
|--------------|----------------------|-------------------------------|--------------------------------------|---------------------|
| Initiated in | 2002 | 2003 | 2000 | 2002 |
| Initiated by | Research Institution | 3 Farmers & Extension service | Farmers only (all of the village) | 1 Farmer & Retailer |



Ettleben – Location and main problems

- Located in one of the most fertile regions of Germany, soil quality factor = 100 % (best conditions for sugar beet and maize growing)
- 1st Land Consolidation Measure from 1935 – 1948
- Farmers in a more than 10-years discussion to get a “2nd Land Consolidation Measure”, but still no realization, as different community actions are discussed/planned like a new bypass around the village
- Continuously decrease of the share of agricultural population in the village (with decreasing influence to the community)
- Increasing disparity between possible farming improvements at given natural resources with new technology and existing field structures

→ In 2000 three farmers of the village

(information about “Transborder farming systems” available and fairly good assistance by the local agricultural extension service)

initiated a location-specific virtual land consolidation project !

Ettleben – Transborder farming by farm-specific management

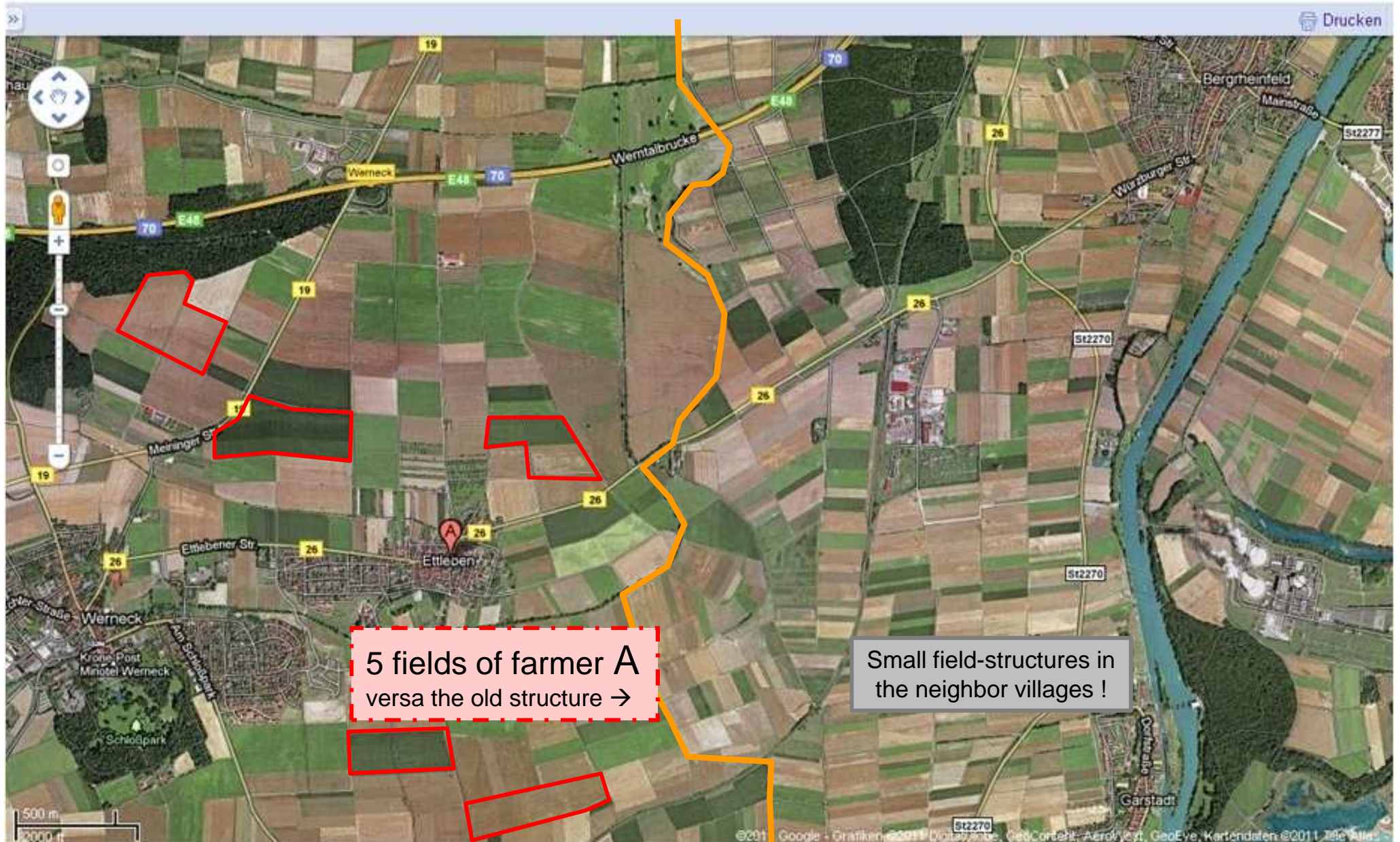
- Ownership of land remains untouched and
- Creation of new field structures related to farm-own operations and management
 - Farmers get new field locations (no resistance by farmers, as soil quality has less disparities)
 - Existing field marks (border stones) should be lowered and localized with GPS for a possible later restoration to the old field structure
 - Unused (disturbing) field roads should be removed
- Use of GIS for new field structure design
 - Data collection of existing structure by an “Agricultural Software House” (HELM)
 - Farmers discuss the most adopted new operational design (3 – 4 meetings)
 - Border stones are lowered by the so called “Sevens” and localized with GPS
 - Redesign of field structure with GIS (HELM)
 - Removal of unused field roads
 - Some small changes/adoptions of the new design caused by total area per farm, average farm-to-field distance
 - New field design acknowledged by the extension service

Ettleben – Location and field structures

Google maps
Deutschland

Ettleben

Maps-Suche

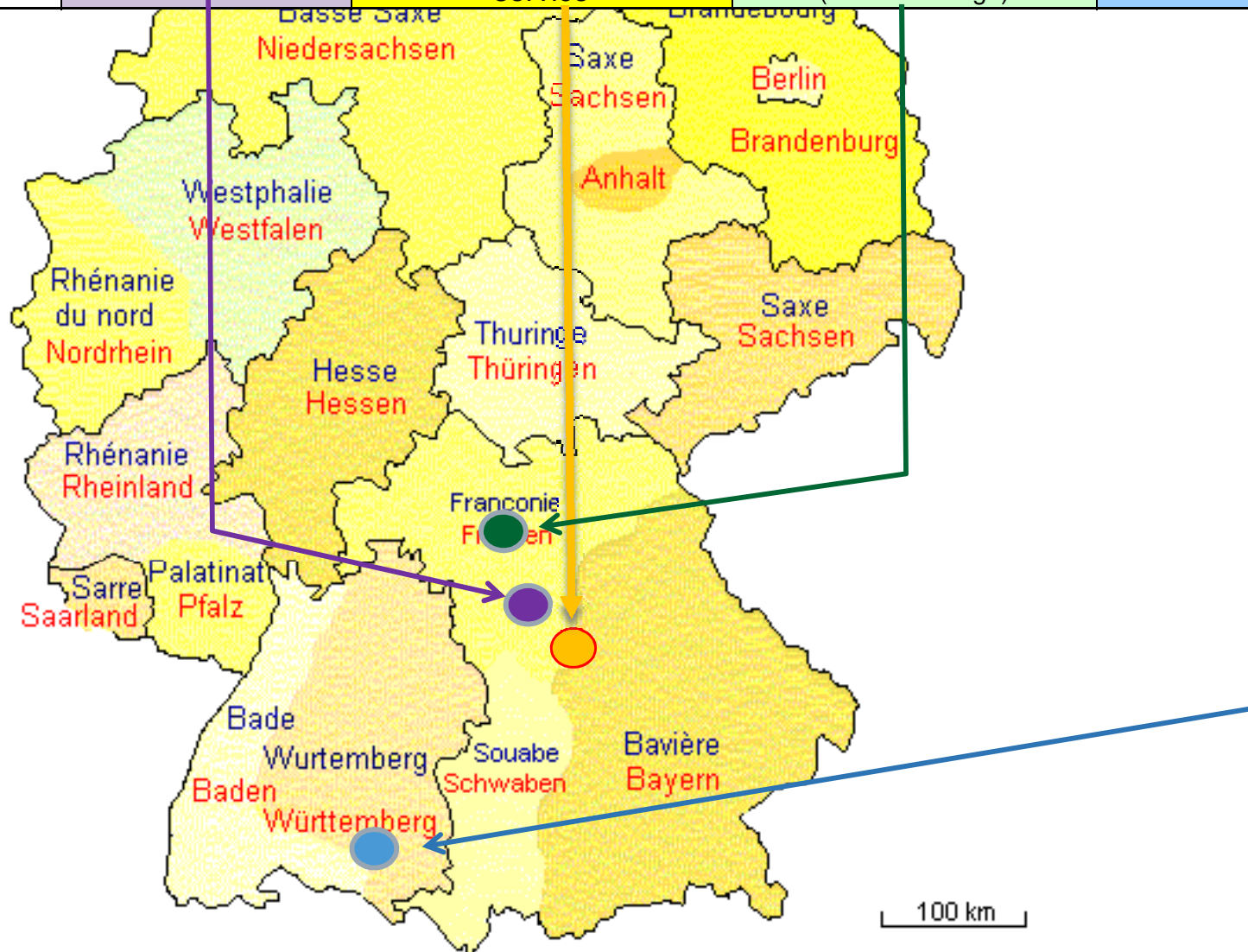


Ettleben- Project evaluation

| Items | Assessment | Rating |
|--------------------------------------|--|--------|
| Project targets | Enlarged field structure for farm-own operations | ++ |
| Transborder field (TF) design | Related to farm-specific requirements | ++ |
| Additional TF-actions | Lowering of all existing field marks (border stones) with GPS-localization Use of GIS for new field structure design Removal of unused field roads | -- |
| Available farm machinery | Remains untouched | +/- |
| Installed new technology | Non | ++ |
| Required investment | Border stone conservation Removal of field roads GIS service | -- |
| Field operations | Farm-specific as it was before | +/- |
| Common purchase and selling | Non | -- |
| Member inter-activities | Very small after realization | - |
| Expected enlargement | Upcoming Land Consolidation Measure will be changed immediately (Expected smaller fields than today will start another transborder field action) Again field operations will be done farm-specifically | -- |

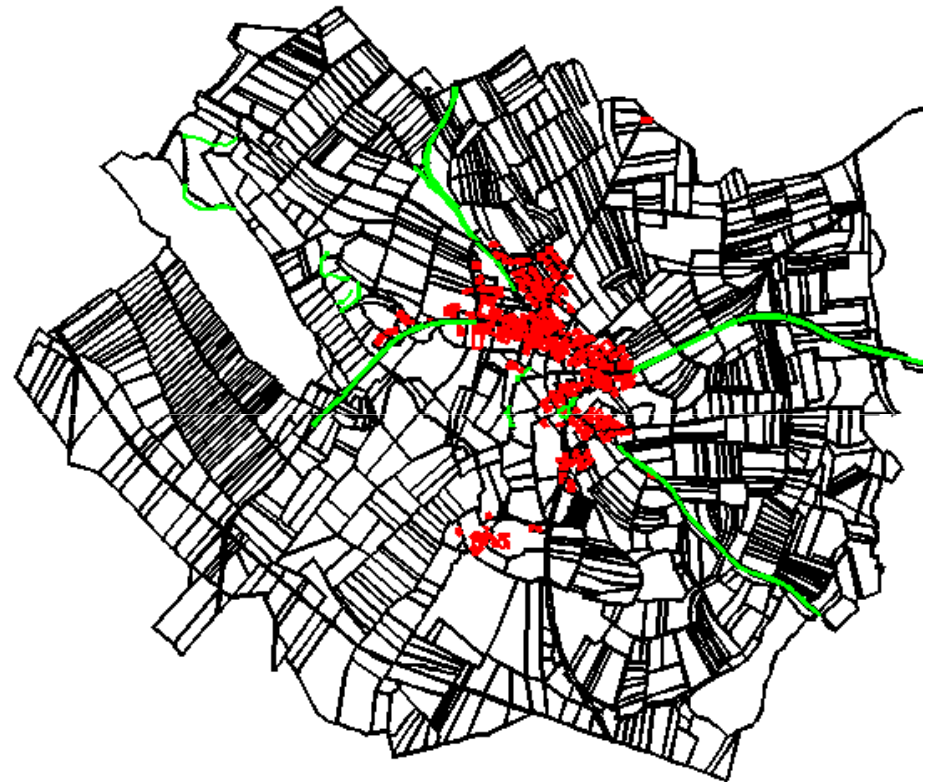
Transborder farming – Realizations in Germany

| Item | Zeilitzheim | Ulsenheim | Ettleben | Riedhausen |
|--------------|----------------------|-------------------------------|-----------------------------------|---------------------|
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| Initiated by | Research Institution | 3 Farmers & Extension service | Farmers only (all of the village) | 1 Farmer & Retailer |



Riedhausen – Location and main problems

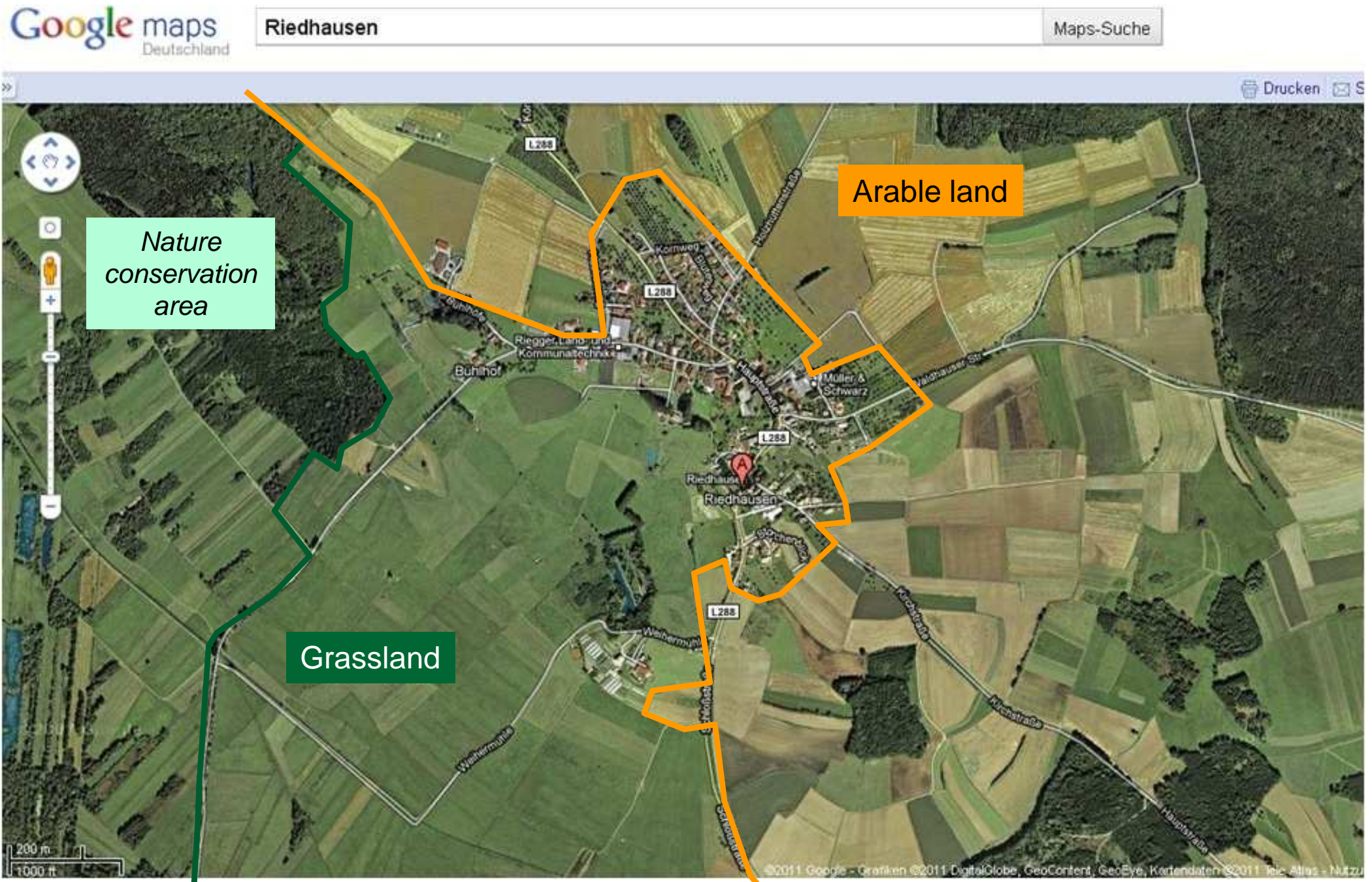
- Riedhausen covers three land use areas
 - arable land
 - grassland
 - land under nature conservation
- Dairying plays an important role in the village (grassland) as well as labor intensive sow breeding (arable land), tourism is coming on
- Riedhausen never had a “Land Consolidation Measure” and therefore very small fields with bad road structure and a large number of fields per farm through the growth of farms at one the side and the abandonment of farmers at the other side



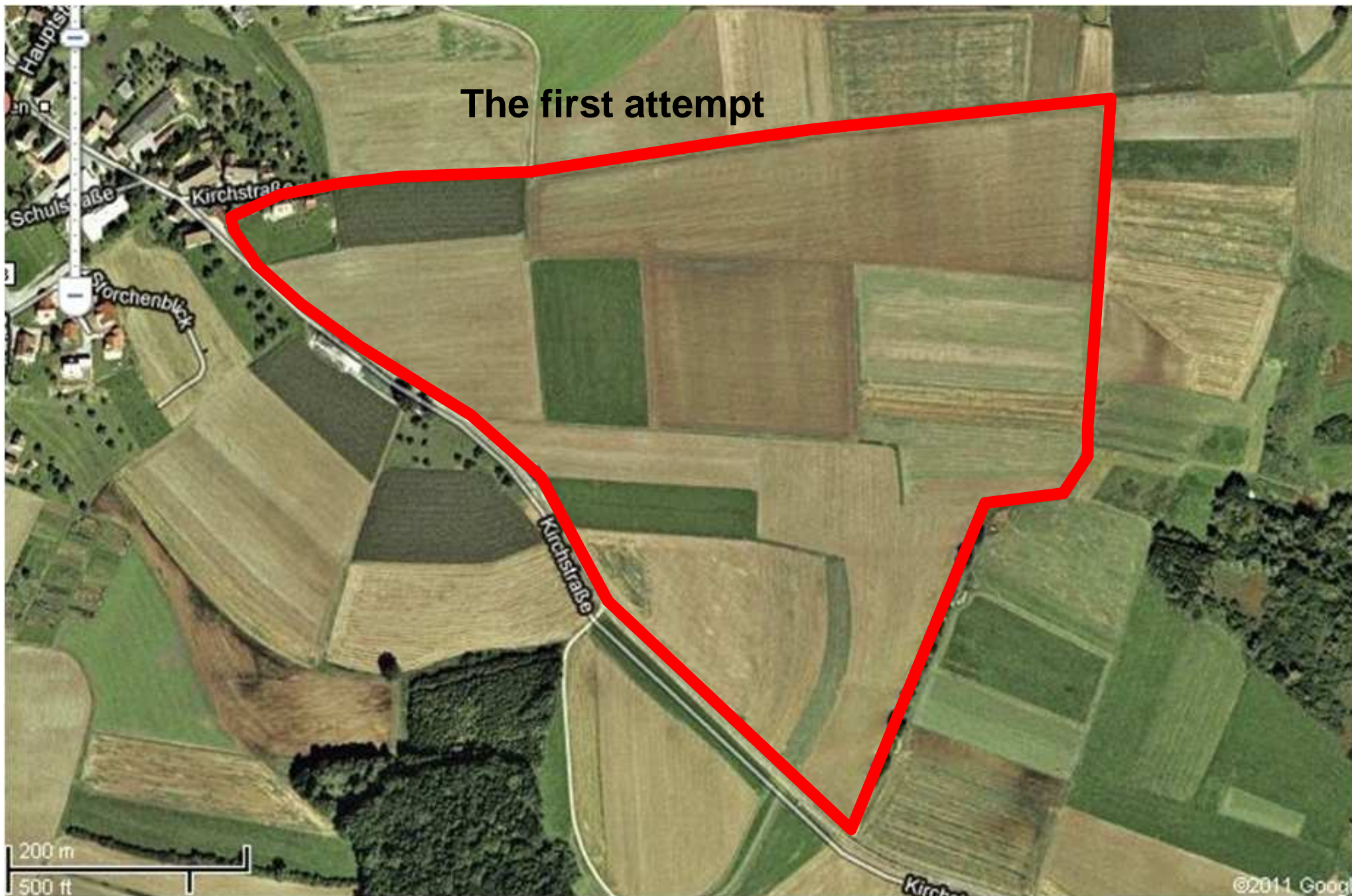
Riedhausen – The two pioneers

- In 1996 a retailer of Massey Ferguson, located in the village, showed a new combine harvester equipped with yield sensor and GPS in a field demonstration and went across (nearly un-seeable) field borders
 - Yield maps presented reasonable yield differences within the harvested area
 - Yield pattern didn't stop at field borders
- Until 2000 the retailer and one farmer discussed deeply about “Transborder farming” using the new technology
- In 2000 a machine corporation was formed by 12 farmers
 - Collective purchase and selling
 - Powerful machinery purchased
 - High powered tractor (185 hp) with tillage and seeding equipment
 - Low powered tractor with fertilizing and spraying equipment
 - Combine harvester with yield monitor and grain chart with weighing facility
- In 2001 first trials at transborder field “Kirchsteig”
- From 2002 extension of transborder fields with government support and support from University of applied Sciences Nürtingen

Riedhausen – View from the satellite and land usage



Riedhausen – Location of 1st transborder field “Kirchsteig”



Riedhausen – Transborder fields in progress (2002 and 2005)

2002



2005



→ **Big enlargement of existing single fields,
but still a huge potential available !**

Riedhausen- Project evaluation

| Items | Assessment | Rating |
|--------------------------------------|---|--------|
| Project targets | Reduction of work overload Labor reduction and reduction of farm-own machinery for field work Reduction of machinery costs | ++ |
| Transborder field (TF) design | Adjusted step-by-step to neighbor fields | + |
| Additional TF-actions | Discussions with non-members to come to land change agreements | + |
| Available farm machinery | Fully replaced by a machine corporations with powerful field technology Farm-own machinery adjusted to new work organizations Village-located retailer member of machine corporation with responsibility for maintenance and repair | ++ |
| Installed new technology | New machine corporations | ++ |
| Required investment | Non for machine corporations (external financing) Farm-specific for livestock technology | ++ |
| Field operations | All done through the machine corporation with best available know how Members overtake grain transport related to the farm-specific needed amount (allocated through the weighing equipment in the grain chart) | ++ |
| Common purchase and selling | In both, used material and produced products Common maintenance and repair of machinery | ++ |
| Member inter-activities | Strongly improved Positive influences to social life in the village | + |
| Expected enlargement | Step-by-step with non-members and new members Ideas on transborder farming in grassland are existing (machine corporation for mowing, tedding and harvesting technology) Nature conservation area shall be included | +/- |

Agenda

1. Agriculture in change
2. Large-scale farming versa small-scale farming
3. Improvements in small-scale farming
4. Transborder farming systems in Germany
 - Zeilitzheim (Theory proof by research)
 - Ulsenheim (Neighborhood)
 - Ettleben (Farming alone)
 - Riedhausen (Social challenge)
5. Evaluation and comparisons
6. Conclusions

Transborder farming – characteristics in a comparison

| <i>Item</i> | Zeilitzheim | Ulsenheim | Ettleben | Riedhausen |
|--|---|-------------------------------|-----------------------------------|---------------------|
| <i>Initiated in</i> | 2002 | 2003 | 2000 | 2002 |
| <i>Initiated by</i> | Research unit & manager of the existing machine corporation | 3 Farmers & Extension service | Farmers only (all of the village) | 1 Farmer & Retailer |
| <i>Still running</i> | Partly in one TF-field only | yes | yes | yes |
| <i>Share of associated farmers</i> | 20 % | 60 % | 100 % | 60 % |
| <i>Type of Transborder Fields</i> | To given situation | Neighborhood | Total new style | To given situation |
| <i>Plot size before TF [ha]</i> | 1.0 | 3.5 | 0.8 | 0.9 |
| <i>Tranborder field size [ha]</i> | 7 | 7 | 12 | 6.3 |
| <i>Consolidation factor</i> | 7 : 1 | 2 : 1 | 15 : 1 | 7 : 1 |
| <i>Coop. machinery usage</i> | Planting, harvesting | Planting, harvesting | Tillage, planting, harvesting | Harvesting |
| <i>Economic savings per ha and year</i> | ≈ € 350 | ≈ € 300 | ≈ 450 | ≈ 400 |
| <i>Ecological benefits</i> | high | small | negative | high |

Transborder farming – future actions / expectations

| <i>Item</i> | <i>Zeilitzheim</i> | <i>Ulsenheim</i> | <i>Ettleben</i> | <i>Riedhausen</i> |
|--------------------------------------|---|---|---|--|
| <i>Future actions / expectations</i> | Land Consolidation measure comes up (great contribution of the TF-project to the final agreement of all village farmers) | Transborder fields shall be enlarged outside only neighborhood fields | Land Consolidation measure comes up (Bypass construction around the village) | Rest of farmers in the village will join soon |
| | ? | Corporative machinery use extended with improved management, service and repair | New land ownership will be arranged in larger transborder fields (50 % greater than today) | Additional engagement in nature conservation (location in a well accepted tourism region) |

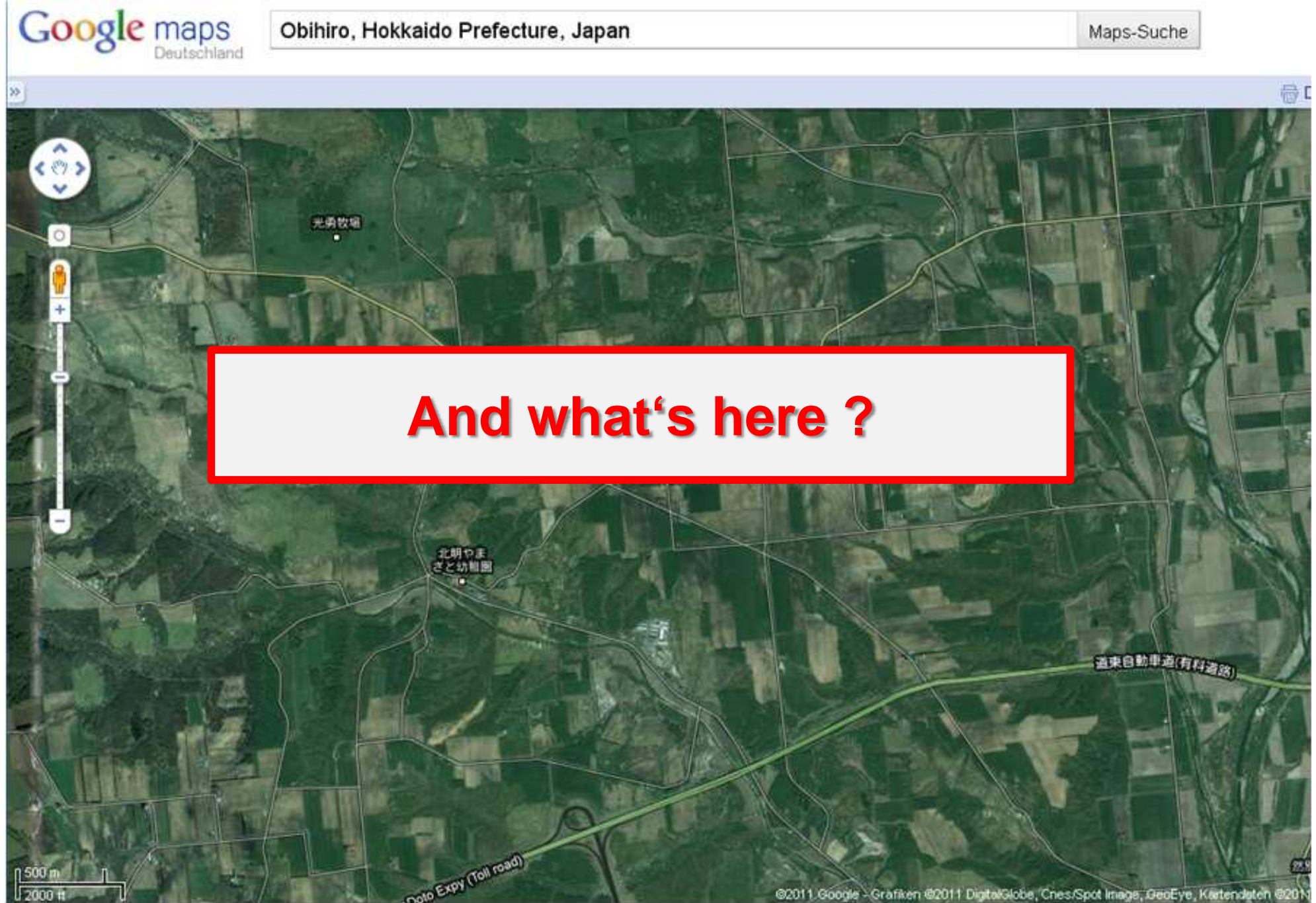
Transborder farming – benefits & risks

| | Benefits | Risks |
|------------|--|---|
| Technology | <ul style="list-style-type: none"> Participation in technological progress Use of site specific technologies in small-structured areas Efficiency effects by joint machinery use New challenges produce new (better) solutions | <ul style="list-style-type: none"> High technological requirements (costs, know-how) Older machinery may become useless Reservation against new technologies among the farmers Slowdown of development of small autonomous vehicles |
| Economy | <ul style="list-style-type: none"> Reduction of labor time and costs over 30 % Efficient machinery use and increasing yields Use of the best available technologies Use of the best available know-how | <ul style="list-style-type: none"> Decreasing autonomy of decision Reservations against each other Necessity of change in traditional thinking Risk of paternalism of bigger farmers |
| Ecology | <ul style="list-style-type: none"> Reduction of soil compaction and resource use Reduction of field and road traffic Reduction of soil erosion by slope adjusted cultivation Building of ecologic cells | <ul style="list-style-type: none"> Risk of uncontrolled enlargement of field structures Risk of decrease of biodiversity Risk of soil damage by using bigger machines Risk of higher soil erosion not considering the slope Risk of increasing intensity in plant protection and fertilization |
| Sociology | <ul style="list-style-type: none"> Increase of corporate feeling Benefits from specialized know-how one another Better (stronger) market position | <ul style="list-style-type: none"> Risk of decrease of attractive landscape structures Risk of decrease of traditional landscape forms |

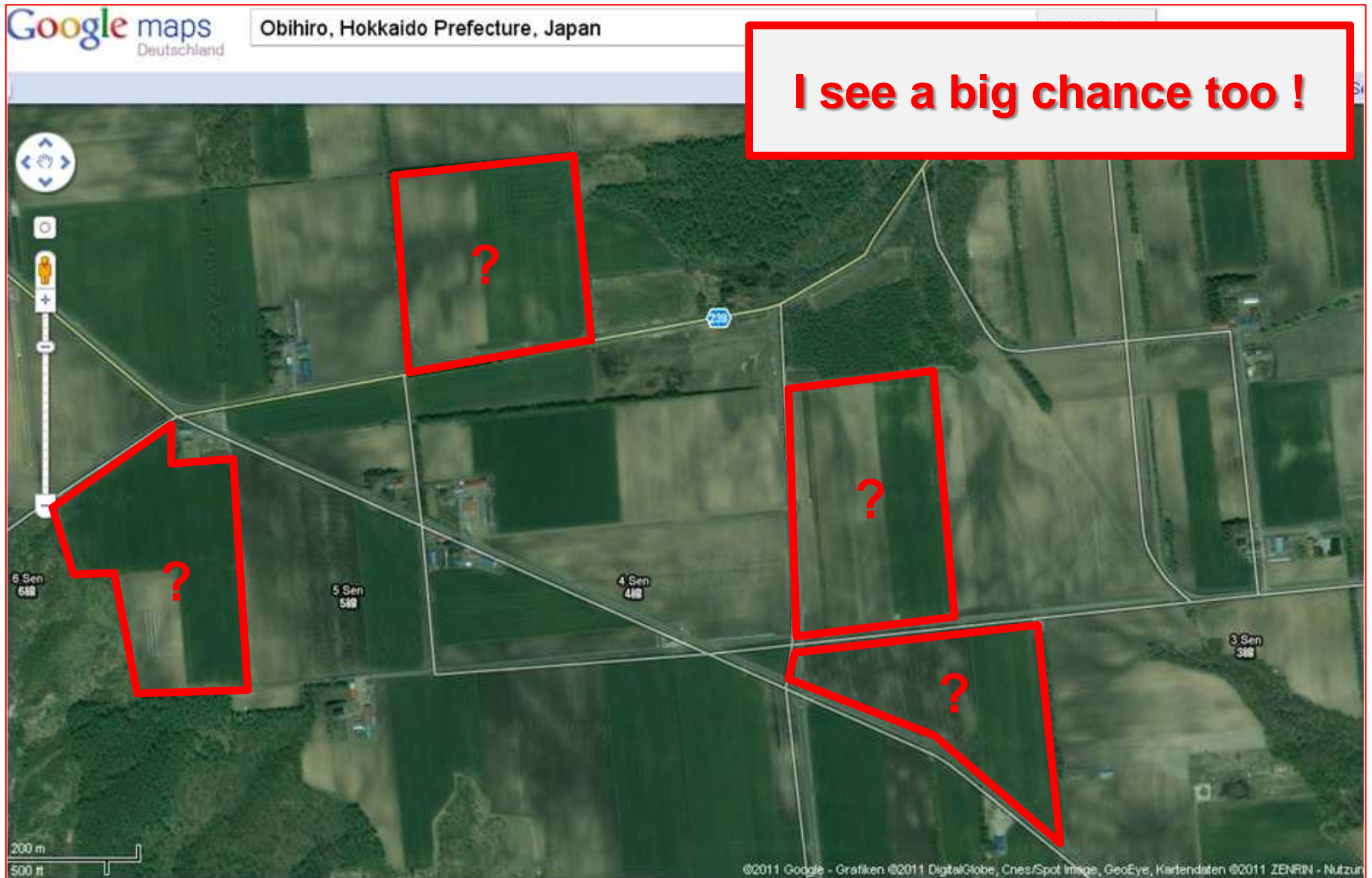
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Agriculture – Tokachi area (field located farmsteads)



Transborder farming – Tokachi area



Conclusions

Besides the traditional "Land Consolidation Measures" a Virtual Transborder farming is a **smart alternative**:

- There are **different alternatives** to initiate a project.
- Change to **machine cooperatives** allow the use of powerful mechanization as well as a significant decrease of costs.
- Field **enlargements may go up to 7 (15) to 1**, depending from the existing field sizes and the given field structure.
- **Smooth extensions** of transborder fields may occur during the installation of transborder farming systems.
- Economic benefits are around **300 to 400 €/ha and year**.
- **Ecologic benefits** result in lower soil compaction, less over lapping and in new possibilities in nature conservation (set aside, hedges, trees, ...).
- **Social benefits** are seen in more farmer to farmer (family to family) activities, in decreasing thinking about competition and in an improved style of life.
- The realized projects in Germany are running now for more than 10 years and all of them created **new benefits in accordance with the given situations**.

If you do not start, you may not be able to finish !

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