# Productivity, biodiversity and nitrate in Multifunctional Grasslands



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# Grasslands

- Complex ecosystems
- Play an important role in our daily life, for:
  - Farming (roughage, part of soil-sward-animal cycle)
  - Biodiversity (biotope for flora and fauna)
  - Amenity (major part of the landscape, lawns, playgrounds)
- Countryside is changing
  - Less important for agriculture
  - More important for residence and recreation
  - Society demands other functions from the countryside
- Competition between different functions
  - Segregation or combination?

# Multifunctional grasslands

- Multifunctional land use is an option
  - to integrate and combine functions,
  - to enlarge economical and environmental sustainability,
  - and to make an area more attractive for local people and tourism

- We studied the impact of multifunctional land use at
  - field level
  - farm level
  - local community level

# Project Sustainable Land Use Winterswijk
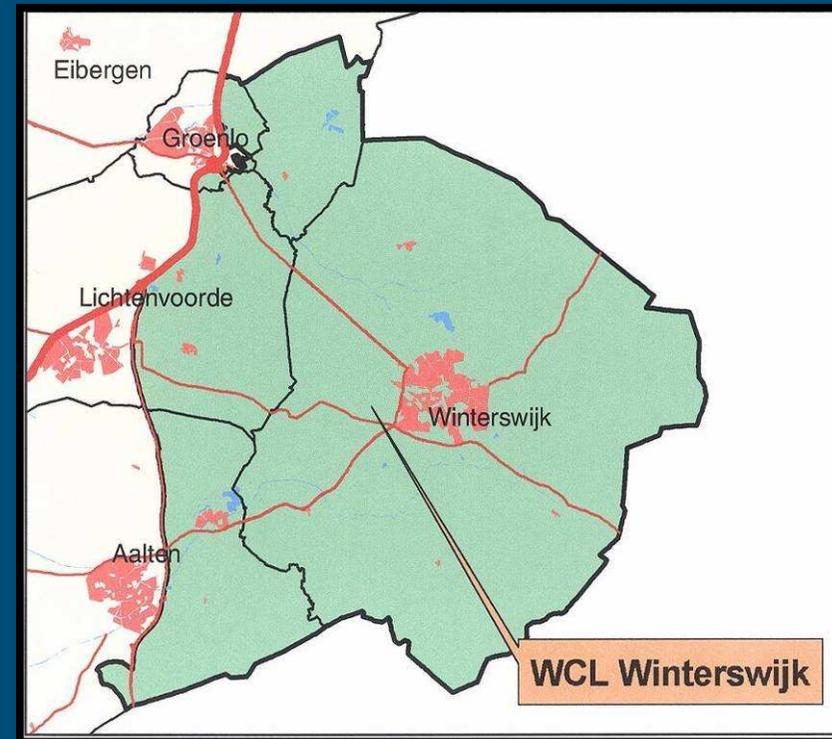


Development, monitoring and demonstration of function combinations during three years (2002-2004) on 14 farms with six grassland types

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# Grassland types

1. Fertilization: 179 kg N ha$^{-1}$   n:11

Ryegrass

2. Fertilization: 107 kg ha$^{-1}$   n:10

Grass-clover

3. Fertilization: 59 kg ha$^{-1}$   n: 8

4. Fertilization: 0 kg ha$^{-1}$   n: 8

Grass mixtures

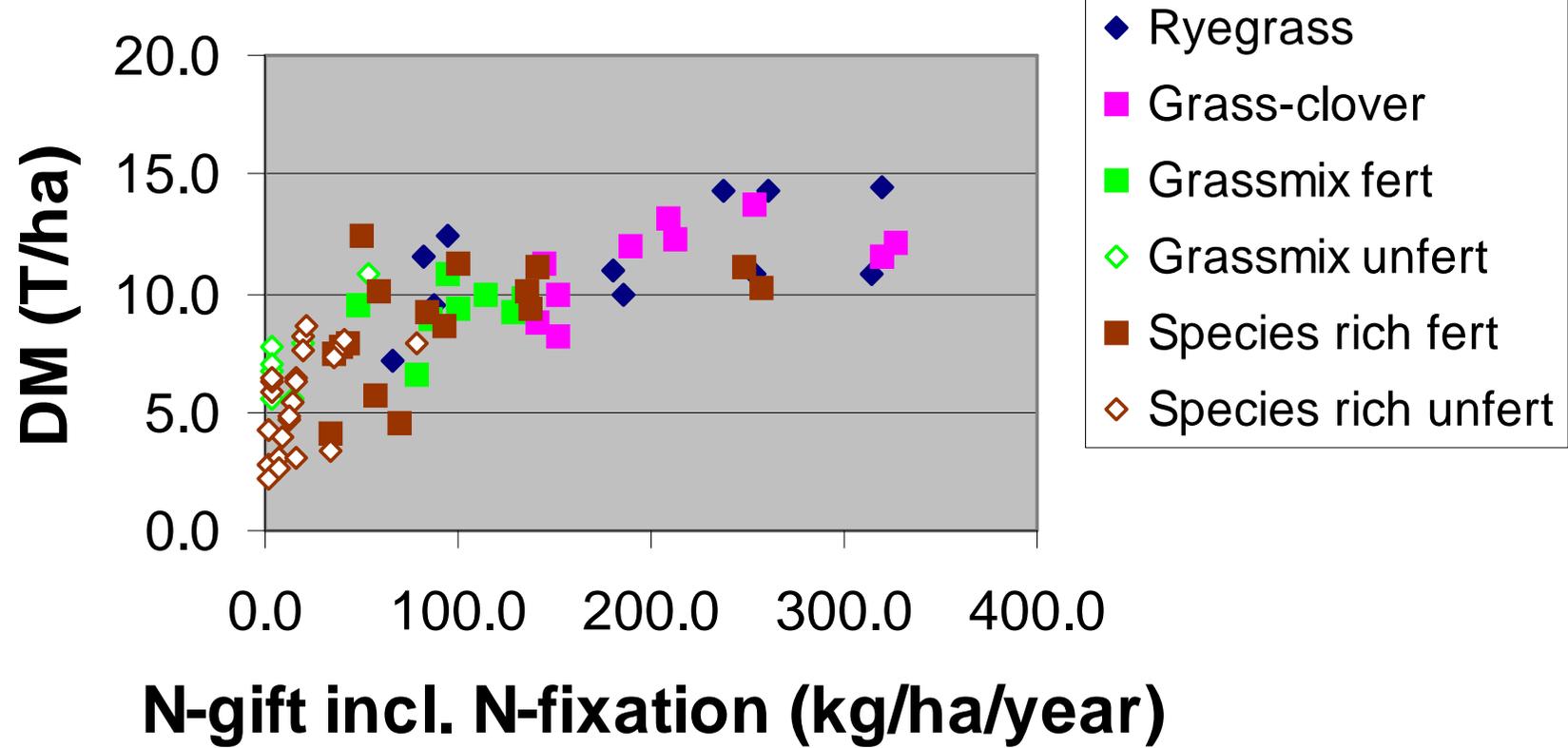5. Fertilization: 50 kg ha$^{-1}$   n:16

6. Fertilization: 0 kg ha$^{-1}$   n: 23

Species-rich

# Grassland types, DM production and N-gift

# Grass production and grass quality

| Grassland type | N-fert. kg ha$^{-1}$ | DM t ha$^{-1}$ | Net energy MJ kg$^{-1}$ DM |
|---|---|---|---|
| 1. Ryegrass (11) | 179 | 11.5 | 6.3 |
| 2. Grass clover (10) | 107 | 11.3 | 6.5 |
| 3. Grass mixture, fertilized (8) | 59 | 9.2 | 5.9 |
| 4. Grass mixture, unfertlized (8) | 0 | 7.5 | 5.6 |
| 5. Species-rich, fertilized (16) | 50 | 8.8 | 5.4 |
| 6. Species-rich, unfertilized (23) | 0 | 5.5 | 5.1 |

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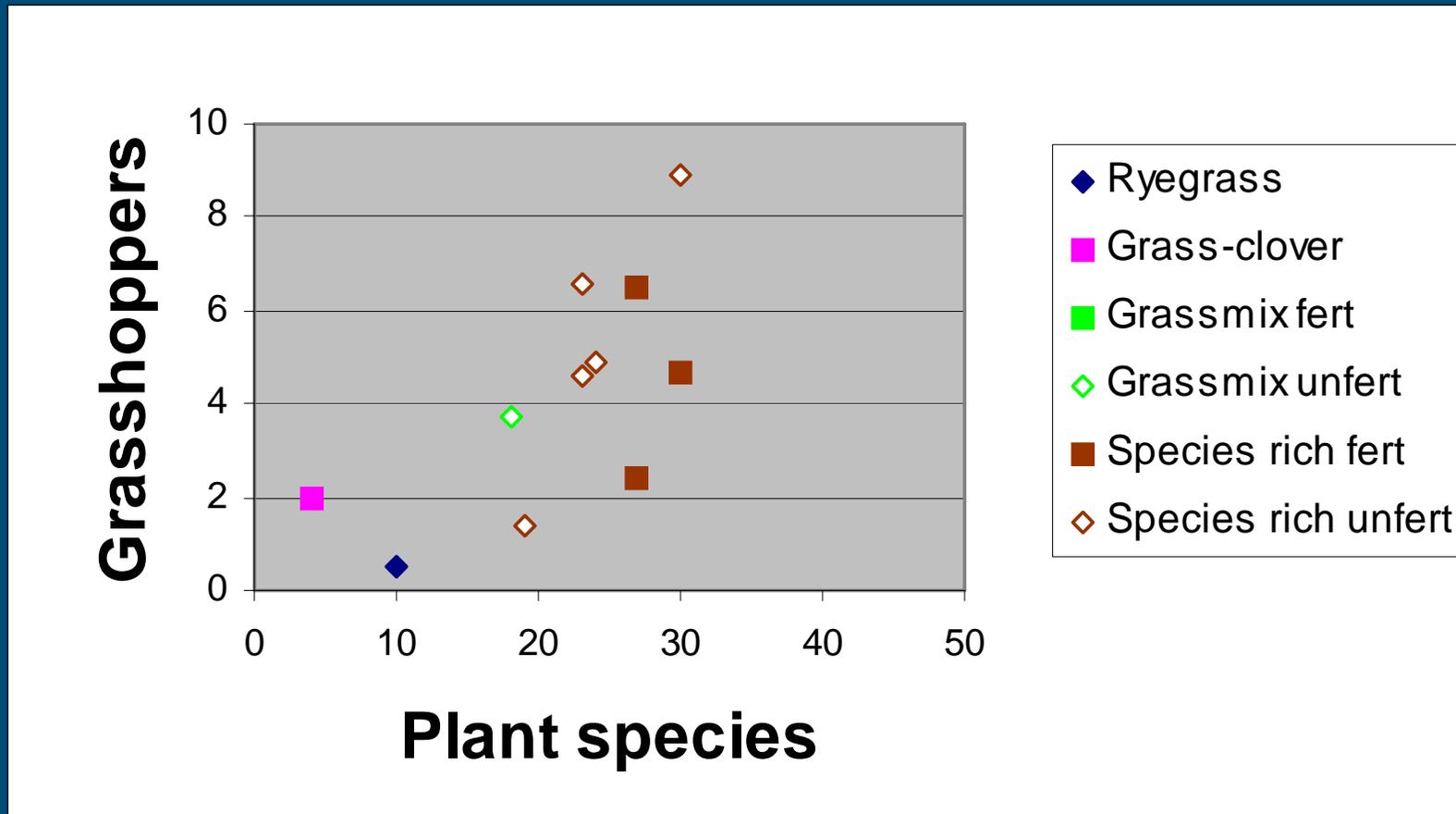# Monitoring biodiversity, amenity and environment

# Relation between species numbers and DM production
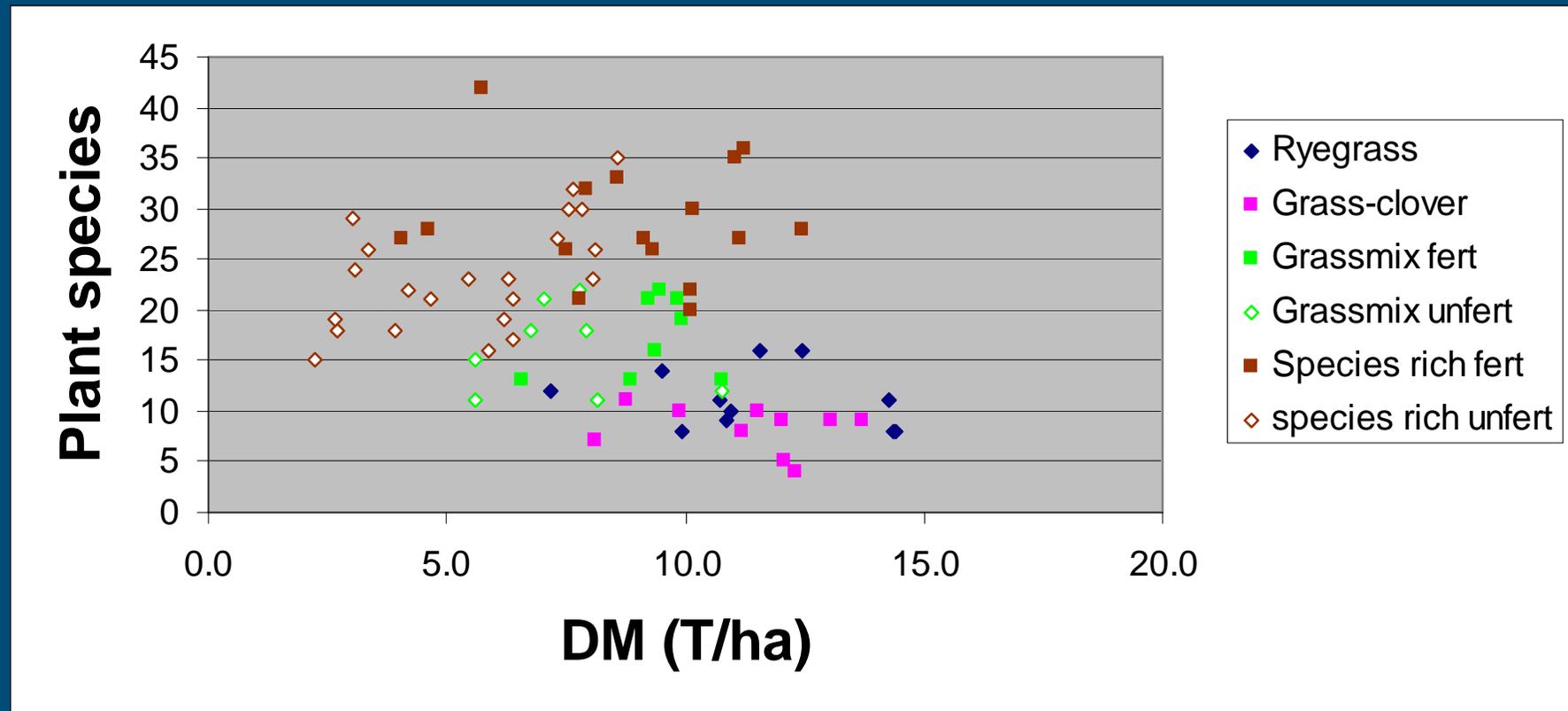
# Relation between N-gift and nitrate in groundwater
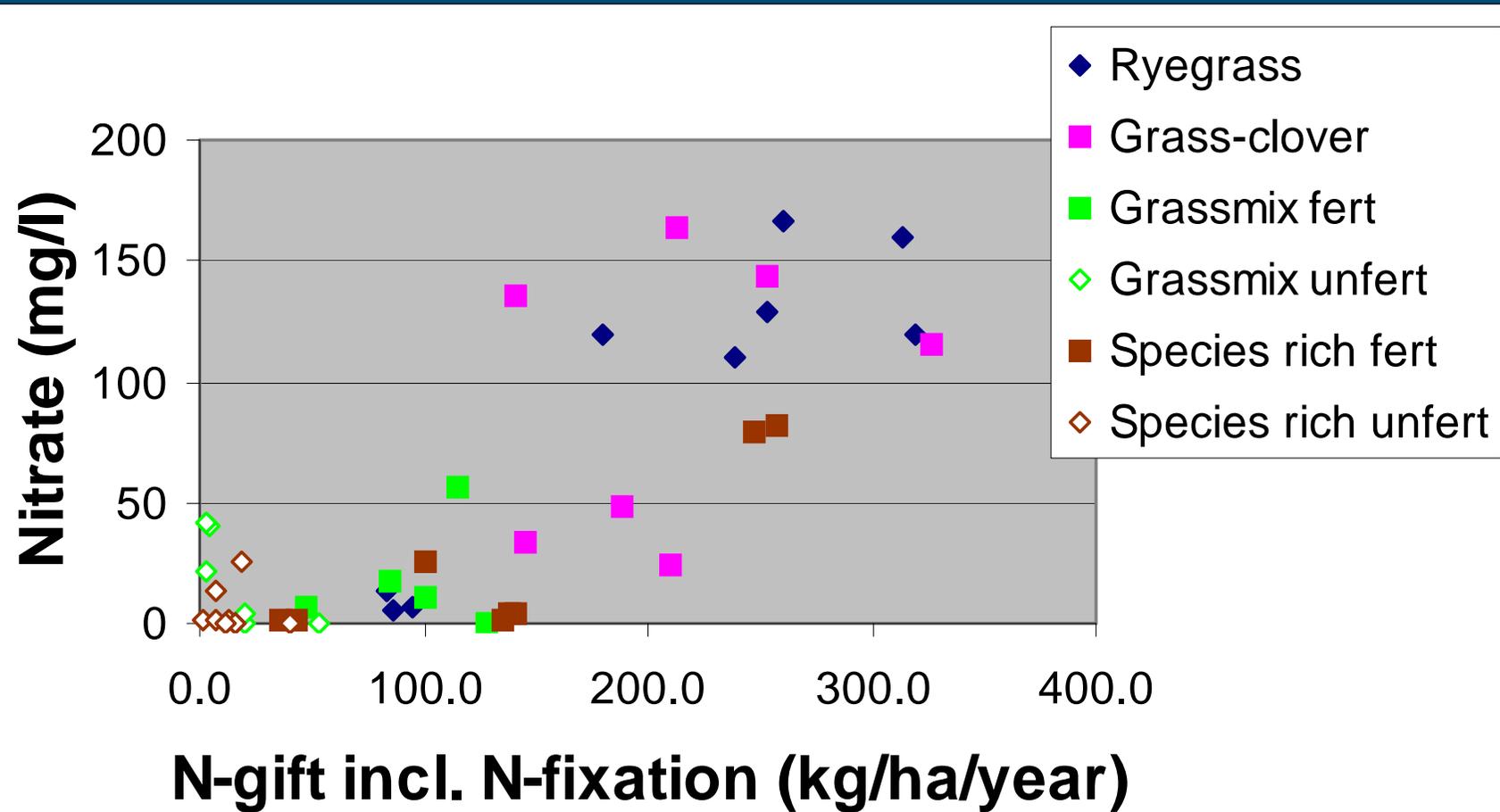
# Relation between grasshopper index and number of plant species

# Biodiversity, amenity and nitrate

| Grassland type | Plant species 100 m² | Butterfly index | Amenity index | NO$_3$ in groundwater mg l⁻¹ |
|---|---|---|---|---|
| 1. Ryegrass | 11 | 0.4 | 54 | 92 |
| 2. Grass clover | 8 | 0.1 | 30 | 91 |
| 3. Grass mixture, fertilized | 17 | | 245 | 18 |
| 4. Grass mixture, unfertlized | 16 | 0.6 | 313 | 18 |
| 5. Species-rich, fertilized | 29 | | 536 | 25 |
| 6. Species-rich, unfertilized | 24 | 2.4 | 533 | 4 |

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# Biodiversity, amenity and nitrate

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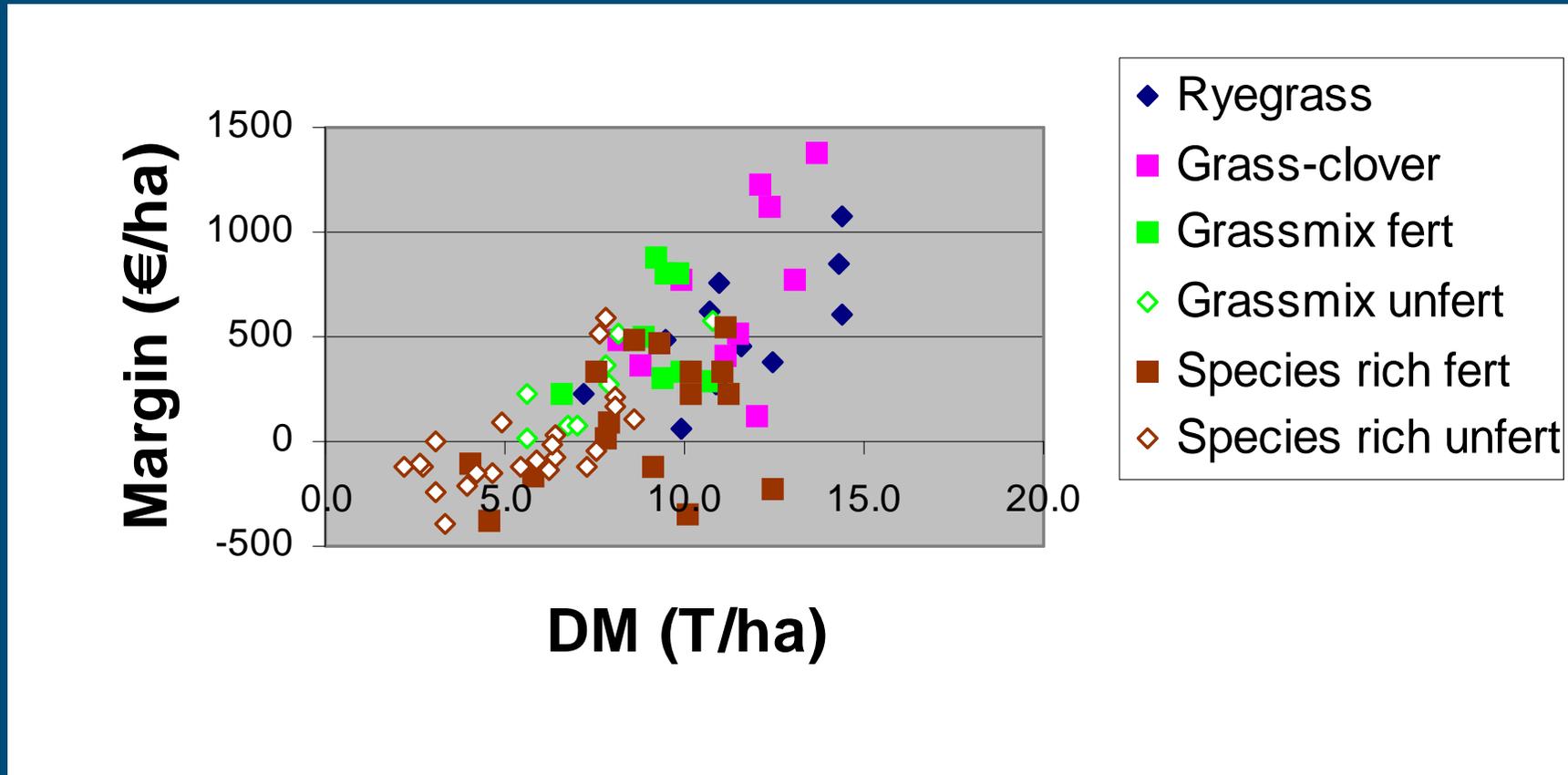WAGENINGEN UR

# Species-rich grassland after re-introduced
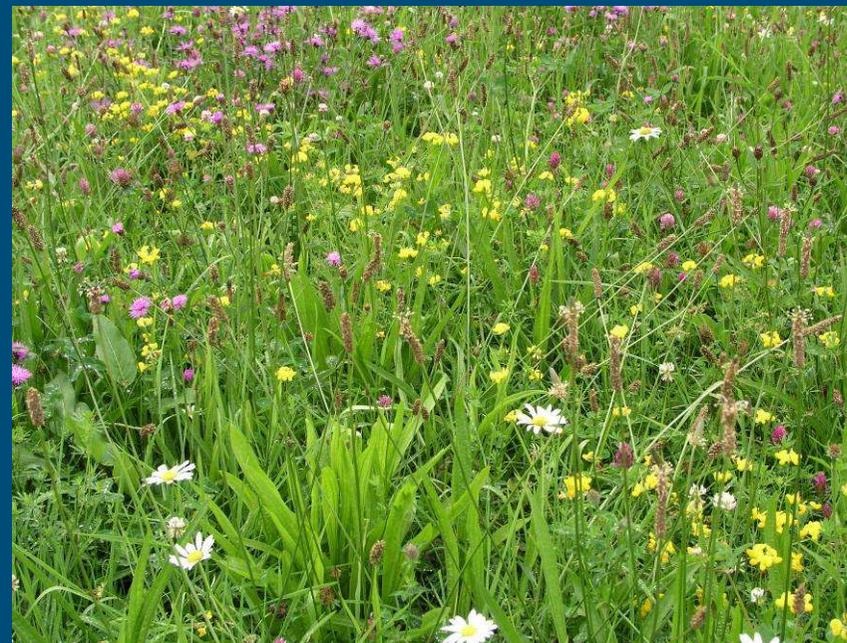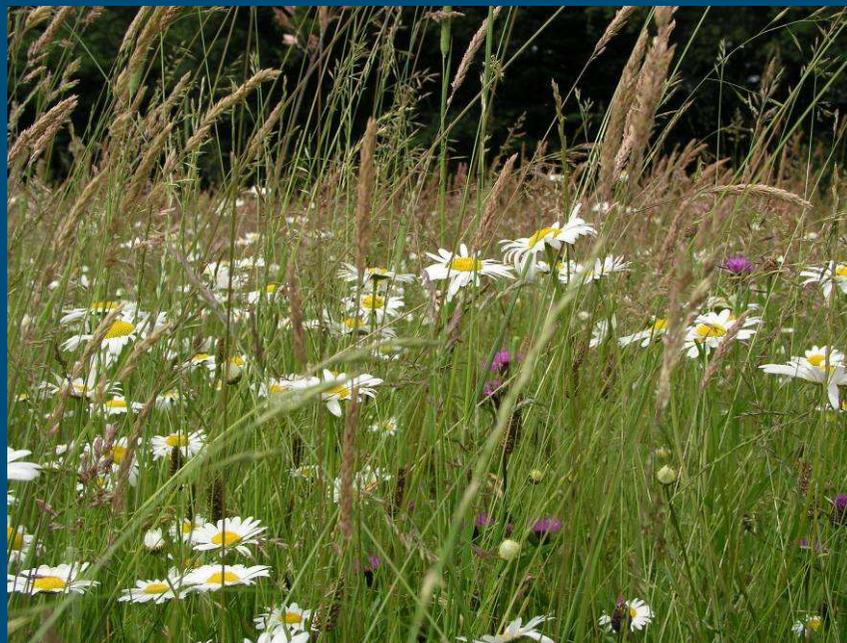
# With re-introduction and without (after 2-4 years)

| Species-rich | Re-introduction | Plant species | Legumes in DM (%) | DM (T/ha) |
|---|---|---|---|---|
| Fertillized | without | 26 | 6 | 8.3 |
| | with | 30 | 14 | 9.1 |
| Unfertilized | without | 21 | 4 | 5.1 |
| | with | 28 | 10 | 6.3 |

# Margin over feed and fertilizers related to DM production

# Profitablity for farmer and region

- For an individual farmer the profit of most grassland types (except grass-clover) was lower than for fertilized ryegrass.,

- But multifunctional land use can help to give an increase in recreation and tourism

- The increase in spending by visitors (75 M €) is much higher than the costs for farmers (4 M €)

- This offers opportunities for arrangements between farmer community and tourist sector to get a more balanced division between costs and revenues ('green blue services')

# Conclusion

Grass mixtures and species-rich grasslands with a limited fertilization can combine a fairly good production with a high biodiversity (plant species as well as butterflies and grass hoppers), low nitrate leaching and create an attractive landscape which can provide extra income for the whole region



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