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"How to both harvest and preserve forests more or better?"



# On production costs of biodiversity zones on arable land and in forests adjacent to fields

*Antti Miettinen<sup>1</sup>, Kari Hyytiäinen<sup>1</sup> and  
Antti Mäkinen<sup>2</sup>*

*<sup>1</sup> MTT Agrifood Research Finland*

*<sup>2</sup> University of Helsinki*



# Introduction

- **Decrease of biological diversity in agricultural environments**
  - intensification and specialisation of agricultural production
  - loss of habitats and rare species
  - weakening of the living conditions of more common species (e.g. pollinator insects) and decrease of valuable ecosystem services
- **Agri-environmental payments**
  - need for cost-effective measures which enhance biological diversity

# Aims of study

- The study compares the costs of two biodiversity measures from the viewpoint of a private landowner.
- The measures considered are:
  1. a biodiversity zone established on the border of a field
  2. a biodiversity zone established on the border of a forest abutting to a field
- The purpose of both measures is to produce meadow-like habitats particularly suitable for pollinator insects and to increase biological diversity.

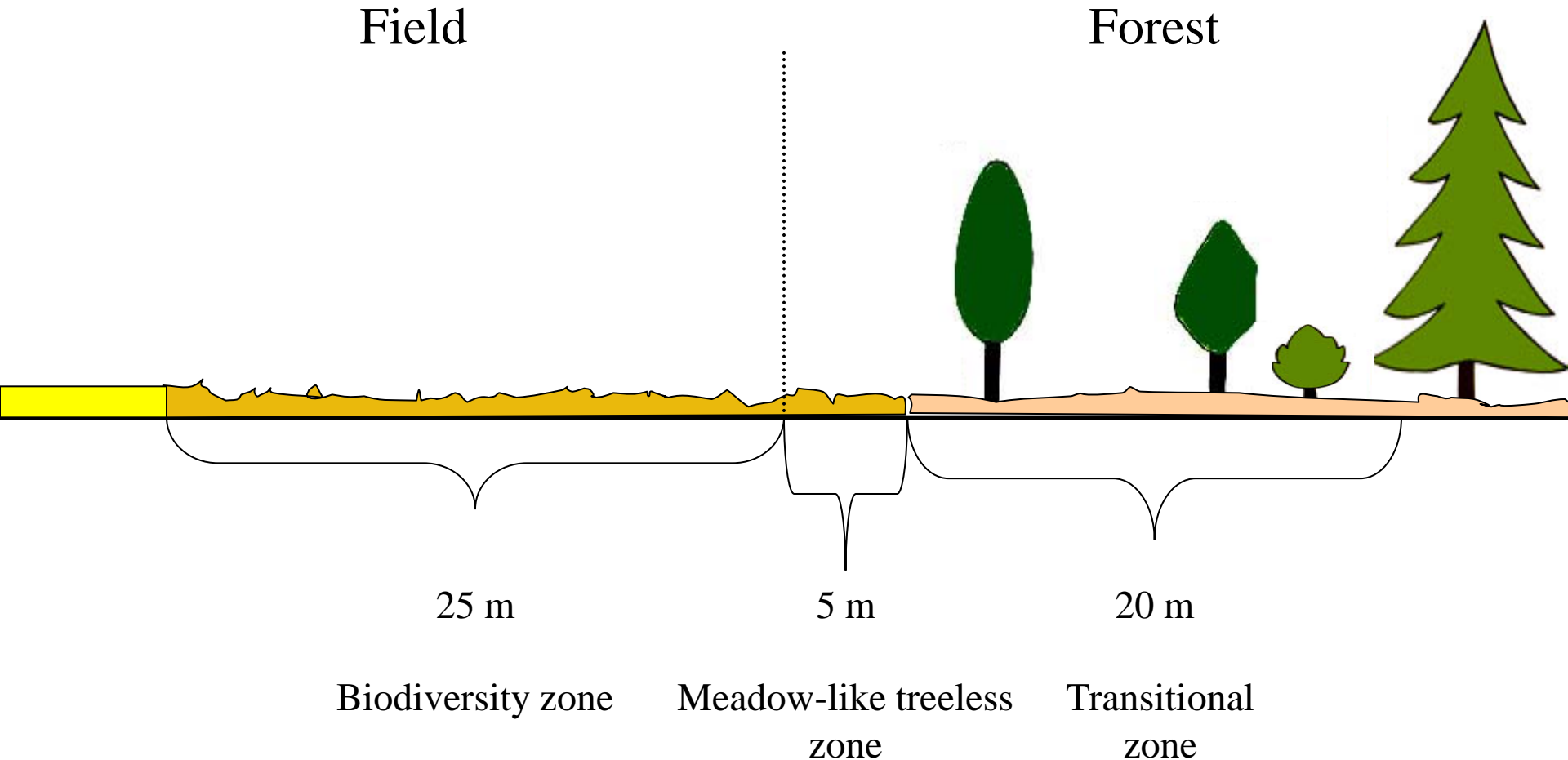
# Material and methods

- To evaluate the costs of biodiversity zones, 30 test plots were established in southern Finland.
- Forest management and fellings were simulated by means of SIMO simulator ([www.simo-project.org](http://www.simo-project.org)).



Photo: Tapio Tuomela / MTT

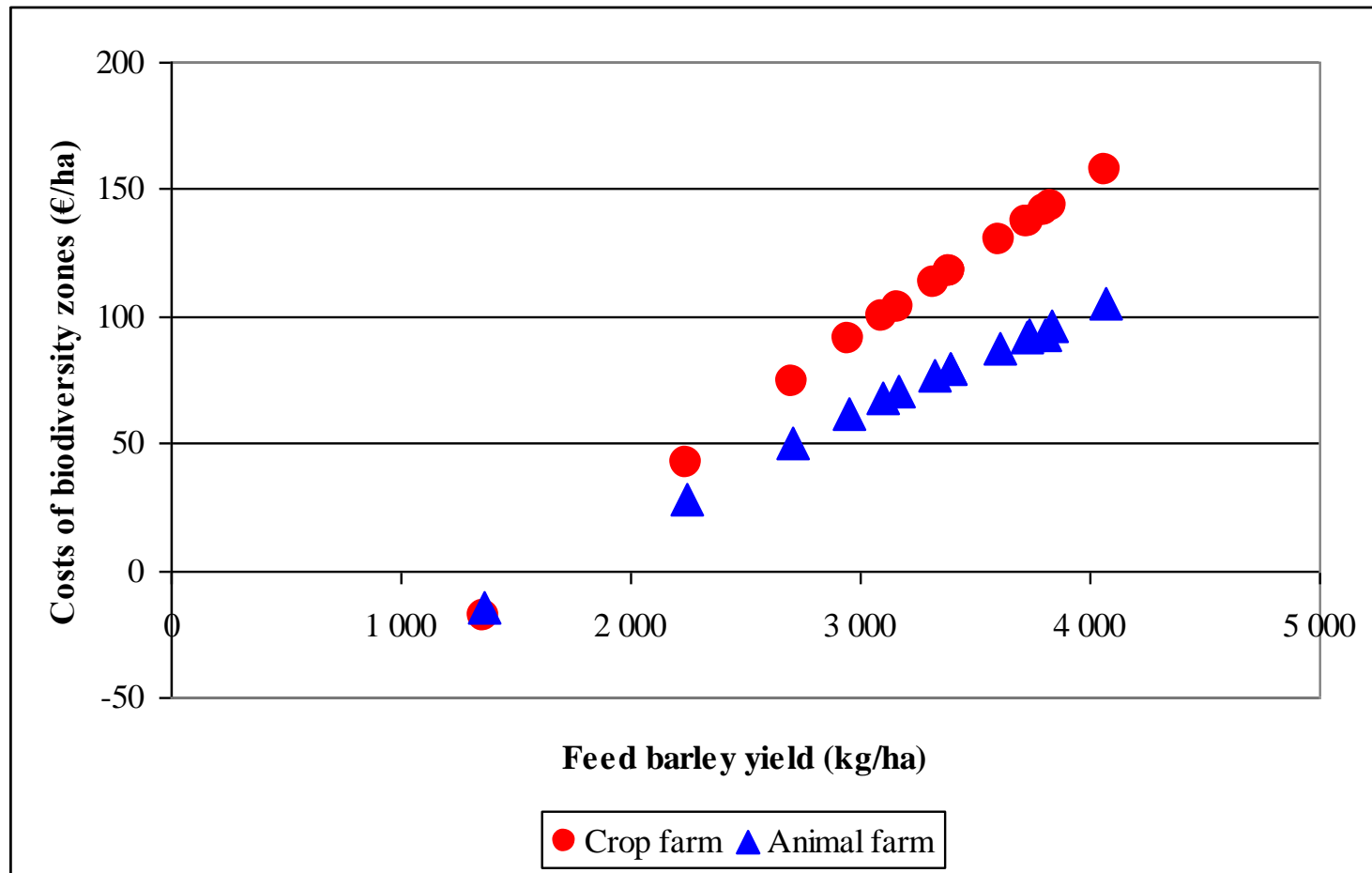
# Biodiversity zones



# Biodiversity zone on field

- The establishment of a 25-m wide biodiversity zone and the annual management of the zone will incur costs to the farmer/landowner.
- In addition, there will be income losses, since the border of a field previously used for agricultural production is now used for the production of environmental benefits.
- The production costs of field biodiversity zones were calculated by subtracting the present value of the net income stream received of the biodiversity zone from the present value of net income received in feed barley production.

# Annual net per hectare costs of biodiversity zones when price of feed barley is €125 per ton



# Biodiversity zone in forest

- In the first simulation, it was assumed that
  - no biodiversity zones are established
  - test plots are managed according to the prevailing practice in Finland (i.e. Forestry Development Centre Tapio recommendations)
- In the second simulation, it was assumed that
  - the 5-metre wide zone is immediately deforested and kept treeless with clearings repeated every 6–7 years
  - the 20-m wide transitional zone is thinned to the basal area of about 8 m<sup>2</sup>/ha, and its stands are managed by light selection fellings every 20 years
  - in the light selection fellings, trees are removed from all age classes, the emphasis being on tall trees



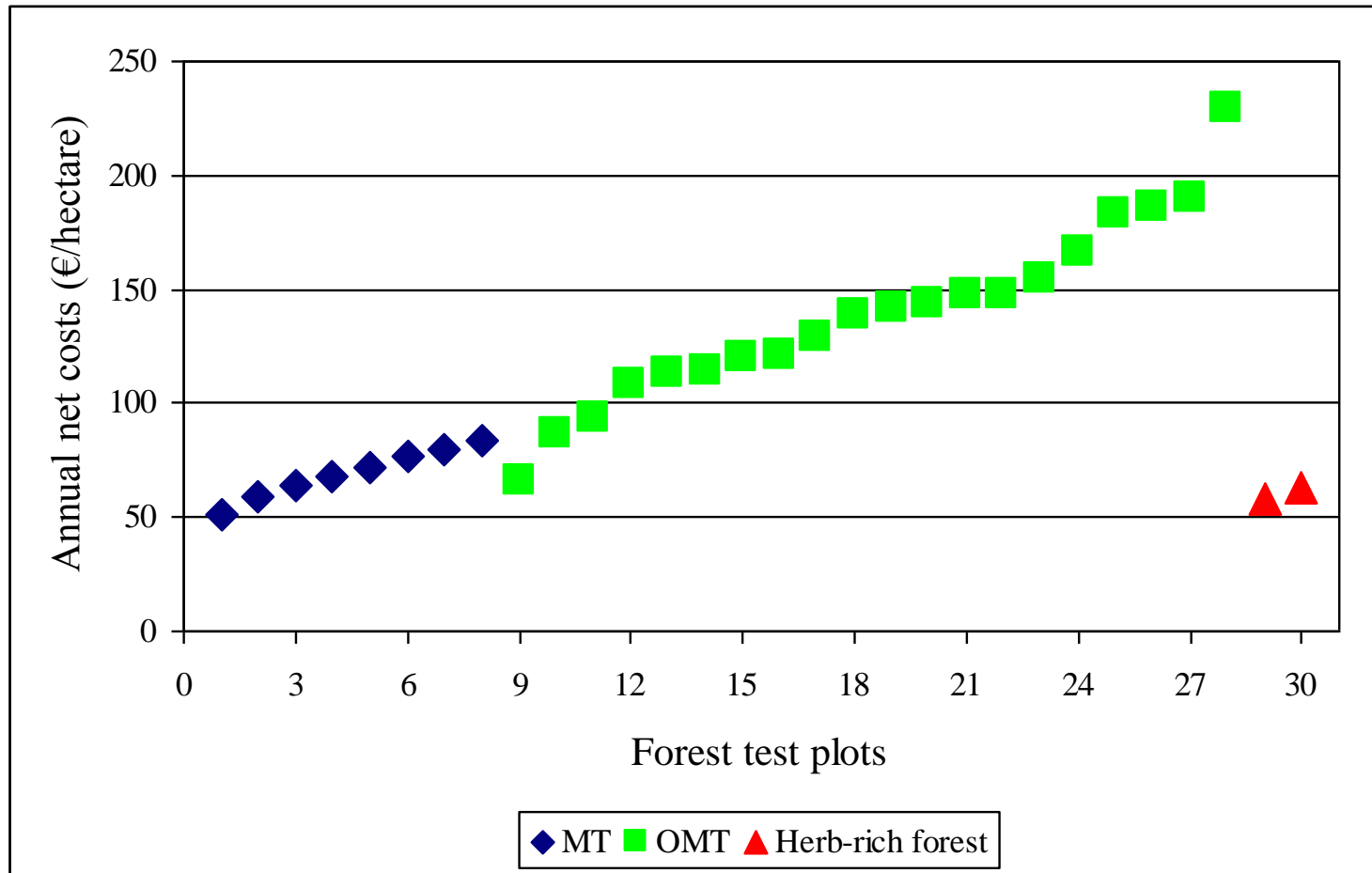
# Estimation results

- Costs are lower if we establish biodiversity zones in forests with poorer soil.
- A biodiversity zone established in an MT-type forest is about €70 cheaper calculated per hectare per year than a zone established on a better habitat (OMT or herb-rich forest).



Photo: Yrjö Tuunanen / MTT

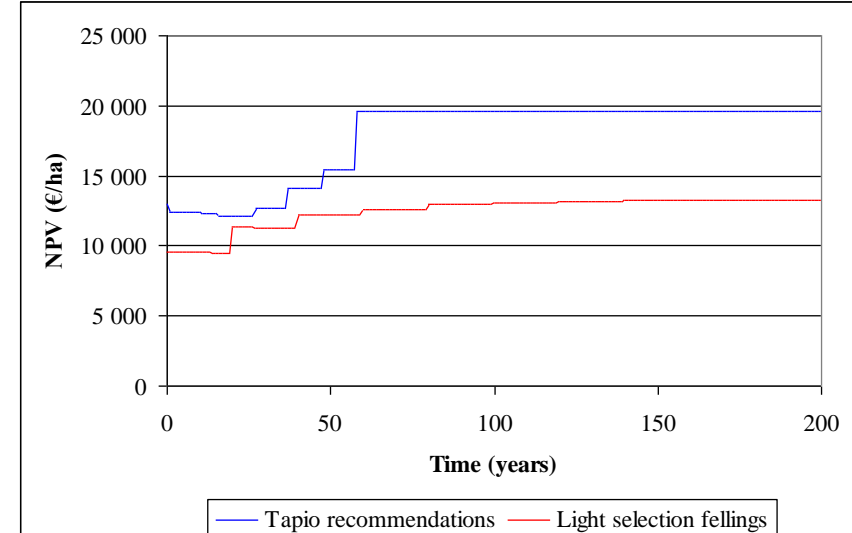
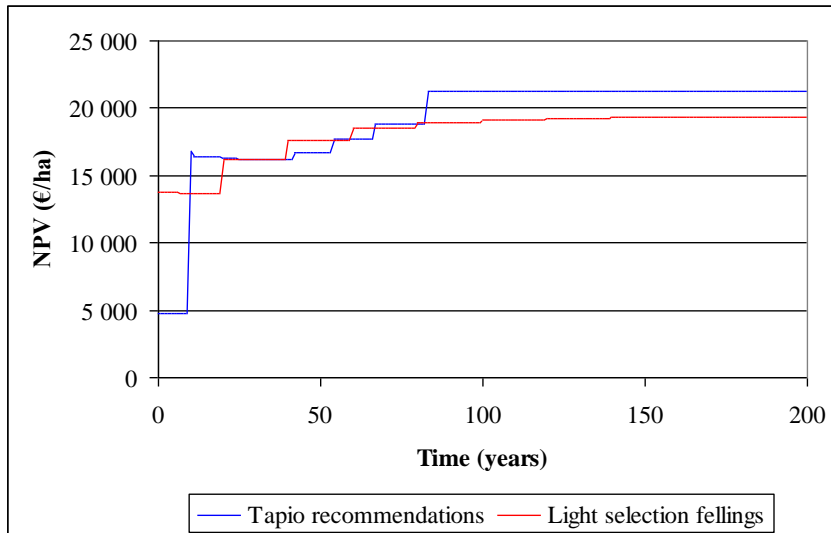
# Annual net per hectare costs of biodiversity zones in forest test plots according to habitat type



# More estimation results

- Costs are lower if we establish biodiversity zones in such forests which are not yet mature for final felling, but have a large volume of tree stand.
  - Biodiversity zones established in forests mature enough for final felling are on average €58 more expensive annually per hectare than zones established in such forests where the first final felling will be performed in some later year.
  - In the initial situation, an increase in the volume of per-hectare tree stand with one cubic metre decreases the annual hectare costs of the biodiversity zone with about €0.20 *ceteris paribus*.

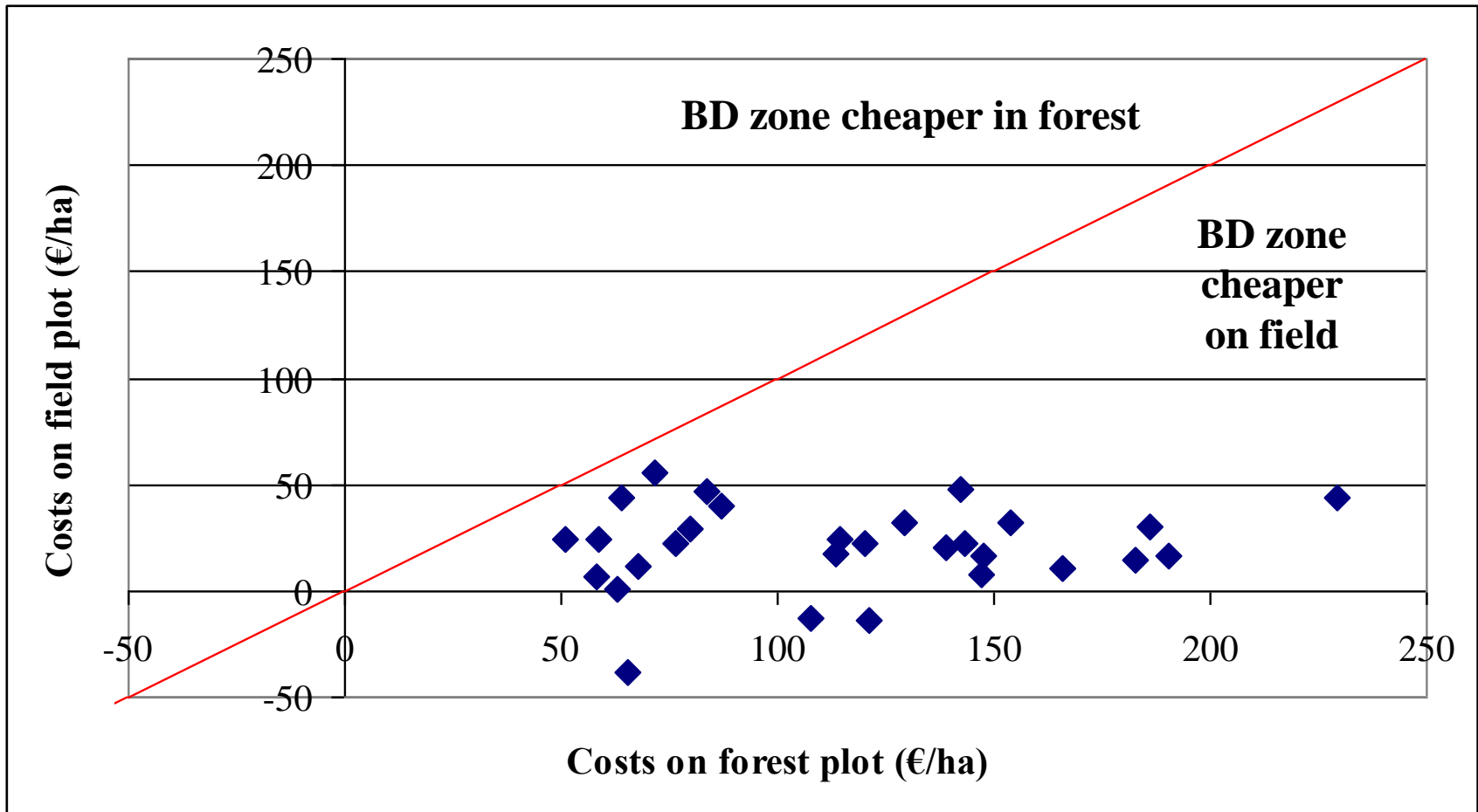
# Accrual of present values of net incomes on forest test plots 4 and 21



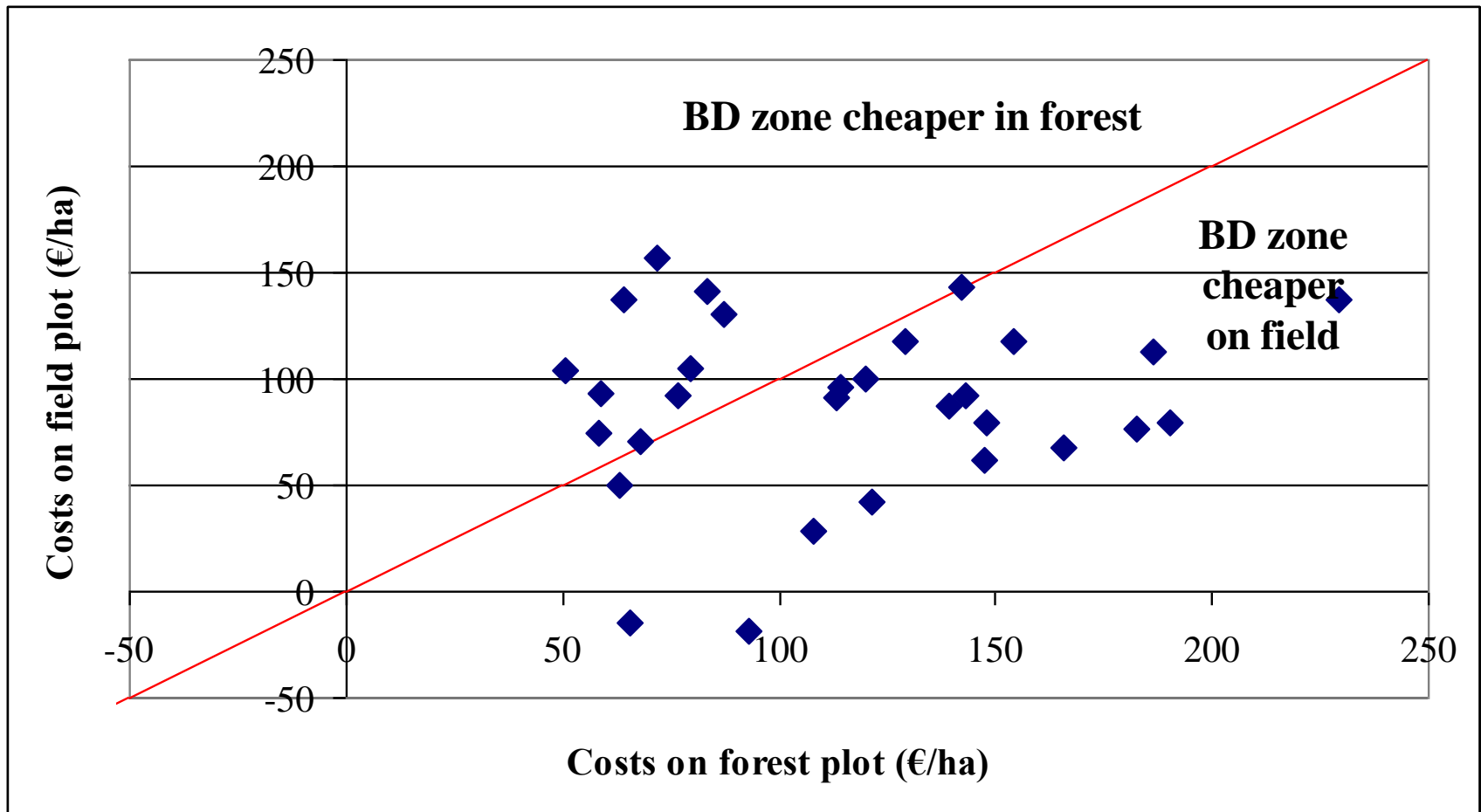
# Forest shading and field cultivation

- Biodiversity zones in forests adjacent to fields have a positive external effect on field cultivation, because the amount of solar radiation received by the field depends, among other things, on the height and location of the forest border adjacent to the field.
- According to our calculations, biodiversity zones and light selection fellings let on average 4% more solar radiation through to field plots than forests managed according to the Tapio recommendations.
- The difference in the value of annual feed barley yields is on average €6 per hectare.

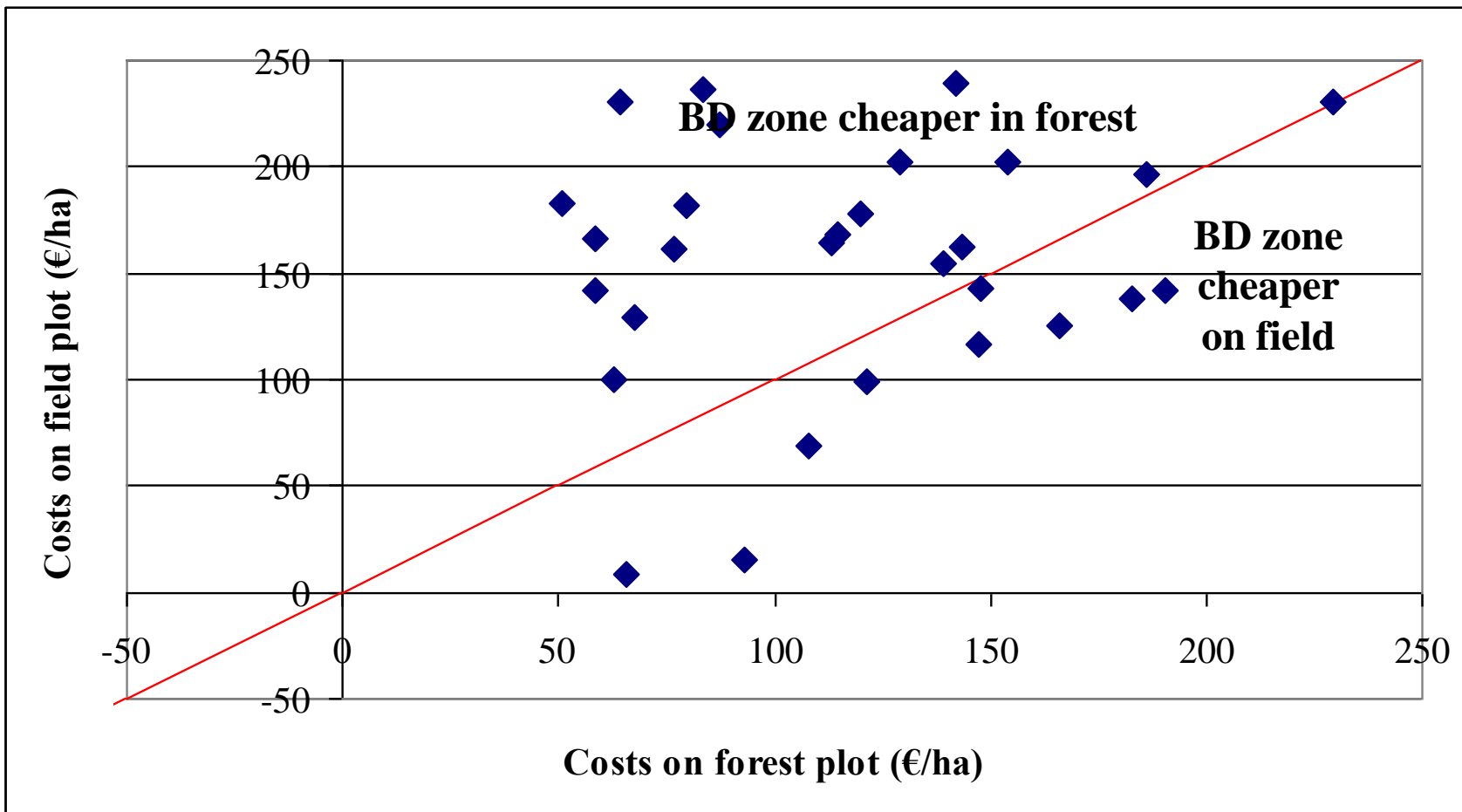
# Annual net hectare costs of biodiversity zones when price of feed barley is €100 per ton



# Annual net hectare costs of biodiversity zones when price of feed barley is €125 per ton



# Annual net hectare costs of biodiversity zones when price of feed barley is €150 per ton





# Conclusions

- The costs of biodiversity zones on arable land depend on the productivity of the field and the price of original crop and whether the farm is able to utilise plants grown on the biodiversity zone.
- In forests, the variation in the production costs of biodiversity zones resulted from soil productivity as well as the structure and volume of trees at the starting point.
- Biodiversity zones in forests adjacent to fields increase the amount of solar radiation received by the field.
- If the price of feed grain is permanently low, it may be viable to establish biodiversity zones on the field rather than in the forest.
- In addition, biodiversity zones established on the field are more easily returned to production than ones established in the forest.