

Performance of different ecosystem services as affected by tree lines in Juchowo biodynamic farm (north-western part of Poland)

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Aim and Methods

The study is aimed to evaluate the effect of tree lines on performance of different ecosystem services in Juchowo biodynamic farm (north-western part of Poland).

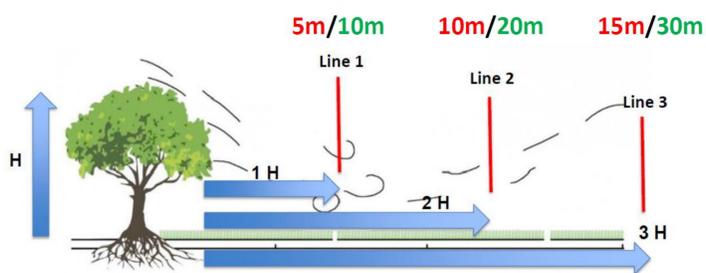
In 2021 two arable plots were established near the tree lines of different height and age. Spelt wheat (2021), winter barley (2022) and grass-clover mixture (2023) were grown near young trees (5-7 years old), while buckwheat (2021), oats (2022) and lupin (2023) close to old trees (<50 years old).

Crop biomass was collected using a 0.5m² frame. Biodiversity of insects was assessed using two methods: **yellow bowls** and **entomological net**. Soil temperature and moisture were measured using an automatic measuring probe left in the field from April to the harvest day of a crop. Most of the results cover 3 years (2021-2023), whereas for biodiversity measurements 2 years were presented.

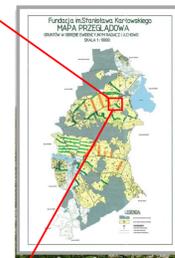
The performance of ecosystem services was assessed using the CICES V5.1 classification system.

DESIGN OF THE STUDY

The monitoring points were located in 3 lines in a distance equals to the multiplied height of the trees: **1x**, **2x** and **3x** longer. Each line consisted of 3 monitoring points.



Location of the experimental plots in Juchowo



Buckwheat cultivated near old trees (2021)



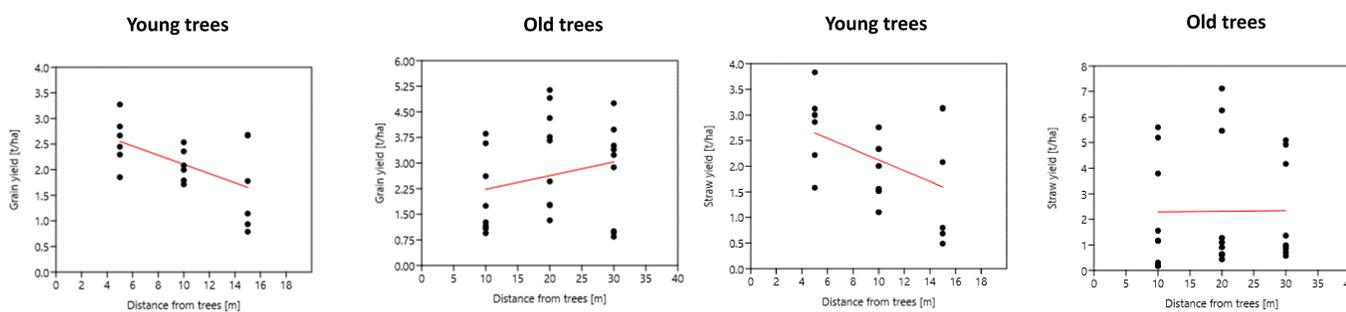
Strip of young trees (2021)



Spelt wheat cultivated near young trees (2021)

Results

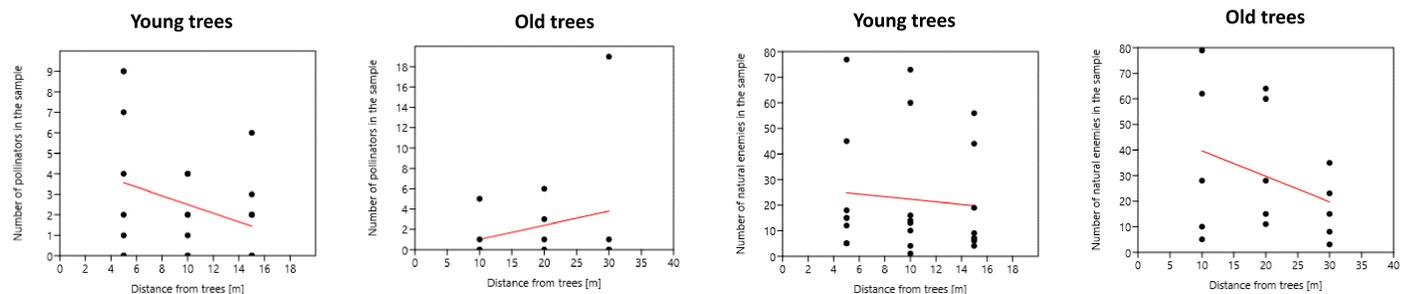
Section	Class	Code (CICES V5.1)	Indicator
Provisioning	Cultivated terrestrial plants (including fungi, algae) grown for nutritional purposes	1.1.1.1	Grain yield [t/ha]
Provisioning	Fibres and other materials from cultivated plants, fungi, algae and bacteria for direct use or processing (excluding genetic materials)	1.1.1.2	Straw yield [t/ha]



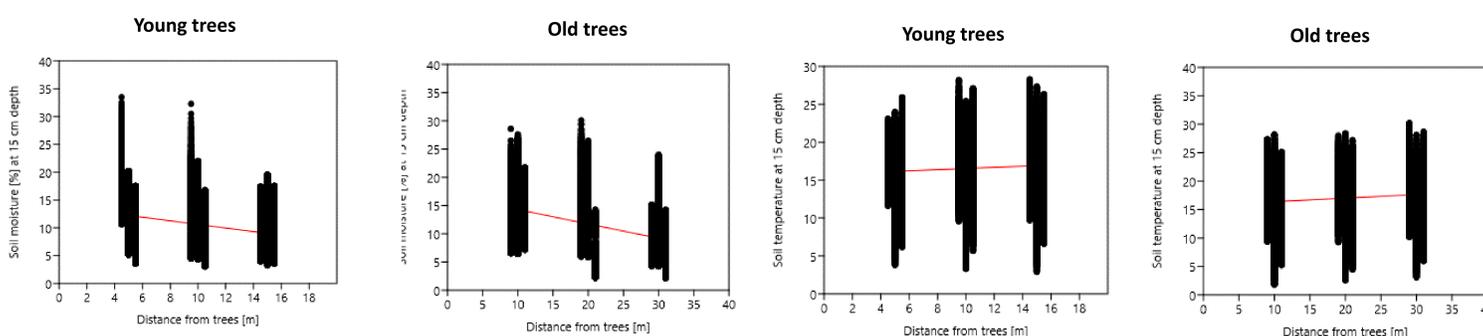
Grain and straw yields were higher near the young trees, probably because of the border effect. Older trees had a negative effect on grain yield at the closest distance, however straw yield was not reduced in this case. Much of the variability in results can be explained by weather extremes, especially drought, but also due to diverse crop rotation.

Section	Class	Code (CICES V5.1)	Indicator
Regulation & Maintenance	Pollination (or 'gamete' dispersal in a marine context)	2.2.2.1	Number of pollinators in the sample
Regulation & Maintenance	Pest control (including invasive species)	2.2.3.1	Number of natural enemies in the sample

The presence of trees had a positive impact on ecosystem services related to pollination and pest management. More pollinators were found near young trees than old ones and. The number of natural enemies of pests was higher near the trees independently on their age and height, which may be due to the presence of strip land under them excluded from cultivation.



Section	Class	Code (CICES V5.1)	Indicator
Regulation & Maintenance	Regulation of temperature and humidity, including ventilation and transpiration	2.2.6.2	Soil moisture [%] at 15 cm depth Soil temperature at 15 cm depth



Trees on arable land perfectly meet climate change mitigation objectives. Soil moisture was significantly higher near the trees and decreased towards the center of the field. Temperature was lower near the trees, even at a distance of 10-20 m. The results will be supplemented with measurements from a lower soil depth.

Key recommendations:

1. Tree lines have a significant potential in delivery of ecosystem services, especially regulating ones (natural crop protection, pollination and climate change mitigation).
2. The proposed agroforestry practice seems to be particularly important in simplified agricultural landscapes which dominate in the north-western part of Poland.