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Ecosystem services provided by trees in organic-biodynamic farming



Institute of Soil Science
and Plant Cultivation



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Background



Hedgerows has been proven as a practice that contributes to strengthening of environmental services in agriculture.



However, the effect of hedgerows may be different for provisioning and regulation services.



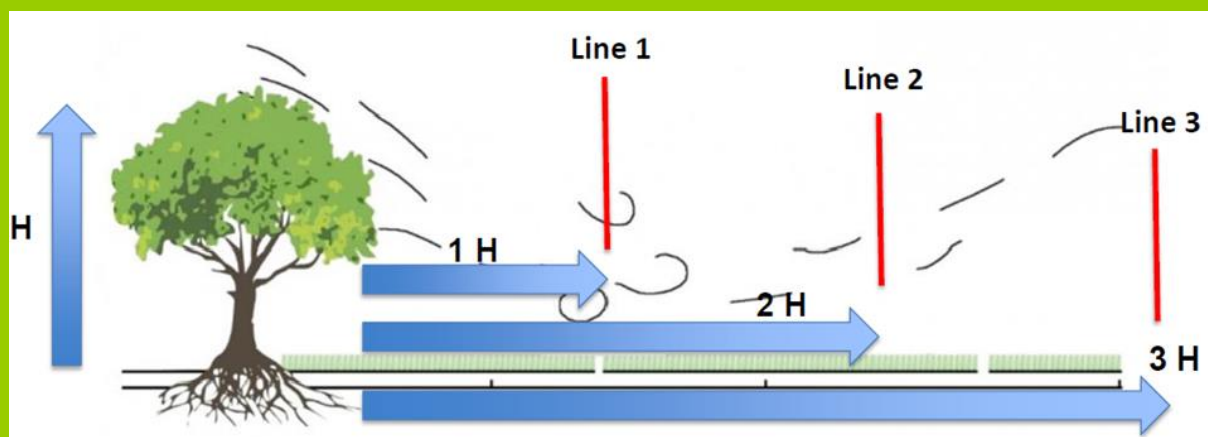
This work attempts to evaluate the effect of trees on crop yields, pollination potential, natural plant protection and climate regulation in organic arable agroecosystems.

Methodology



We assessed the potential of different ecosystem services, such as climate change mitigation, crop biological protection and pollination.

To collect data for indicators, samples and measurements were taken at three different distances from the trees. The distance at which measurements were taken was a multiple of tree height. In the case of young trees, it was 5m, 10m and 15m. In the case of old trees, it was 10m, 20m and 30m.





We found that crop yields were on average higher in the vicinity of trees, especially in case of young ones, however it depended on the species grown. For example, lupin and buckwheat grown near old trees yielded less than cereals.



Soil moisture is a good indicator of climate change mitigation that can be delivered by maintaining or planting trees in open areas. In our study at the closest distance from trees (5-10 m), soil moisture was 14%, at the next distance (10-20 m) 12% and only 10% at the furthest distance (20-30 m). This suggests that trees create suitable conditions for water storage in the soil.



Soil temperature is another indicator of adaptation to climate change. At the first and second distance from the trees, the temperature was almost 1°C lower than at the furthest distance from the trees (20-30m). Old trees, in particular, have a major impact on keeping soil cool.



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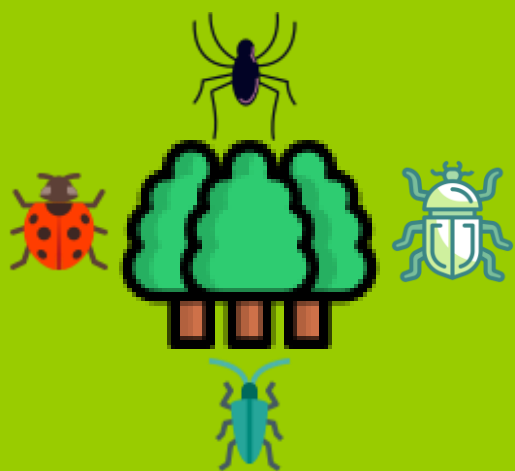


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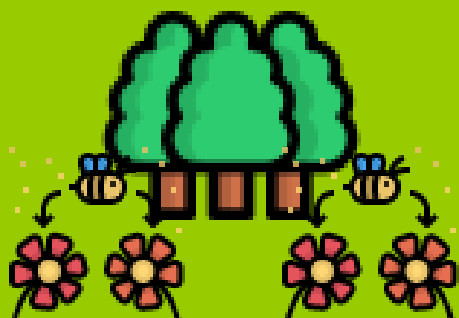
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The large number of natural enemies of pests near trees created good conditions for increasing natural plant protection. Several groups of predators such as ladybugs, spiders, carabids and minute pirate bugs were more numerous near the trees than in more distant locations.



The presence of trees influenced the reduction of pests such as aphids, thrips, leaf beetles, weevils, leaf bugs and gall midges. This is due to the formation of a good habitat for their enemies. However, some diseases and pests may be linked with the presence of trees.



The presence of trees had a positive impact on ecosystem services related to pollination. More pollinators were found near young trees than old ones, however, it depended on the plants cultivated. Also, the larvae of some pollinators are natural enemies of pests.



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In the vicinity of the trees, greater microbial activity was found affecting the improvement of soil quality. The number of bacteria was 22% higher. Dehydrogenase activity was 135% higher, acid phosphatase 112% higher and alkaline phosphatase 48% higher. Soil carbon content was higher by 37% and nitrogen content by 12%.

The main take home messages:



No significant reduction in crop yields



Conservation of soil moisture



Temperature reduction



Reduction in the number of pests



Increased presence of pollinators and beneficial organisms



Increased microbial activity and improved soil quality