

Ecosystem services of biodiversity in organic grasslands



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The use of multi-species mixtures in herbage production can add value in terms of improved conditions for pollinating insects, better resource utilization, carbon sequestration, yield stability, animal health and product quality.

This is the hypothesis of a new project - Eco-Serve - where the goal is to design grasslands, which increase both the nature value and provide an economically sustainable food production.

Grasslands provide a range of services in terms of quality feed, soil fertility and environmental benefits when incorporated into a crop rotation. However, the fields on organic farms are often large and the plant biodiversity is low.

The starting point of a new project is therefore to raise plant biodiversity in order to increase the 'natural value' of cropped land. Biodiversity can be increased by using mixtures of several grass species and inclusion of leguminous and non-leguminous herbs. It is expected especially to affect pollinating insects, which generally are in crisis, and to this end temporary leys are created that can provide flowering plants throughout the growing season.

Additional benefits of multi-species mixtures may be improved animal health and product quality – and in the marketing of livestock products with a 'good story'. The prerequisite for all is that the production level is to some extent maintained, so it at the end of the day is also economically attractive for farmers.

Declining pollinator populations

Pollinating insects are declining, both honey bees and wild pollinators (bumblebees, solitary bees, butterflies and hoverflies). In Denmark, the number of honey bee colonies have dropped by 39% over the period 1985-2005, and although the simultaneous decline in the number of beekeepers (49%) are somewhat reversed, the number of colonies remain small. For wild bees the decline is at least as comprehensive. The Red List includes roughly half of the 29 Danish bumblebee species (41%), 56% of butterflies, 34% of moths and spiders, and 31% hoverflies, but we do not know the status of solitary bees.

There are many possible causes for the decline. Diseases, parasites, abandonment of habitat, fragmentation of landscape, climate change and the intensification of farming are all possible causes. In this project we will therefore investigate whether organic pastures with an increased number of herbs, selected among the so-called bee-plants, and managed with a cutting strategy that ensures



*Grasslands with flowering 'bee-plants' may offer help to pollinators in crisis.
Photo: Karen Søegaard.*

Table 1. Competitiveness of grassland herbs

Strong competitors	Intermediate	Weak
Chicory	Salad burnet	Chervil
Plantain	Birdsfoot trefoil	Sainfoin
Caraway		Melilot

flowers in the field throughout the season will result in more species and a higher number of pollinators.

It is estimated that pollinating insects worldwide contribute to 15-30% of food production and the bees are considered the most important pollinators. The value of pollination in Denmark alone is estimated to approx. 90 million euro per year.

Establishment of niches

Plant species used in leys, are chosen to in order to get quality feed while having a huge production under fertile soil conditions. The most important are perennial ryegrass, white clover and red clover. The huge growth potential of these species and broad growth form make them strong competitors against other species. It is demonstrated by the fact that there are almost no weeds in these fields. When we want to introduce a higher biodiversity, the challenge is therefore to establish niches for less competitive species.

We have started to investigate various herbs sown with clover to assess their competitiveness when they grow directly with the strong competitor clover. There are three strong spe-

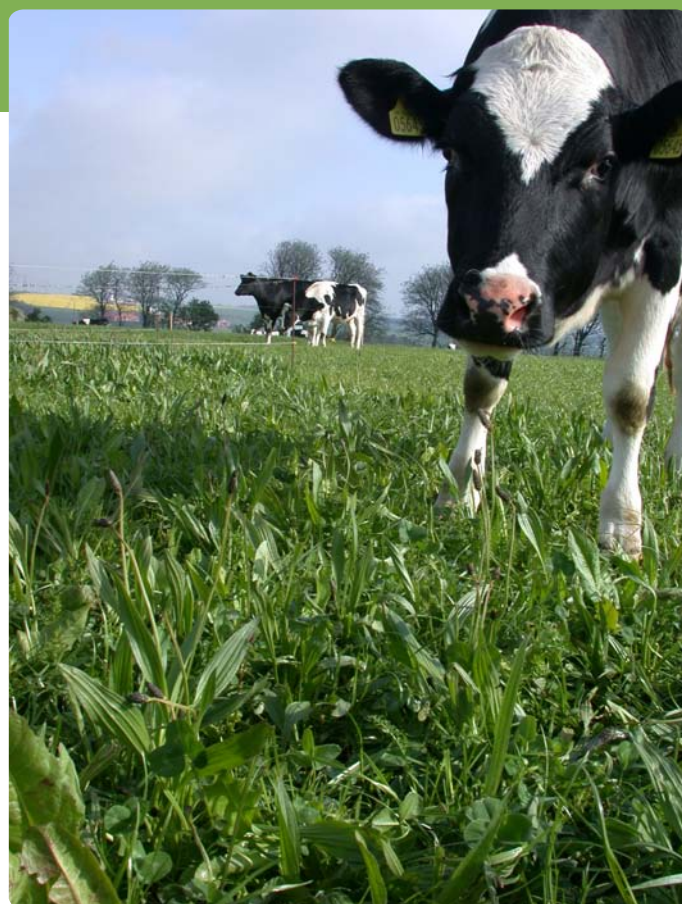
cies, chicory, plantain and caraway (Table 1). If a high biodiversity is to succeed, it is necessary to create architecture in the field with areas that meet the needs of the weak competitors.

To achieve an effect on feed quality, it is necessary that the individual herb is represented in significant quantity in the field, which is less important if the goal is to have a food source for insects. In this project, we explore ways to accommodate both purposes.

Production and duration of 17 different species will be tested in pure stand, including field scabious, red dead nettle, white dead nettle, dandelion, borage and chives. Additionally, we test various two-species mixtures with one leguminous and one non-leguminous species in order to find suitable combinations of less competitive species.

Added value and marketing value

An increased plant biodiversity in grassland not only may improve conditions for pollinating insects, but may also have other positive effects. We will investigate the possibility of increased carbon storage in soil because of deeper root growth and



Multi-species mixtures can increase the use-value of grasslands among other things yield stability and animal health.

Photo: Karen Søegaard.

thus greater sequestration of carbon at depth. Moreover, one project aim is to produce high quality cheese based on hay with many species and develop marketing concepts for such multi-functional organic products. Finally, we will calculate the real value of ecosystem services (pollination, animal health, etc.) and an increased marketing value of quality products with a

'good story'. The project just started and runs until the end of 2013. It is funded by the Green Development and Demonstration Program and follows the chain from the field to the consumer.



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More information
Read more about the Organic RDD project EcoServe on the webpage: http://www.icrofs.org/Pages/Research/organicrdd_ecoserve.html
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