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# CONTRIBUTION FOR IMPROVING THE AGRO-ENVIRONMENTAL EFFICIENCY OF AGROFORESTRY SYSTEMS FOR HONEYBEES IN AGRARIAN ENVIRONMENT

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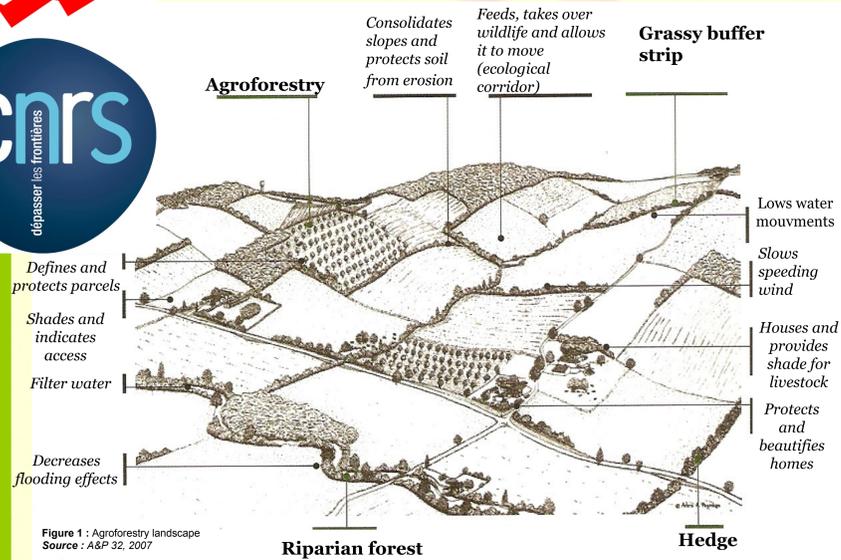
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# CONTRIBUTION FOR IMPROVING THE AGRO-ENVIRONMENTAL EFFICIENCY OF AGROFORESTRY SYSTEMS FOR HONEYBEES IN AGRARIAN ENVIRONMENT

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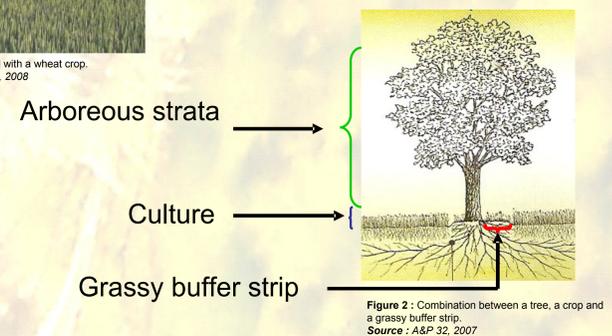
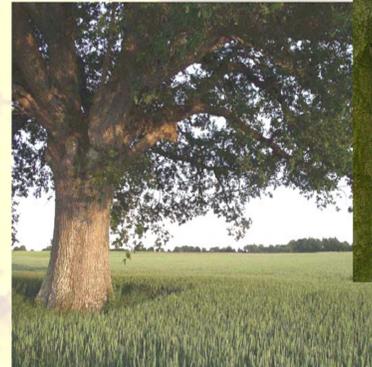
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## The importance of a high biodiversity landscape for maintaining honeybees in agrarian environment

Most of the plants cultivated in Europe (84% overall) need pollinators to produce. But since several decades, a decline of the insect pollinators population can be witnessed, and even the extinction of some of them (Vaissière et al., 2008). Honeybees are particularly affected by such a loss, and their extinction is increasing, endangering the future of agriculture. An understanding of this multifactorial problem is required.

In this regard, the consequence of the current reduction trend of fallow in agricultural environment is a decrease of the melliferous resources. Therefore, it is crucial to promote "new" areas of high biodiversity on the edge of cultivated areas in agrarian environment, like hedges, river bank vegetation, or to (re)introduce trees in the cropping systems. Such cropping patterns are known as **agroforestry systems**, and the hypothesis is made that they are able to sustain and even promote beekeeping activities.



## How useful could be agroforestry for apiculture ?

According to ICRAF, agroforestry is an integrated approach of using the interactive benefits from combining trees and shrubs with crops and/or livestock. It combines agricultural and forestry technologies to create more diverse, productive, profitable, healthy and sustainable land-use systems..

Trees and crops associations can show several types of combinations (intercropping in corridors, windbreak hedges, isolated trees in cultivated fields). On a landscape scale, agroforestry offers complex systems like hedged farmlands, ensuring even an intensive agriculture highly mechanized but using less chemical inputs. Thanks to the combination between arboreous strata, bushes and grassy strips, agroforestry systems can offer melliferous resources of higher quantity and quality

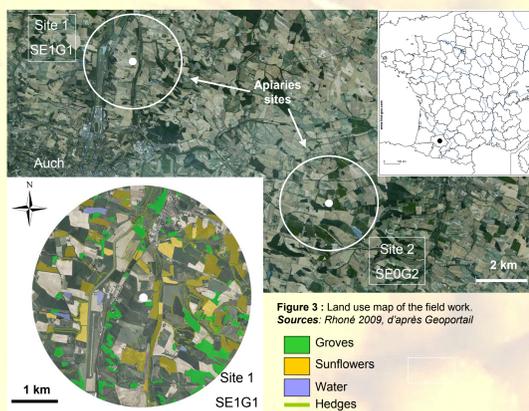
## Experimental measurements of agroforestry systems' value, for honeybees

The French Ministry of Agriculture and Fishing is finding a strong interest in agroforestry by supporting an important CASDAR (Compte d'Affectation Spéciale pour le Développement Rural Agricole) development project entitled "Improving the agri-environmental effectiveness of agroforestry systems in agrarian environment". The aim of this project is to contribute to a better knowledge of agroforestry systems and promote new agroforestry technical routes in order to minimize the impact of intensive agricultural practices on water and soil quality, and on biodiversity. This project is focused on five research topics : "biological control", "biological life of soil", "water cycle", "biomass production", "regulations".

**The present study is part of the topic « biological control ». We intend to study four groups of auxiliaries, including pollinators such as the honeybee (Apis mellifera mellifera), to measure melliferous interest and diversity of nutrient resources (in term of quality and quantity) that agroforestry systems can offer to bees, in order to maintain them in agrarian environment.**

## Methodology

### Location of the field work areas



➤ Two experimental sites located in Gers, South West of France (showing the same soil and climatic conditions) have been selected. Each of them corresponds to a 3 km radius circle (average distance for a foraging bee). These two sites are 10 km away from each other. The first "experimental" site SE1G1, corresponds to an agroforestry system. The second site SE0G2, or « control site », has a similar density of vegetation but a lower plant diversity.

➤ Each site has an apiary of 10 hives belonging to the same beekeeper. Three hives per site are equipped with pollen traps. Three other hives per site are equipped with dead bee traps.



## Work Hypothesis

- Agroforestry systems promote qualitative and quantitative development of the melliferous resources
- Agroforestry systems promote the availability and durability of the melliferous resources at the landscape level in term of time and spatial scattering

### Types of observation (March to October)

Objects	Features
Beekeeping monitoring	<ul style="list-style-type: none"> <li>➤ Weighing hives (1 time a month)</li> <li>➤ Counting the dead bees (2 times a week)</li> <li>➤ Measurements of brood (1 time a month)</li> </ul>
Pollinical monitoring	<ul style="list-style-type: none"> <li>➤ Pollen harvest (2 times a week)</li> <li>➤ Pollen analysis in laboratory</li> </ul>
Foraging observation	<ul style="list-style-type: none"> <li>➤ Foragers enumeration using the transect method for the herbaceous strata and the 100 flowers method for the arboreous strata (1 time a week).</li> </ul>
Meteorological data	<ul style="list-style-type: none"> <li>➤ Pluviometry, Temperatures, Wind</li> </ul>
Botanical inventory of all sites	<ul style="list-style-type: none"> <li>➤ Melliferous ressources typology.</li> <li>➤ Blooms monitoring on each site from March to October, for 2 years.</li> </ul>
Mapping the agrarian land use and cover map around the apiary using GIS and remote sensing	<ul style="list-style-type: none"> <li>➤ Location and grassland areas measurements (fallow land, grasslands, hayfields ..), hedges, copses, bulding areas, gardens, using the a GIS software (Geographical Information System)</li> </ul>

## Expected results and outlooks for 2010 and 2011

The implementation of the first year of CASDAR project experimentation ensured us to:

- validate the protocol after having tested all methods developed on the field,.
- test the relevance of the first two selected sites
- establish the essential criteria for the selection of 6 other sites planned in addition to those two, to be selected during the first year of experimentation (2009).

So, during 2010 and 2011, experimentations will be conducted on 8 sites in order to assess the agroforestry systems value for maintaining honeybees in intensive agrarian environment. The last year (2011) will also be devoted to the data analysis and processing. The results of this initial work will complement a PhD thesis in Geography started in September 2009 and dedicated to the same problematic.