SPAGE in agriculture to combat pest insects.

An agroecological approach considering olive fly (*Bactrocera oleae)* in organic olive orchards in Crete

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Content

- Organic agriculture principles and SPAGE.
- The importance of olive production.
- SPAGE and socioeconomic aspects in olive production.
- SPAGE and the control of the olive fly.
- SPAGE and the food web in the agroecosystems.

Principles of organic agriculture related to SPAGE

- The precautionary approach.
- Creating an agroecosystem balance
  - conserving and increasing diversity
- Minimize negative agroecological disturbance and costs.

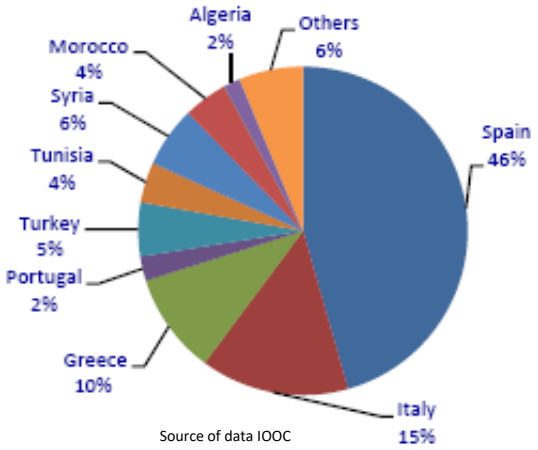
- Consumer trust is based on the application of these principles
  - the production and market of organic products depends on this.

Olive Production

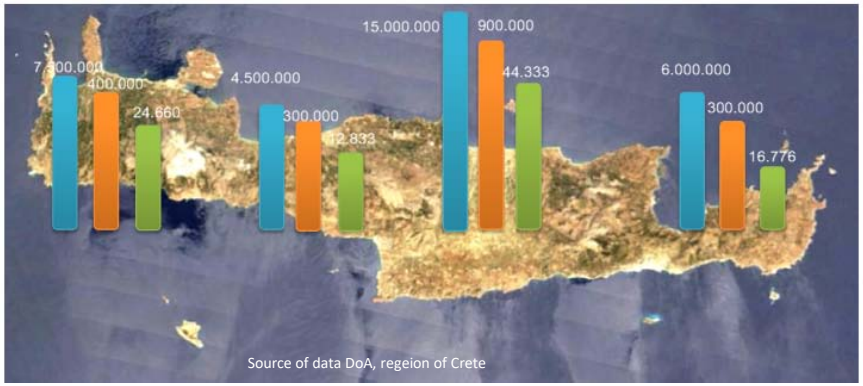
- Olive groves
  - determine the character of the landscape and of rural production in the Mediterranean.
- Olive oil has been the most prestigious edible oil since antiquity
  - Even today, despite the growth of a number of substitutes, olive oil
    - remains the oil for the Mediterranean,
    - a cultural element,
    - closely connected with the life and the nutrition of the inhabitants of Mediterranean.

Importance of olive growing in Crete

- Cretan economy is based on:
  - agrofood
  - tourism.
- Olive growing is the most important cultivation
  - olive trees cover 20% of the total island surface.
  - determine the
    - nature and landscape
    - economy
    - culture and food culture.
- Crete produces around 40% of the Greek olive oil production.
- Cretan olive oil is considered of top quality.



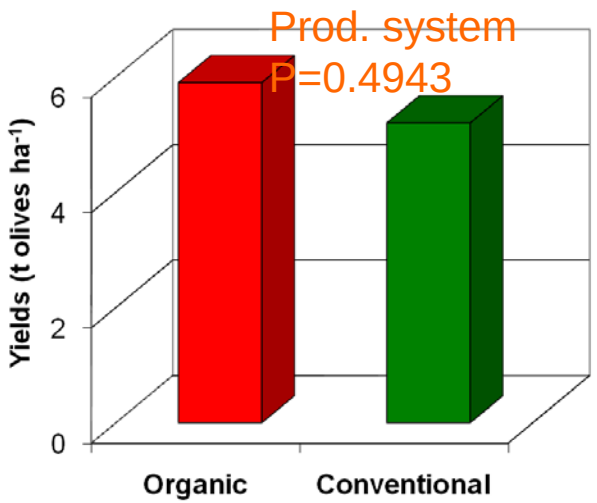
Source of data IOOC



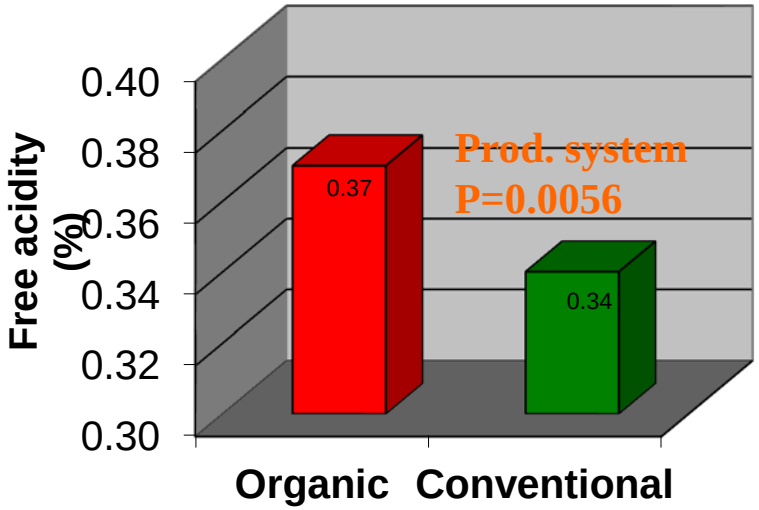
Source of data DoA, regeion of Crete

Yield and quality of organic olive products

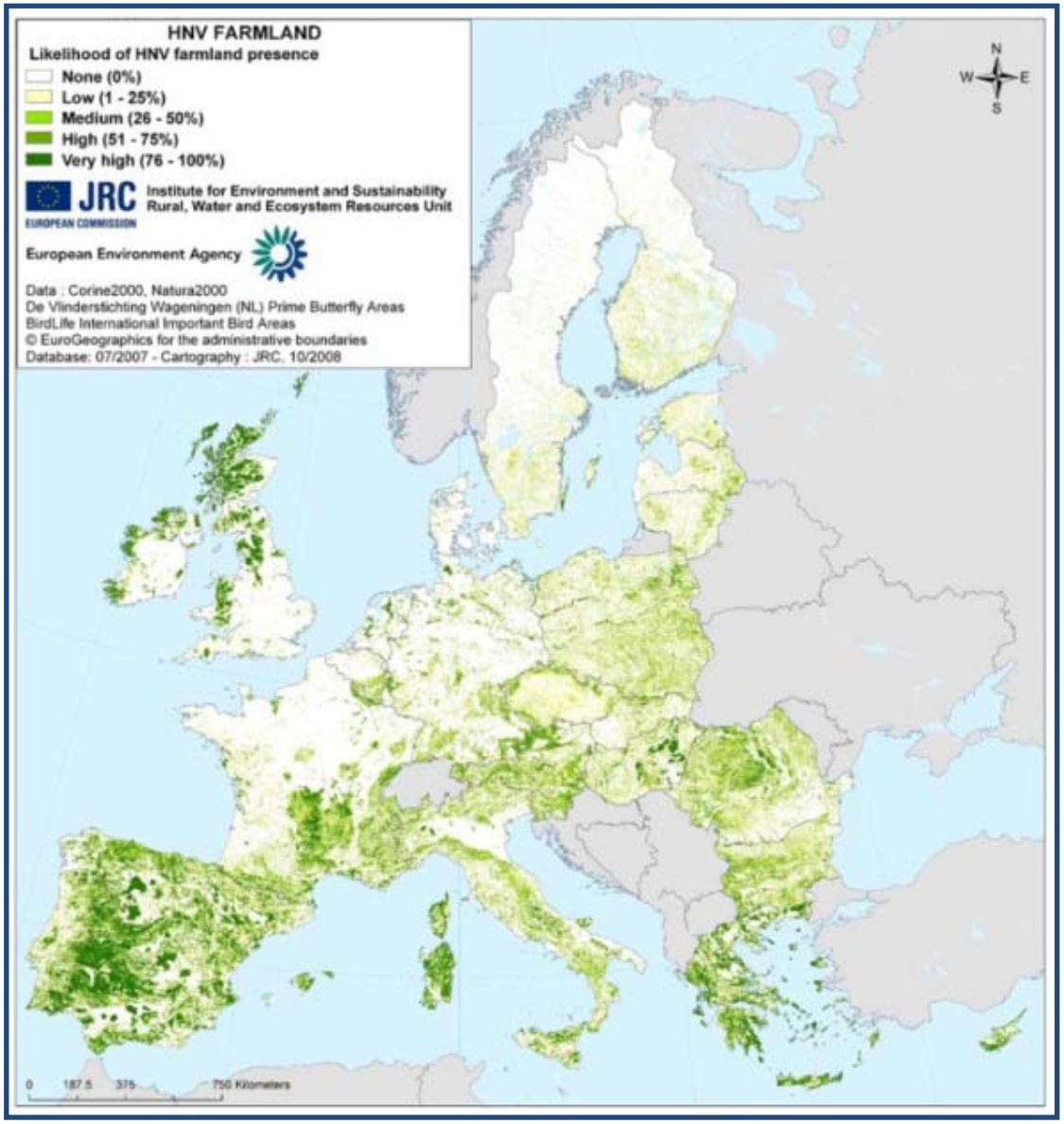
- Yields are similar to conventional.
- Chemical, physical and organoleptic quality is similar.
- Environmental quality is high.



Volakakis et all, 2011 and 2017



High Nature Value farmland in Europe



SPAGE effects on organic olive growing

- GMOs are not allowed in organic farming.
- Olive products will not be able to be sold as organic.
- The image of organic olive products
  - natural products
    - extra virgin olive oil is a high quality natural juice.
  - quality products beneficial for health and the environment
  - environmental (soil, air, water, biodiversity, landscape) quality
    - high Nature Value (HNV) olive orchards - included traditional managed
    - low input, organic olive orchards

  will be destroyed as well as the consumer trust.

The SPAGE technology and its costs

- The consumer perception of olive oil
  - natural product
  - high organoleptic and nutritional value.
- Ethical concerns
  - Consumer preference and right for choice for low input (like organic) and natural products.
    - olive growing and olive oil is a cultural marker for Crete
    - olive growing effects and relates to the natural environment and the landscape.

Food Traceability

- "Traceability" means the ability to trace and follow a food, feed, food-producing animal or substance intended to be, or expected to be incorporated into food or feed through all stages of production, processing and distribution (EU)

- What will be the effect of SPAGE technology on product traceability?

Ethical Traceability

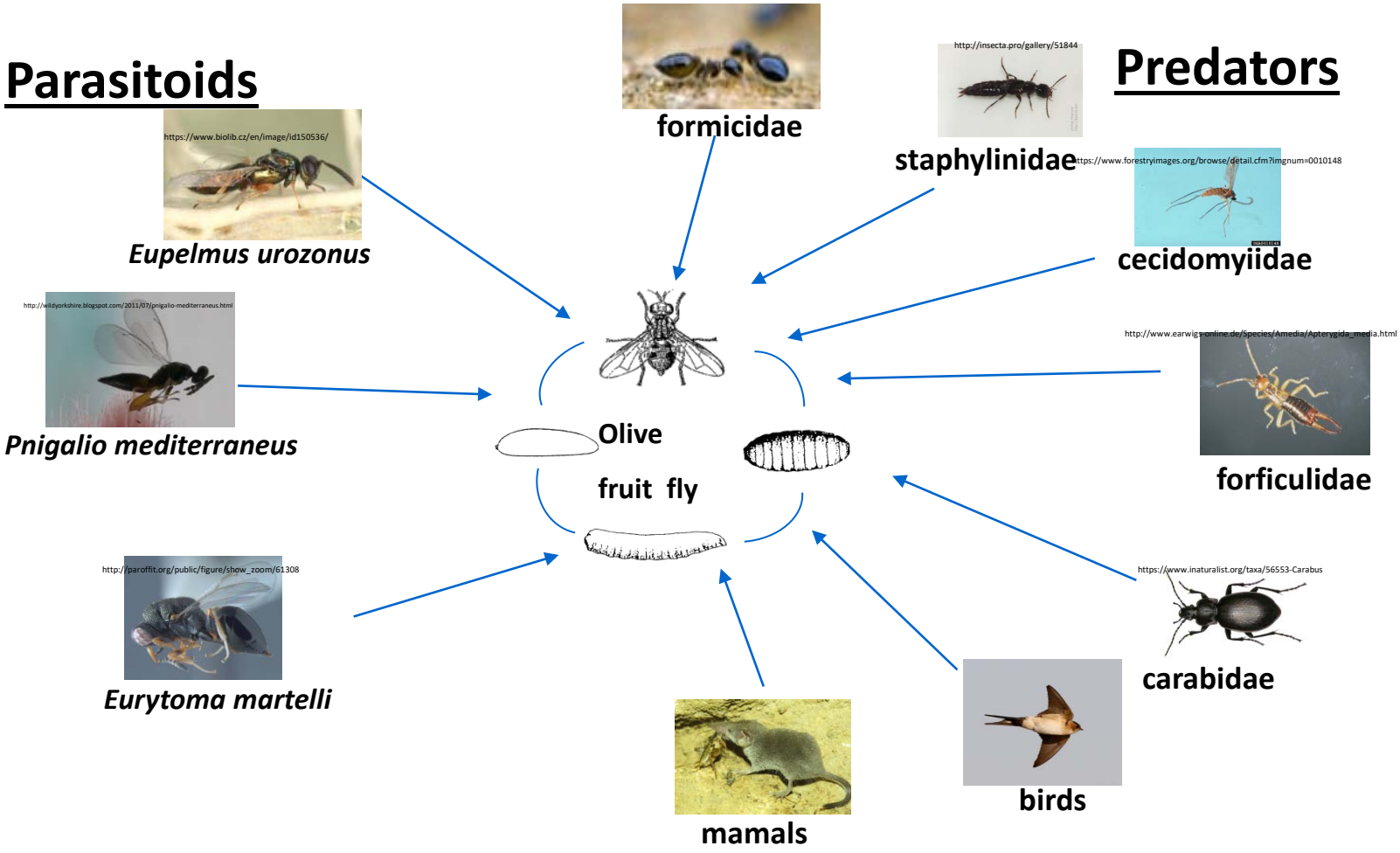
the ability to trace and map ethical aspects of the food supply chain by means of recorded identifications

Coff et al., 2008

Ecological pest management in organic olive orchards

- A method among others of the agroecosystem management.
- Rely on natural control factors
  - creating a green infrastructure.
- Preventive cultural practices
  - canopy management
  - irrigation water management
  - ground floor and green infrastructure management.

Functional diversity in olive agroecosystem and biological control of the olive fly – the web



Olive fly management in organic olive groves

- There are available low input technologies
  - low economic cost
  - local, low input technology
  - minimum agroecological disturbance
  - yield and quality are not reduced
  - they have a positive perception by the consumers.
- It is different for conventional production
  - state bait spays with synthetic chemical pesticides are applied for olive fly control.

Olive fly (*Bactocera oleae*) control in organic olive orchards

Ecotrap

Elkofon

- Control is based on a combination of tactics including:
- attract and kill trapping
  - Protection with mass trapping.
- extra control measures
  - Bait sprays with hydrolysed protein and plant or microbial insecticides
  - Natural mineral (e.g.) kaolin-based particle film formulation.
- Olive fly can be successfully managed in organic (as in conventional) orchards.

What will happen if the olive fly will be eliminated?

- Will due to the broken complex food web another secondary pest will become key pest?
  - there are more than 380 pests of the olive tree.
  - beneficial's will be effected.
- What will be then the cost for the
  - olive farmers and
  - the environment
    - related to control applications for pests that may become primary due to the broken food web.
- What will be the cost for the organic olive growers
  - synthetic chemical pesticides are not allowed.

SPAGE and past attempts to radically reduce the olive fly

- Sterilization failed to deliver the promised results.

- Past failed attempts demonstrate the need for a holistic agroecological approach taking into consideration agronomic, ecological and socioeconomic realities before applying new technologies.

What will be the effect of SPAGE? Diversity in Crete

- Crete is a hot spot of plant biodiversity in the Mediterranean
  - around 2100 plant species
  - more than 300 endemic.
- Olive growing and the applied practices effect the biodiversity.
- What will be the effect on flora and fauna biodiversity and the food web of the application of SPAGE technologies?

Natural plant diversity of olive orchards

194 plant taxa from 47 different plant families occur in olive orchards located at Western Messara plain, Crete

Families with most species

- Asteraceae 41 species

- Poaceae 38 species

- Fabaceae 26 species

- Apiaceae 10 species

Beneficial insect hosting plants

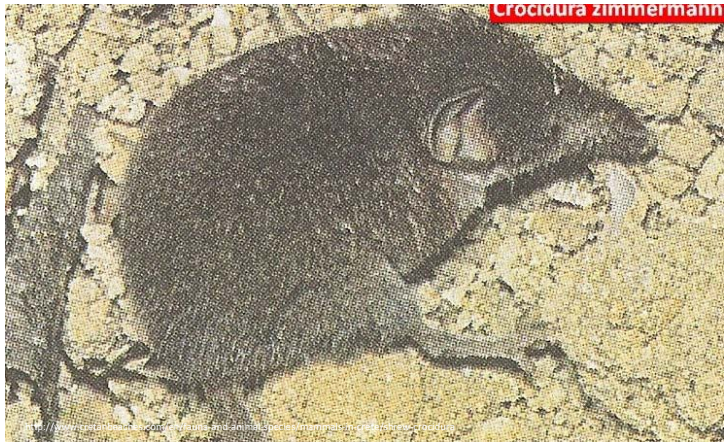
Thymelaea hirsuta

Ditrichia graveolens

Fauna diversity in olive orchards - Vertebrates

Examples are small endemic mammals like the

- *Crocidura zimmermanni*



- *Acomys minous*

Fauna diversity in olive orchards - Invertebrates

- Endemic lepidoptera like the *Plebejus (Kretania) psylorita*

http://www.iucnredlist.org/details/16084579/0

- Endemic (Crete and its adjacent islets, Naxos, Tinos and Andros) orthoptera like the *Chorthippus biroi*.

Interdependence in the Cretan biodiversity

- The endemic *Zerynthia cretica (Aristolochia cretica)*, and the *Aristolochia sempervirens* provide food for the larvae of *Zerynhia cretica*.

http://www.lepiforum.de/lepiwiki.pl?Zerynthia_Cretica

http://biodiversitysitia.gr/wpsitia/aristolochia-cretica/

http://canope.ac-besancon.fr/flore/Aristolochiaceae/especes/aristolochia_sempervirens.htm

The changing environment

- The climate change, abiotic environment, and its effects on the biotic environment
  - the food web related to the olive fly changes due to abiotic changes
  - Such changes effect:
    - the olive fly populations
    - the parasites and predators.
  - What will be the effect of changes on pest pressure like the olive fly?
    - Do we need in long term the SPAGE technologies as olive fly population pressure is reduced due to climate related changes?

What will be the cost and the long term effects of eliminating the olive fly from the food web?

- Ecological
- Agronomic
- Economic
- Social


Thank you