Vineyards, Orchards and future CAP

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Arthropod decline in grasslands and forests is associated with landscape-level drivers

Sebastian Seibold, Martin M. Gossner, Nadja K. Simons, Nico Blüthgen, Jörg Müller, Didem Ambarlı, Christian Ammer, Jürgen Bauhus, Markus Fischer, Jan C. Habel, Karl Eduard Linsenmair, Thomas Nauss, Caterina Penone, Daniel Prati, Peter Schall, Ernst-Detlef Schulze, Juliane Vogt, Stephan Wöllauer & Wolfgang W. Weisser

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Associated Content

Nature | News & Views

Robust evidence of declines in insect abundance and biodiversity

William E. Kunin

Sections | Figures | References

Abstract

Data availability

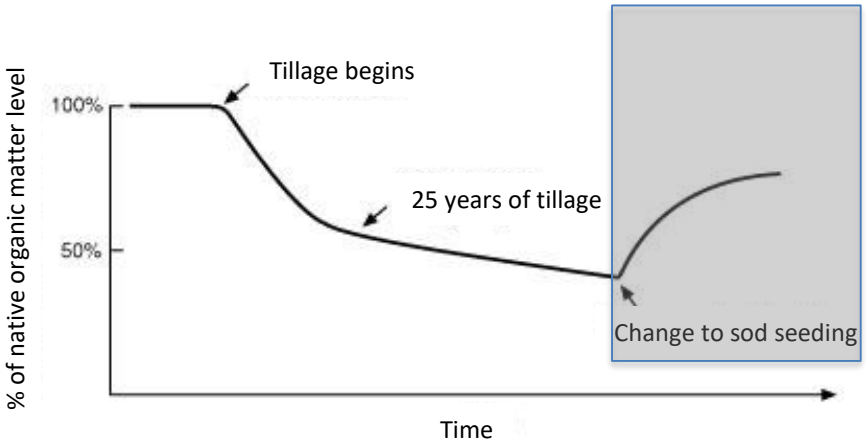
References

Acknowledgements

Author information

trends differed ac[illegible]phic levels. Our results show that there are widespread declines in ar[illegible]d biomass, abundance and the number of species across trophic levels. Arth[illegible]declines in forests demonstrate that loss is not restricted to open habitats. Our results suggest that major drivers of arthropod decline act at larger spatial scales, and are (at least for grasslands) associated with agriculture at the landscape level. This implies that policies need to address the landscape scale to mitigate the negative effects of land-use practices.

The soil releases a large quantity of carbon that was bound in the past millennia



1950 -> today

50 Pg (*10^9 t)

of Carbon was released to the atmosphere

Food and Climate

Connecting the Dots

THE PROBLEM

We can't fix the looming climate disaster if all we do is cut fossil fuel emissions.

Even if we had the political will to achieve zero emissions over the next few decades, we would far surpass what scientists refer to as the point of no return—450 ppm of CO^2 in the atmosphere.

DEGENERATED SOILS

- Have contributed 25-40% of the current excess CO^2 in the atmosphere.
- Have moved 50-75% of the original carbon content of the earth's soils into the atmosphere and the oceans.
- Produce nutrient-poor food that contributes to malnutrition and poor health.
- Grow plants that are less drought-resistant.
- Intensify rural poverty and hunger, contributing factors to war and civil strife.

REGENERATION INTERNATIONAL

ANY USE WINE LABELS?

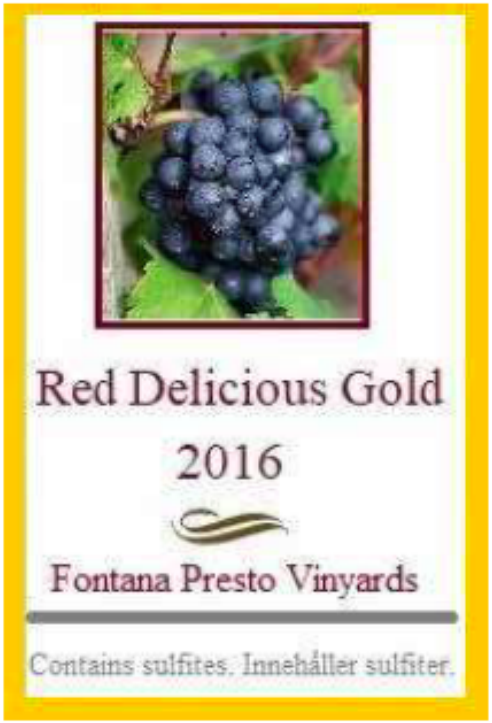
RUDOLF SILLÉN, NATURVINSAKADEMIEN

According to EU rules from 1979, the wine industry is exempt from presenting content on their bottles. A list of contents is basically prohibited on wine labels. The motive is shrouded in obscurity, but according to my contacts with administrators at the National Food Administration and the Swedish Chemicals Agency, this is due to commercial policy reasons and pressure from strong lobby groups among wine producers. According to the EU, wine is defined as "alcoholic beverage made from fermented grape must from freshly harvested grapes".

That definition might be true for wines made before the chemical revolution in the 1950s. Nowadays, all wines except natural wines are produced using various chemicals and processes. Some of the chemicals found in the wines are definitely detrimental to health. This applies especially to the systemic pesticides used in cultivating grapes. Many pesticides can occur at levels that are significantly higher than what is permitted for drinking water…

WHAT'S IN THE WINE?

What you learn by reading the bottle label is not a whole lot. Alcohol



er. The highest level found in one of

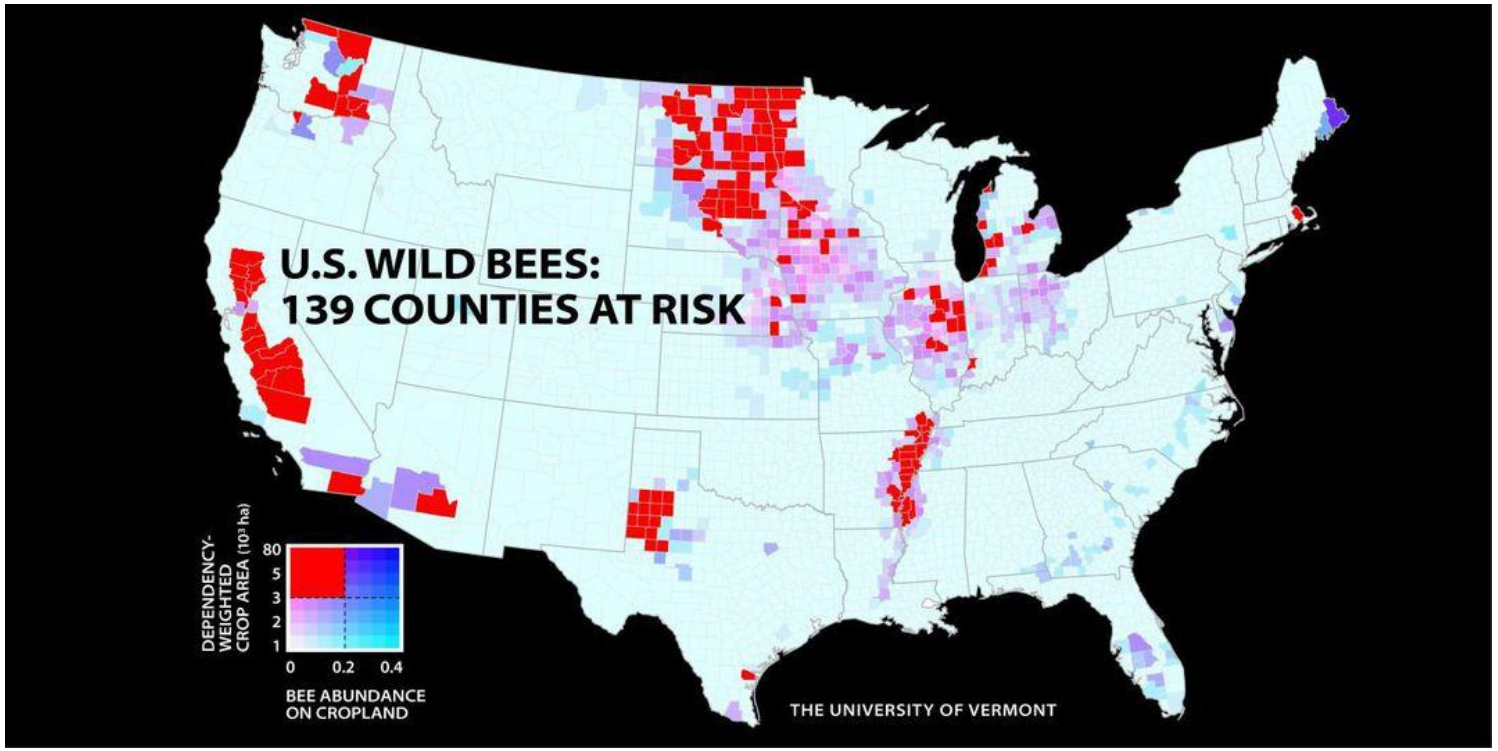
ficiency. On the bottle label, the text "Contains sulfites" must be reported if the content exceeds 10 mg/L. Not particularly informative since the wine can contain anything between 11-300 mg/L. For organic wines, spraying with systemic pesticides is not allowed, and the permitted number of chemicals and processes is limited to about 40. For natural wines, no chemicals are allowed except for minor amounts of sulfites.

WHAT MOTIVES ARE THERE FOR INTRODUCING AN INGREDIENT LIST?

The first motive is the "health as-

Consumers are more and more concerned about health issues

Not only herbicides and insecticides: Toxicity of fungicides to bees is also demonstrated



Uncertainty for the future

- climate change (disease, pest, biocontrol, abiotic/biotic stress)
- stringent regulatory requirements (less PPP available, is there a bright future for copper ?)
- from quantity to quality: interest in locally produced natural wine (vs mass produced industrial ones)

A global synthesis reveals biodiversity-mediated benefits for crop production

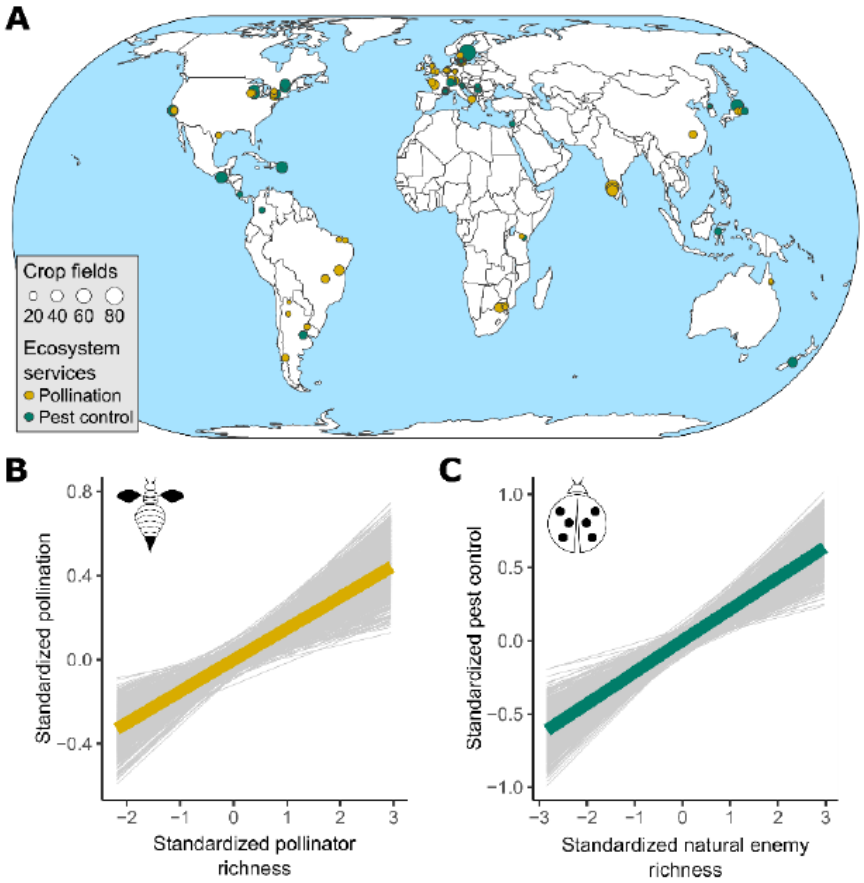


Fig. 1. Distribution of analyzed crop systems and effects of richness on ecosystem services provisioning.

Dainese et al. (2019).

insects

MDPI

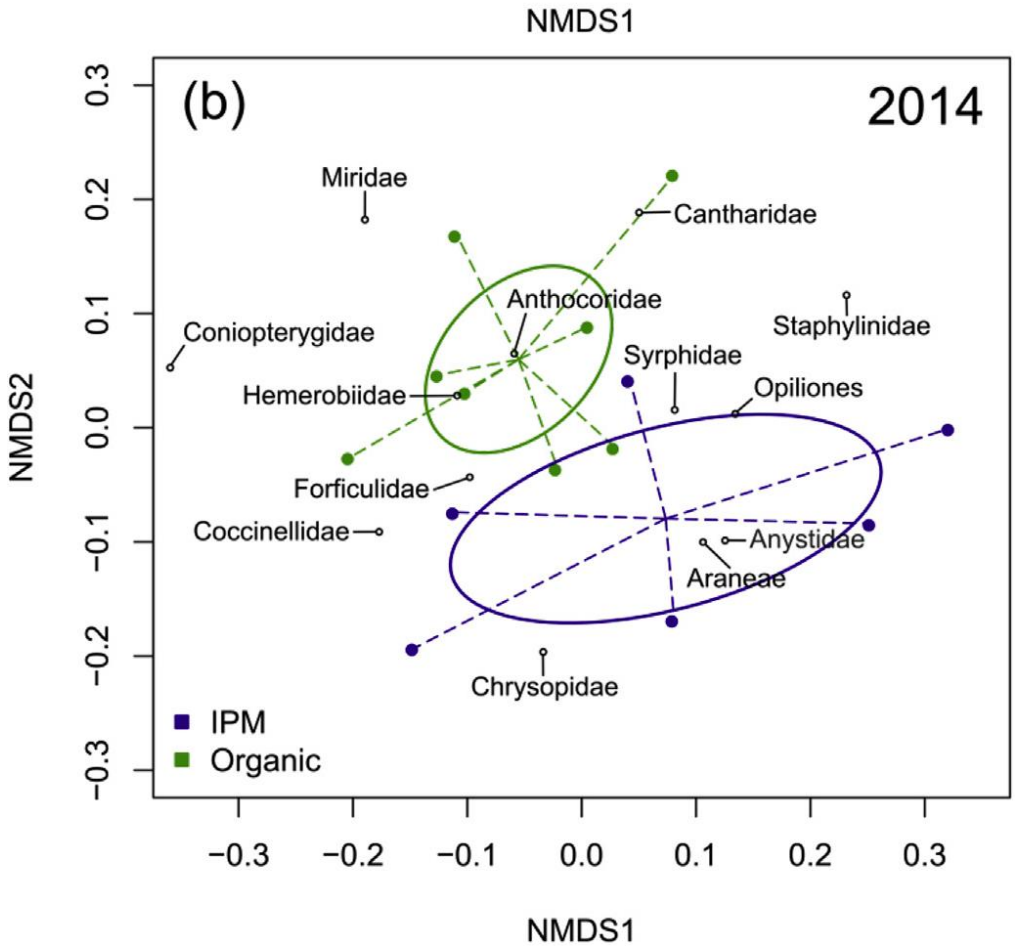
1 *Review*

2 Managing (extra-) floral resources in apple orchards 3 for pest control: ideas, experiences and future 4 directions

5 Annette Herz[1*], Fabian Cahenzli[2], Servane Penvern[3], Lukas Pfiffner[2], Marco Tasin[4] and Lene
6 Sigsgaard[5]

- "Compared with annual arable crop systems, perennial orchards/vineyards offer a habitat for a more diverse community of organisms with different ecological needs [...]."

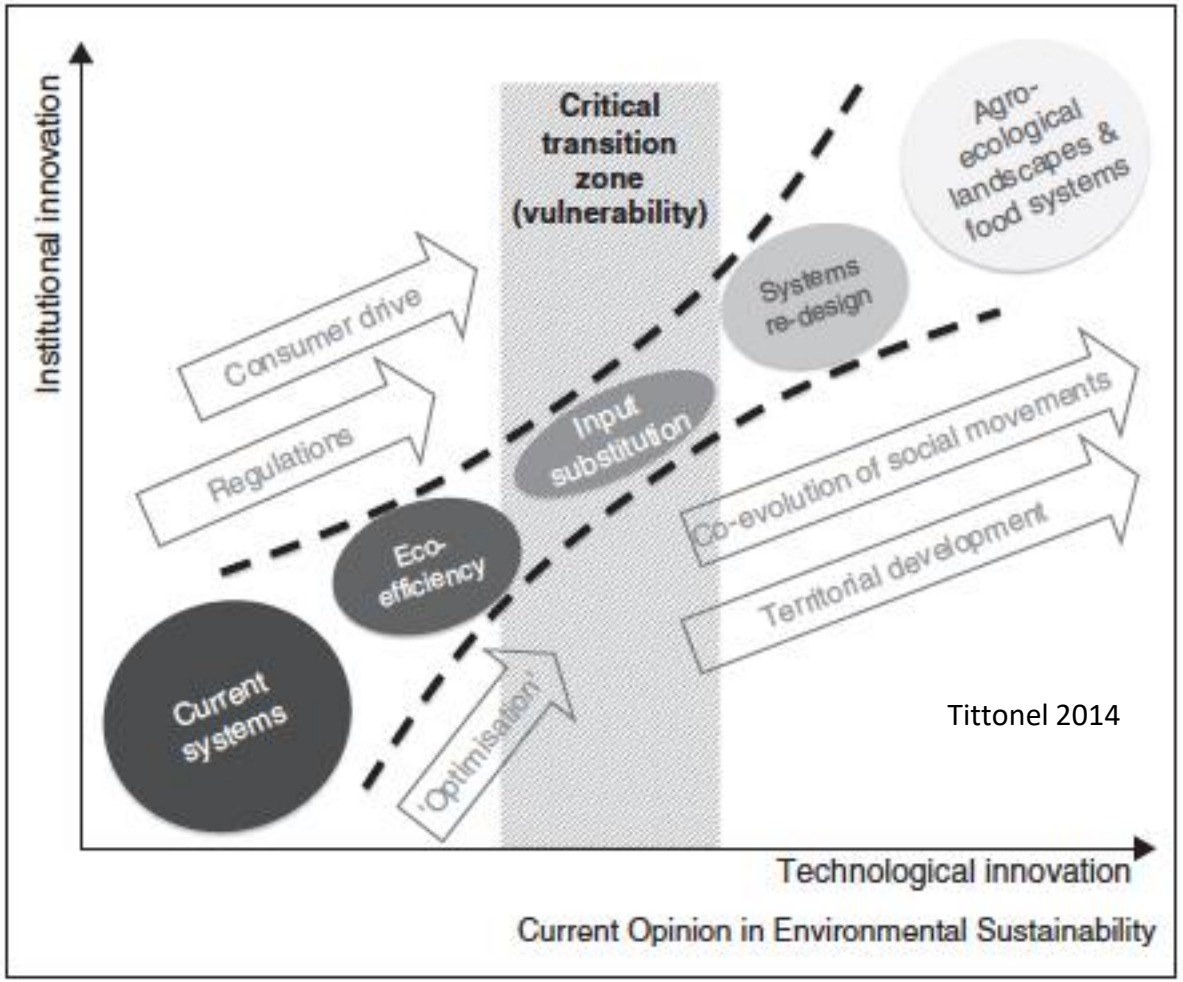
Effect of organic farming on natural enemies of pest



Swiergiel et al. 2019.

Proposed ecological intensification of the current food system

A “Beyond organic” thinking



IPM future in vineyards: turning back the triangle?

Modern crop are based on fossil-fuel based inputs

Use of Chemical Pesticides

Sensitive varieties
Extreme monoculture
High use of non-renewable inputs

Is it possible to change to an ecosystem-based IPM?

Reduced use of Chemical Pesticides

Semiochemicals
Tolerant varieties
Diversification of the crop
Enhancement of

IPM is compulsory in EU from 2014

A case study: Area-wide mating disruption in Trentino-South Tyrol region: consistent efficacy over 25 years

- 46,000 ha of apple and grapevine
- **more than 32,000 (70%) ha are treated with MD in year 2011 (replaced insecticide: 20000 - 30000 kg/year)**
- **strong co-operation between researchers, field advisors, ph. producers and growers to reach an area-wide program**

Green manure and nitrogen in the must

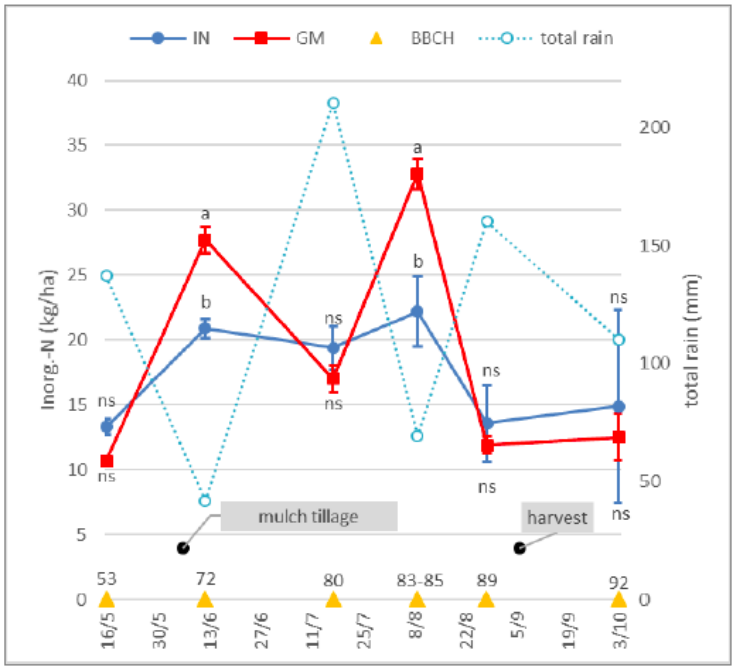


Fig. 2. Inorganic nitrogen (inorg.-N) release dynamics in the 0-40 cm soil layer (average ± SE) as a function of the fertilization strategy (mineral fertilizer IN, green manure GM) and sum of the precipitation (total rainfall) between two consecutive soil samplings in 2017. Within each sampling, different letters point-out significant differences according to Tukey test at $p<0.05$.

BIO Web of Conferences **13**, 04010 (2019) https://doi.org/10.1051/bioconf/20191304010
CO.NA.VI. 2018

Green manure effects on inorganic nitrogen dynamics in soil and its accumulation in grape must

Roberto Zanzotti[1*], and *Enzo* Mescalchin[1]

(47% Poaceae, 40 %Fabaceae, 13% Brassicaceae andBorraginaceae)

Inorganic N and Yeast Assimilable N did not differ

Green manure in organic vineyards

Journal of Applied Microbiology

Journal of Applied Microbiology ISSN 1364-5(

ORIGINAL ARTICLE

Soil microbiota respond to green manure in organic vineyards

C.M.O. Longa, L. Nicola, L. Antonielli, E. Mescalchin, R. Zanzotti, E. Turco and I. Pertot

Research and Innovation Centre, Fondazione Edmund Mach (FEM), San Michele all' Adige (TN), Italy

Fungal and bacterial communities were often enhanced by organic + green manure management

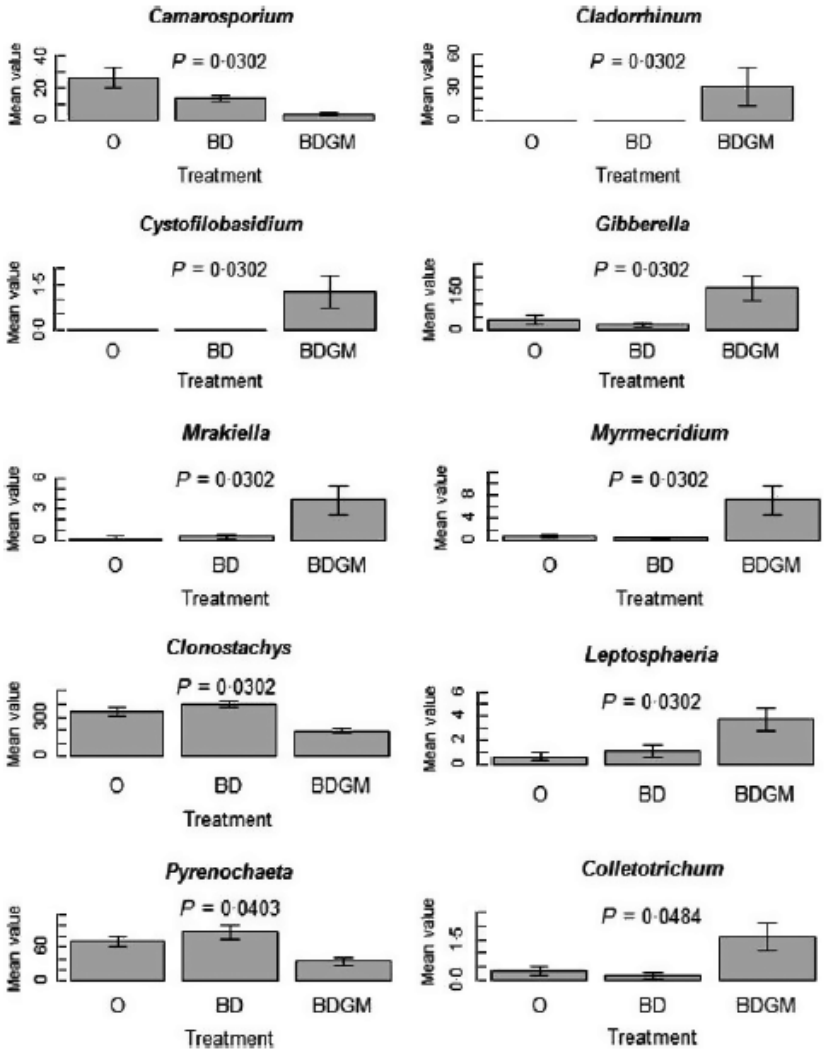
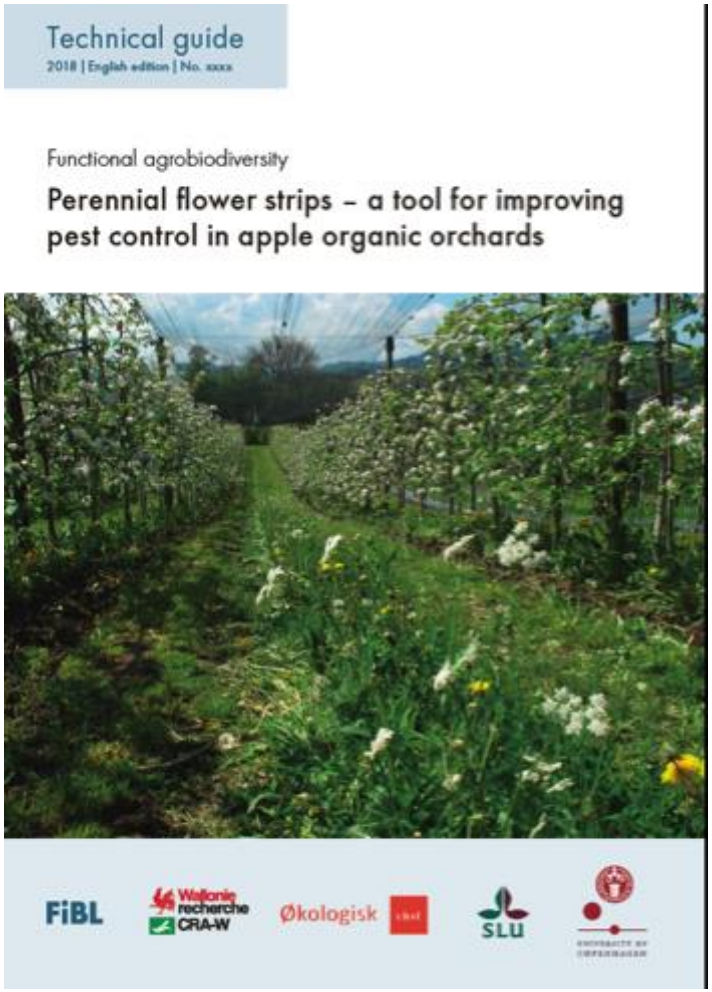


Figure 4 Bar plots of the different fungal OTU abundance at genus level for different types of vineyard soil management obtained via permutation ANOVA. Only significantly different genera (*P*-values corrected using FDR) are shown (mean ± SD of number of reads). O, samples from organically managed soil, BD, samples from biodynamically managed soil, BDGM, samples from biodynamically managed soil with the addition of green manure.

Mescalchin et al. 2018

Flower strip: the orchard example



Soil preparation and sowing of flower strips

Sowing periods

Two sowing periods are possible:
In regions with short winters:
(i) from April to May and
(ii) from early September to mid-October.

In regions with long winters:
(i) in May and
(ii) in August to early September (after harvest).

Climatic conditions immediately after sowing have a major influence on the result. Sowing between the end of April and early June enables germination of a part of the seeds before summer drought. Further seeds will germinate in the following years.

In regions with frequent dry periods in spring, sowing can be postponed or done in autumn, in order to increase the chance to quickly benefit from a wet period inducing a good germination rate. Late sowing also allows soil cultivation during summer, which reduces perennial weeds and regrowth of grasses. Moreover, lower weed developments can occur during autumn.

Soil preparation

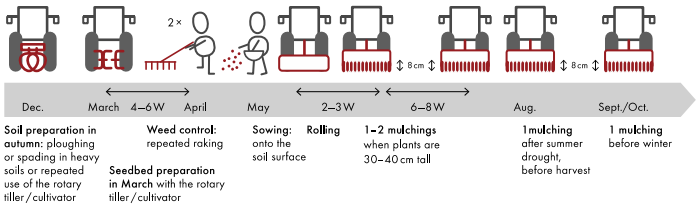
A carefully prepared seedbed promotes good germination and early development of the sown species and reduces later maintenance measures. The goal is to prepare a seedbed reducing the grass competition, so that it will stay vegetation-free at least for four weeks.

The recommended width for flower strips is equal to the inner distance between the tractor wheels plus 10 cm, resulting in a 5–10 cm overlap into the tractor track at each wheel. It depends on the available machinery for soil preparation and mulching.

How to proceed:

- Only work the soil after it has dried well.
- Prepare a relatively fine seed-bed using a rotary tiller / cultivator. Avoid too fine seedbed, as it will silt when it rains and thus hinder emergence of the sown plants.
- Ensure good settling of the soil for four to six weeks to allow a good contact between seeds and soil.
- Before sowing, encourage germination of weed seeds through repeated (two times) superficial (max. 3 cm deep) mechanical harrowing or manual raking. This will reduce weed pressure after germination of the seed mixture.

Procedure for sowing a flower strip and management in the first year



Which landscape do we want ?

Monoculture vineyards

Vineyards with biodiversity

Example of natural enemies
dispersal into the vineyard
from a biodiversity constructed island
(Altieri et al 2010)

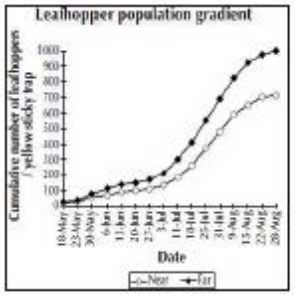


Figure 5. Population of leafhoppers near (<25 m) and far from a corridor (Nicholls et al, 2001)

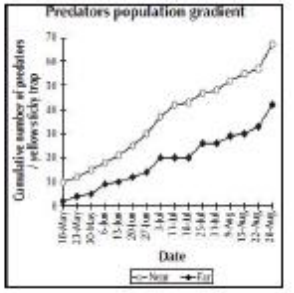


Figure 6. Population of predators near (< 25m) and far from a corridor (Nicholls et al, 2001)

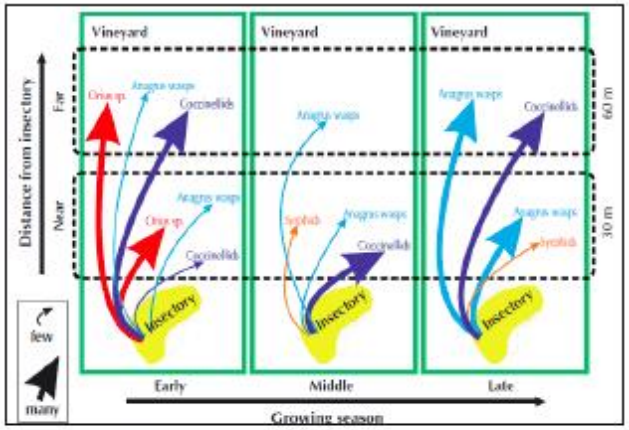
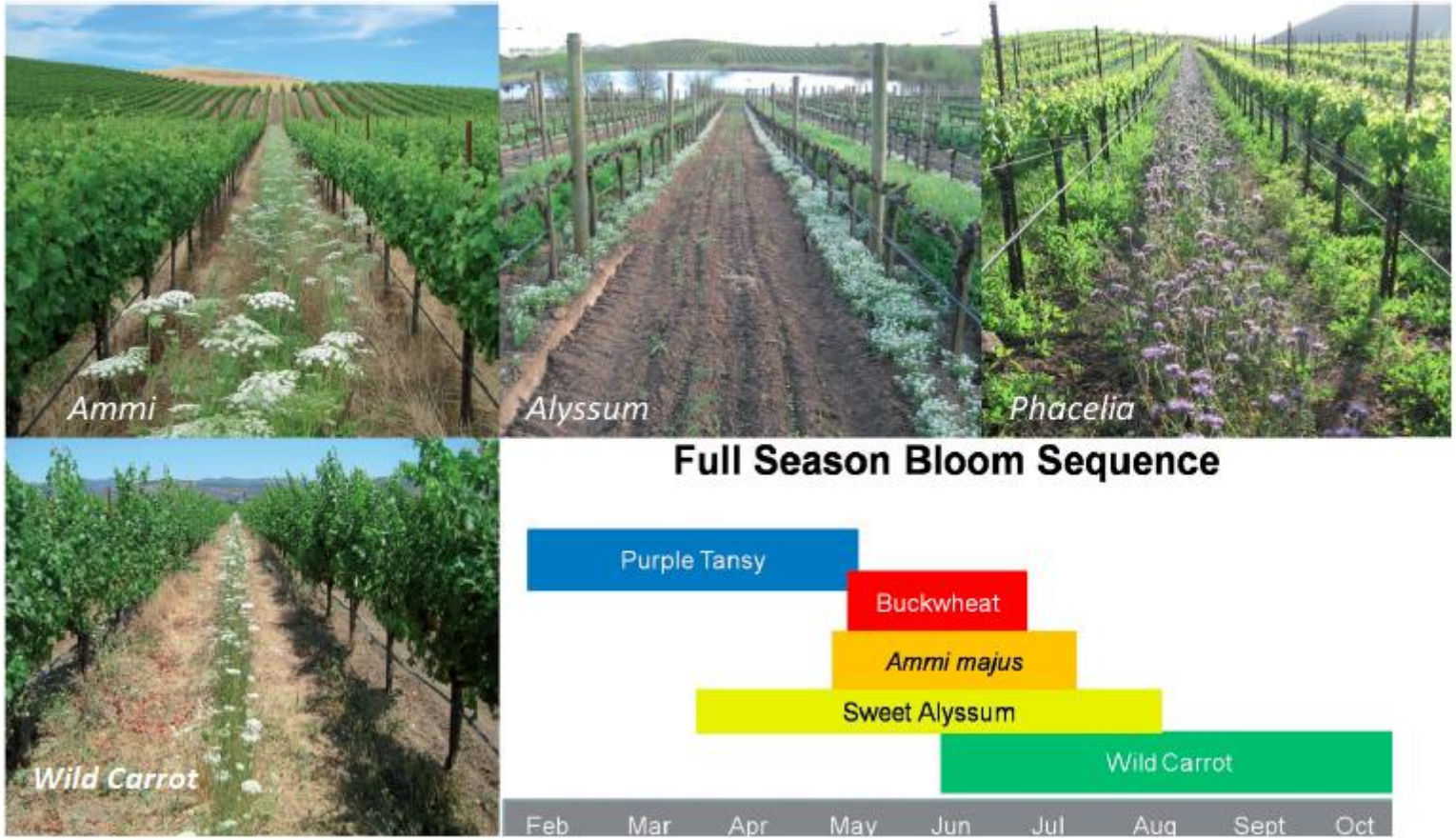


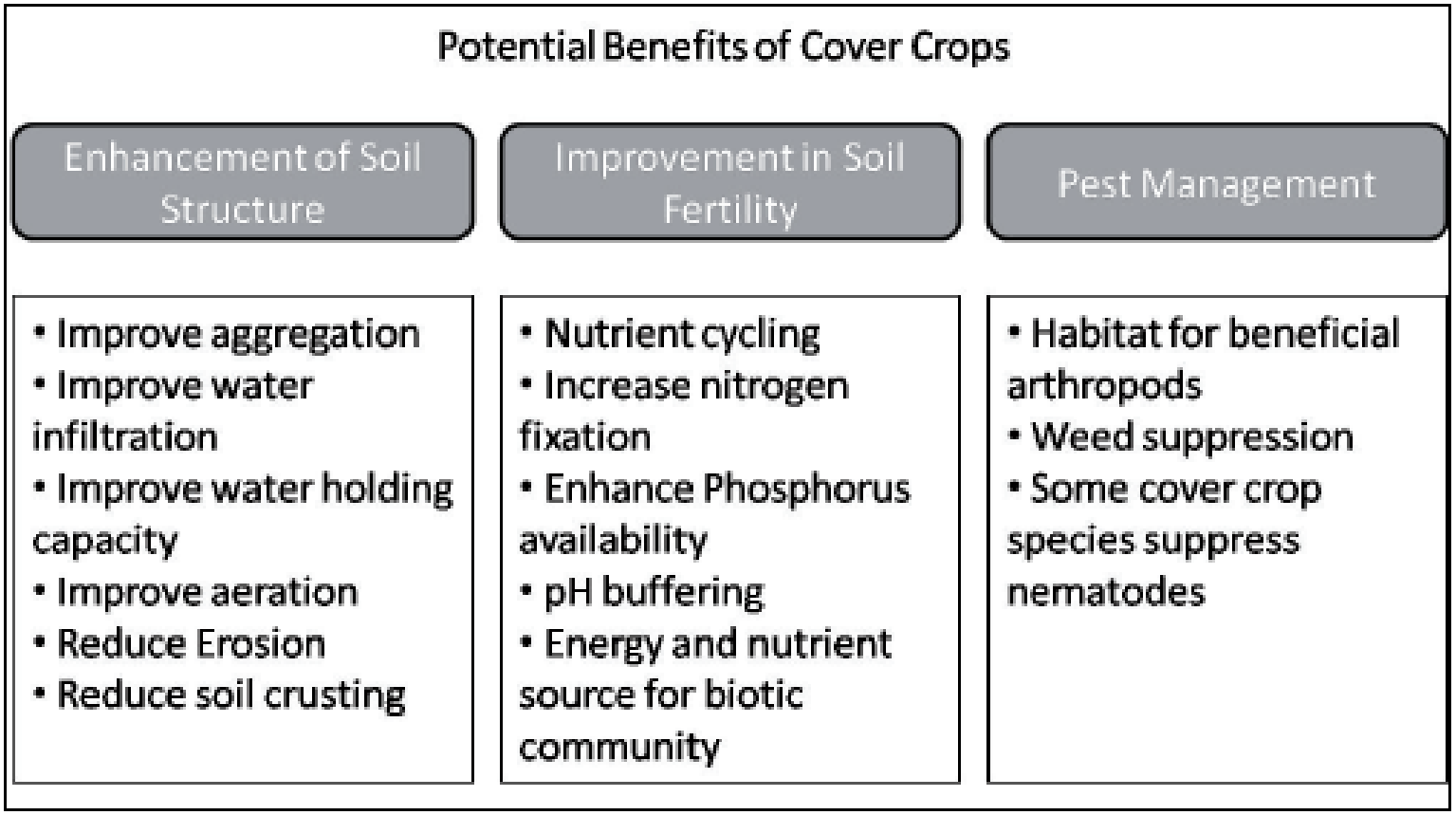
Figure 7. Dispersal of Anagrus wasps and generalist predators from the island into de vineyard.

Flowering sequence of 5 cover crops to ensure pollen, refuge and nectar to natural enemies



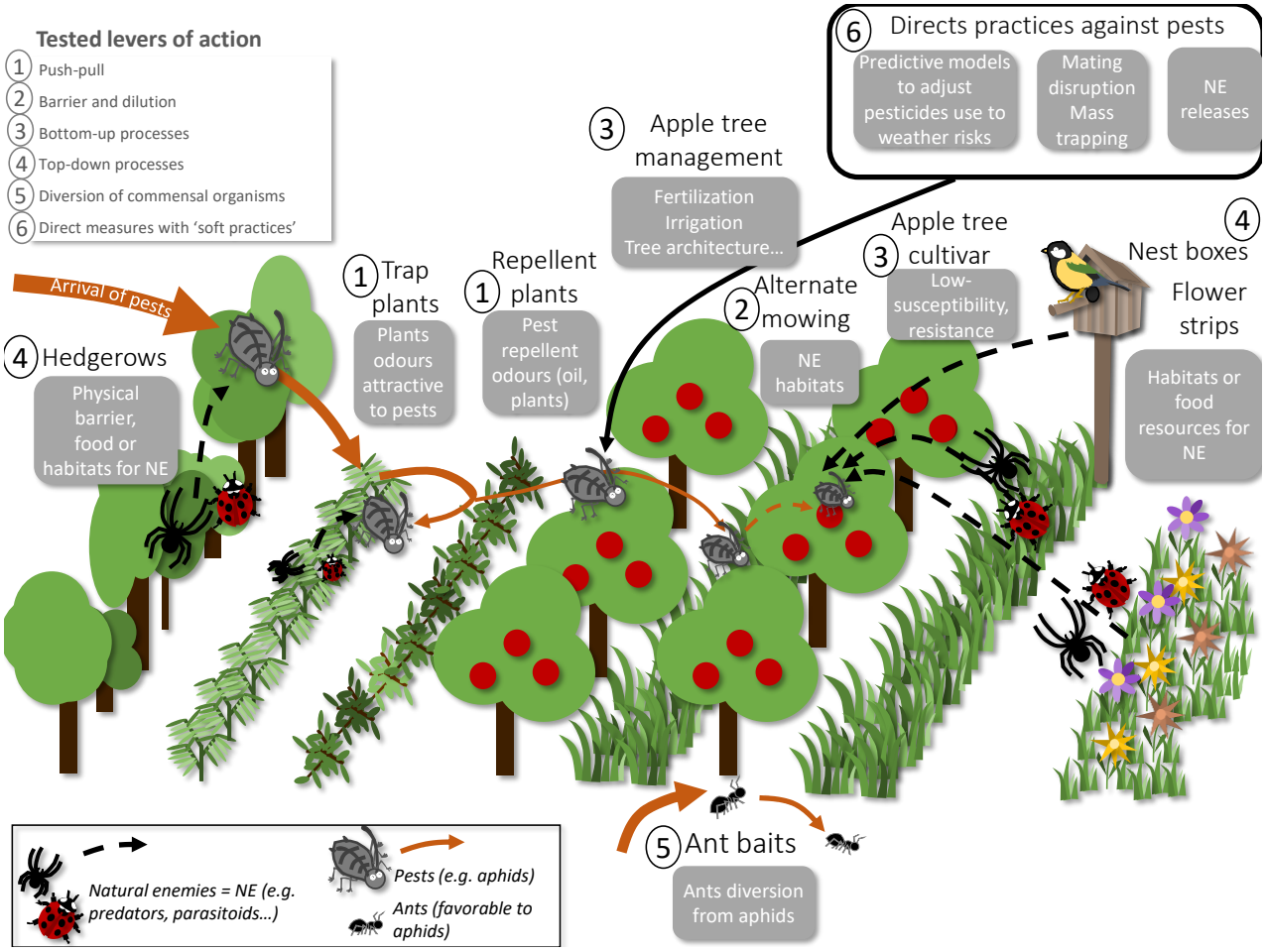
Altieri et al. 2010

Multiple benefit from cover crop in vineyards: beyond organic



Altieri et al. 2010

Is this the vineyard we would like to see around?



Participatory action: Designing Pests Suppressive Vineyards

From Vegetation Database to Participatory Landscape Design

Relationship between landscape and predation/parasitism of pest species in single crops

Integration of multiple maps into a single bio-control service map

Baveco & Bianchi 2007

My proposal

- **Beyond organic approach (social, ecological and economical aspects)**

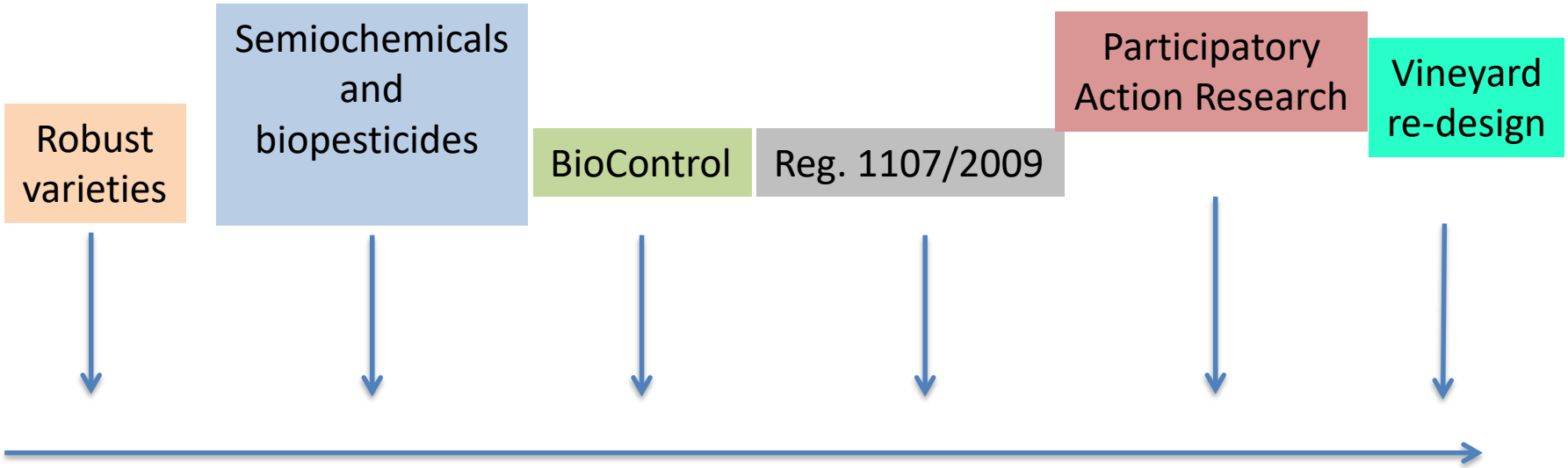
- actively involve **farmers**, **advisors**, researchers and local politicians to co-develop (1) a perennial (=permanent) biodiversity structure in the landscape including corridors (2) a field demonstration with disease resistant varieties and (3) field efficacy evaluation of new low risk PPP and the biodiversity structuree at a regional level

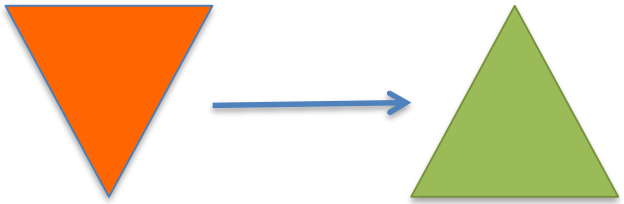
- promote a new approach to soil management mimicking nature (cover crops + organic matter on the surface as in nature to conserve water, nutrients, carbon and soil life and to reduce soil compactness) (->resilience towards climate change). This will also stimulate soil biota relevant to biocontrol.

- increased support to local natural wine production (especially at the small-to middle scale level) with a view to increase quality and price for growers (to reach a price which gives profit, without eroding the environment)

- higher support to organic and IP farmers operating on hilly terrain, with high associated labor cost

Conclusion: The toolbox for sustainable vineyards





Possible challenges perceived by wine growers

- •Land/space limitations -focus on vines only (when implemented as single farm)
- •Lack of funding to plant/protect habitat and to use cover crops
- •Water or labor limitations for establishing hedgerows
- •May attract vertebrate pests (eg, voles) and their management should be discussed
- •Concern about invasive species (plants & insects, see BMSB in S Italy)
- •Lack understanding of measurable benefits for the society (although many recent publications measured that)
- Higher knowledge required to manage the ecosystem (in comparison with a monoculture)

Biodiversity and Insect Pests

Key Issues for Sustainable Management

Edited by
Geoff M. Gurr, Steve D. Wratten
and William E. Snyder with Donna M. Y. Read

WILEY-BLACKWELL

California

New Zealand (Green Waipara)


Thank you for your attention !