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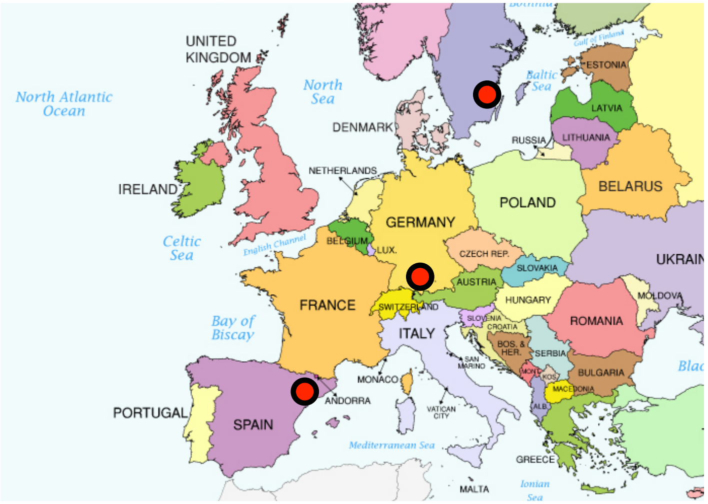
FACCEJPI

Managing ecosystem services for fruit production in different European climates (**EcoFruit**)



BiodivERsA/FACCE-JPI joint call on “Promoting synergies and reducing trade-offs between food supply, biodiversity and ecosystem services”

1. Project structure and partners
2. Background
3. Objectives
4. Work plan
5. Status quo
6. Stakeholder involvement / Challenges





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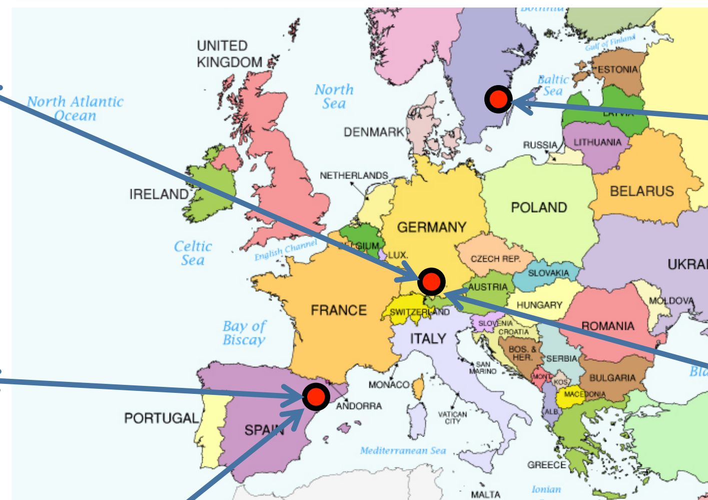
1. Project structure and partners

P1: Freiburg
Alexandra Klein
Virginie Boreux

P2: Oviedo
Daniel García
Marcos Miñarro
Rocío Rosa García

P3: Barcelona
Jordi Bosch
Anselm Rodrigo

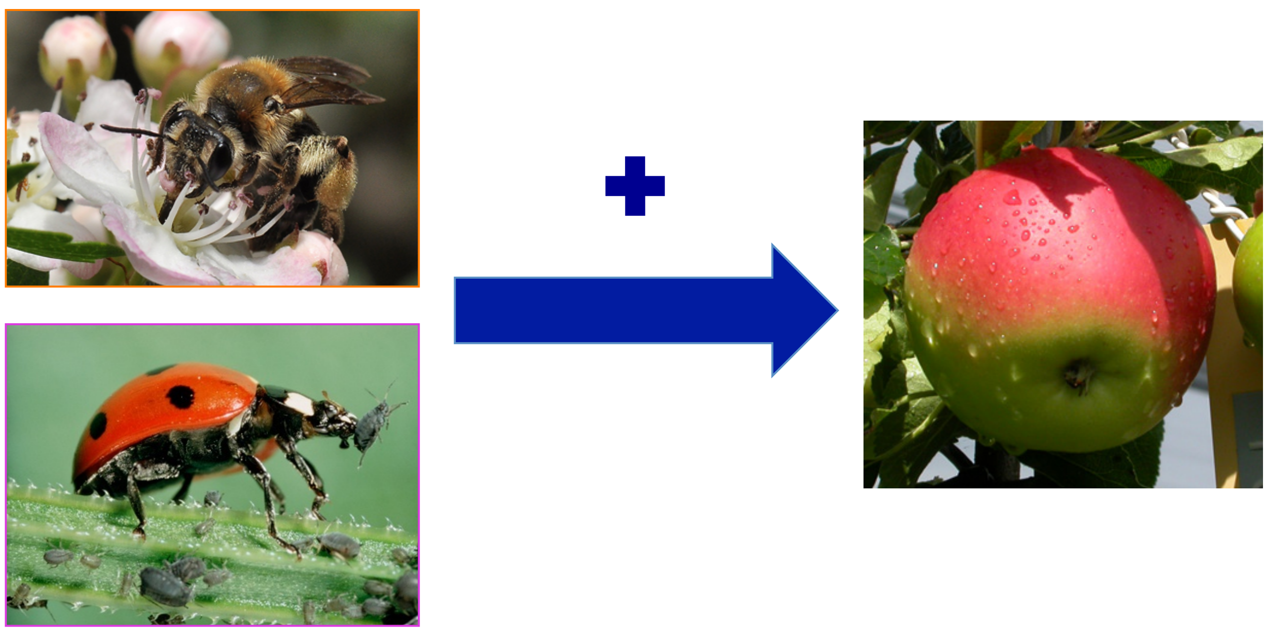


P5: Stockholm
Peter Hambäck

P4: Darmstadt
Nico Blüthgen
Karsten Mody

2. Background

Ecosystem services (ES) provided by mobile organisms **pollinators** or **predators** are crucial for fruit production



The role of agri-environmental schemes **for biodiversity and ecosystem services**

Agri-environmental schemes (AES) aim at “promoting agricultural production compatible with nature conservation” (Primdahl et al. 2003)

AES include

- **Small patches of semi-natural habitats**
- **Organic farming practices**

Hedgerows

Flower strips

The role of agri-environmental schemes and landscape context **for biodiversity and ecosystem services**

Landscape context can affect biodiversity and ecosystem services and the influence of AES

The role of agri-environmental schemes and landscape context **for biodiversity, ecosystem services and dis-services**

AES and landscape context may not only benefit crop production but also **increase pests** (Zhang et al. 2007, Martin et al. 2013).

The role of agri-environmental schemes and landscape context **for biodiversity, ecosystem services and dis-services**

➔ distinguish between

service and **disservice** providers to quantify **trade-offs** between

positive effects of pollinators/predators/parasitoids



on **fruit production**

negative effects of pests



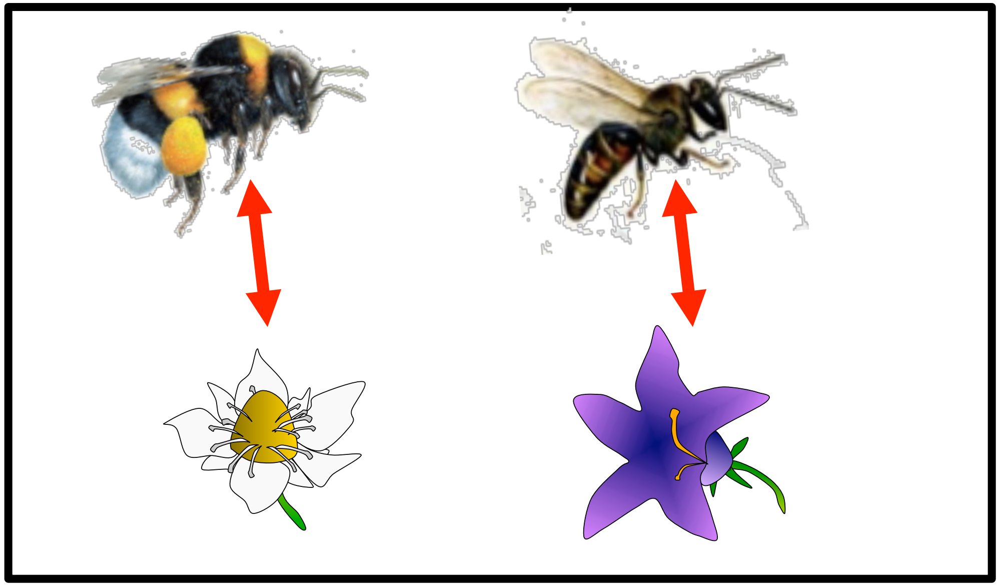
Biodiversity and ecosystem services:
Understanding the mechanisms of
biodiversity-ecosystem services relationships

Biodiversity of **service providers affects magnitude** and **long-term persistence** of **ecosystem services** in two main ways:

(1) **Functional complementarity**

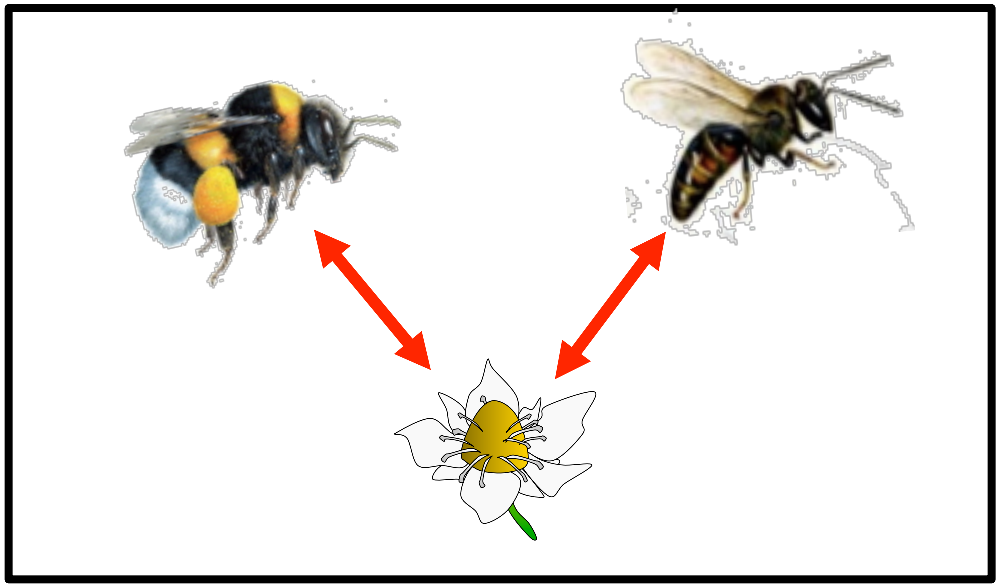
(2) **Functional redundancy**

Functional complementarity



species show different quantitative and qualitative contributions to ES
➔ direct positive effect of biodiversity on ecosystem functioning and service

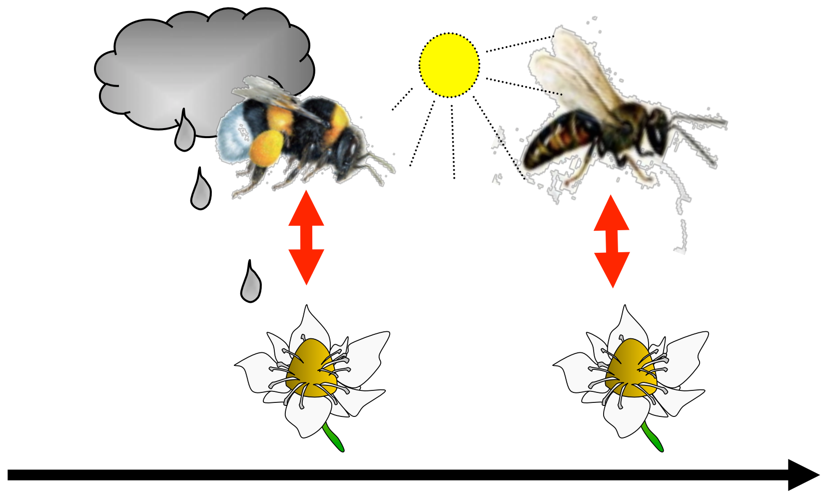
Functional redundancy



species can overlap in their particular contribution to ES - functionally redundant species

➔ may compensate for the loss of other species ("insurance hypothesis")

Response diversity



Environmental conditions
or disturbance regimes...

Species may be redundant in their functional niche, but complementary in other niche dimensions

Blüthgen & Klein (2011) *Basic Appl Ecol*

Understanding the mechanisms of
biodiversity-ecosystem services relationships

Response diversity allows to deal with environmental variability

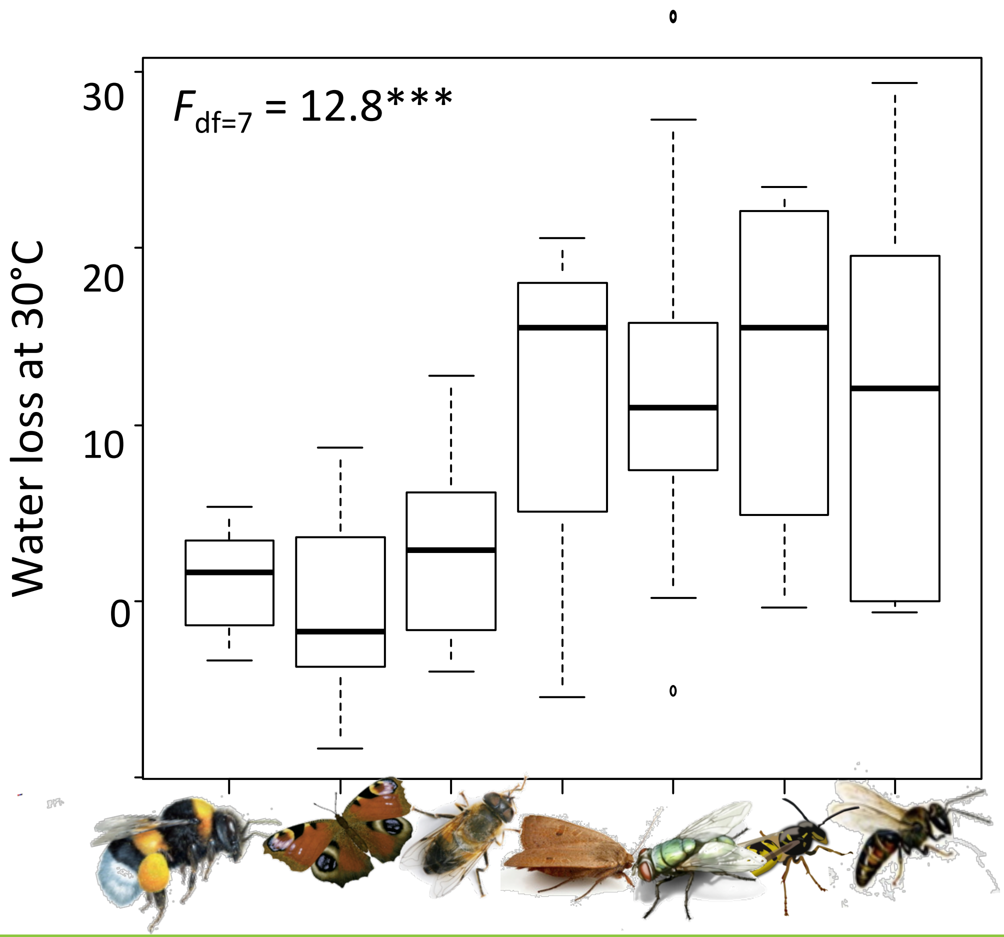
➔ **particularly important in view of climate change**

Response diversity related to species traits:

The importance of species traits in changing climatic conditions

Response diversity and **functional role** of animals in agro-ecosystems closely linked to **specific traits** (response and functional traits)

The importance of species traits in changing climatic conditions



Kühsel et al., *submitted*

Proposed model farming system: apple orchards

- **Apple grown throughout the world / the most important fruit crop in Europe**
- **Susceptible to loss of pollinators and natural enemies**
- **Different AESs implemented for apple across Europe**

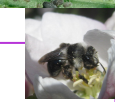


3. Objectives

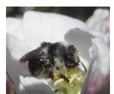
- **Effects of European AES on biodiversity and ecosystem services and disservices in different landscape contexts?**
- **How are effects related to net fruit production in different climates across Europe?**
- **Changes in response and functional diversity across climates?**

5 Work packages

3. Objectives WPs

WP1: Freiburg



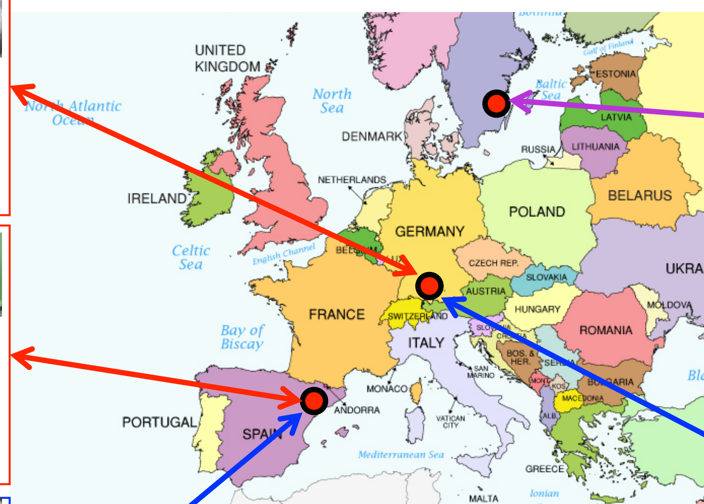
Effectiveness of AES on pollinator diversity and **pollination services**

WP2: Oviedo

Effectiveness of AES to **control pests** and the diversity of natural enemies

WP3: Barcelona

Functional importance of pollinator diversity and role of **response traits** for **pollination**



WP5: Stockholm

Response traits to buffer changing climatic conditions for services and dis**services providers**

WP4: Darmstadt

Functional importance of predator diversity and role of **response traits** for **pest control**

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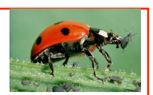
3. Objectives WPs

WP1: Freiburg

Effectiveness of AES on pollinator diversity and **pollination services**



WP2: Oviedo

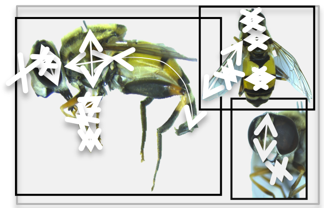
Effectiveness of AES to **control pests** and the diversity of natural enemies

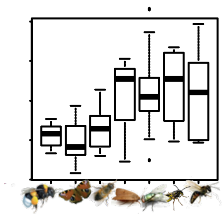
1. How is biodiversity of different functional groups affected by AES implemented on "farm-scale" and "adjacent-farm scale" depending on the landscape context?

2. How does effectiveness of AES on biodiversity translate into multiple functions or intermediate services affecting the final service fruit production?

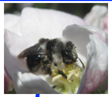
fruit production

3. Objectives WPs





WP3: Barcelona



Functional importance of pollinator diversity and role of **response traits** for **pollination**

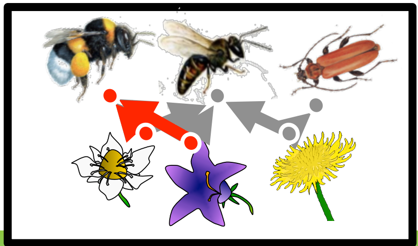
WP4: Darmstadt

Functional importance of predator diversity and role of **response traits** for **pest control**

3. Does biodiversity increase multiple ecosystem services when communities include a **diverse array of traits** (**functional complementarity**)?

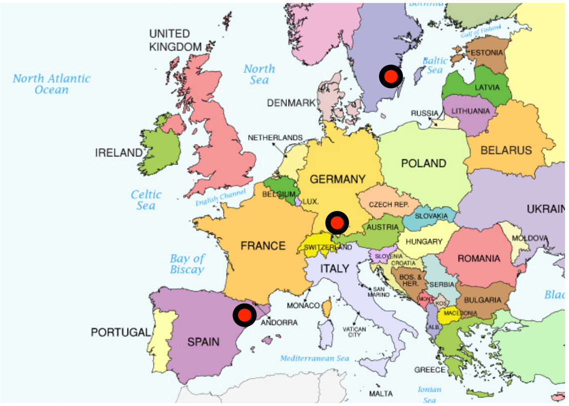
4. How does biodiversity drive ES by **spatial and conditional complementarity**?

5. Effects of AES at different scales on **diversity of traits** (response diversity) and **specificity of food webs**?



3. Objectives WPs

WP5: Stockholm
Response traits to buffer changing climatic conditions for services and dis-**services providers**



Modelling climate change effects:

6. Do species-specific responses to climate cause differences in insect communities along the **south-north European gradient?**

7. Effects of expected climatic changes on species abundance along the north-south European gradient and on **relative importance of services and dis-services in apple orchards**?

8. **Trade-offs between services- dis-services provisioning** for crop production in relation to the AES in different landscape context?

3. Objectives: expected outcome

- **Project will enhance knowledge of how to promote synergies and reduce trade-offs between food supply (apple production), biodiversity and ecosystem services.**

- **Project will complement ongoing pan-European research**
  LIBERATION, SCALES, STEP, MULTAGRI
  to provide extensive trait-based data set of multi-trophic interactions of the most important European fruit production system for further synthesis studies.

4. Work plan

General: Parallel work at 28 (14 organic/14 conventional) selected orchards in all three participating countries.

Specific analyses and field work will be conducted by certain participants following the WP structure

4. Work plan

4.1 Selection of study orchards and trees (all countries / all partners)

4.2 Assessing AES management information (all countries/ all partners)

3.3. Pollination services (all countries/ Barcelona, Freiburg, Stockholm)
4.3.1 Flower visitation and pollination limitation (all countries/ Barcelona, Freiburg, Stockholm)
4.3.2 Pollination efficiency of main pollinators (Germany/ Freiburg)

4. Work plan

4.4. Pests, enemies and pest control services (all countries/ Darmstadt, Oviedo, Stockholm)
4.4.1 Diversity of pest and natural enemies including rates of herbivory, fruit attack and predation (all countries/ Darmstadt, Oviedo, Stockholm)
4.4.2 Diversity of birds and their role in controlling pests (Spain - Oviedo)

4.5. Fruit production as the final ES in the target production system (all countries/ Darmstadt, Barcelona, Stockholm)

4.6. Establishment of trait database for pests, enemies and pollinators
4.6.1 Morphometric measures (all countries/ all partners)
4.6.2 Physiological measures (Germany – Darmstadt)

4.7. Response trait from the literature, temporal complementarity and climatic responses (Germany – Darmstadt, Sweden – Stockholm)

5. Status quo

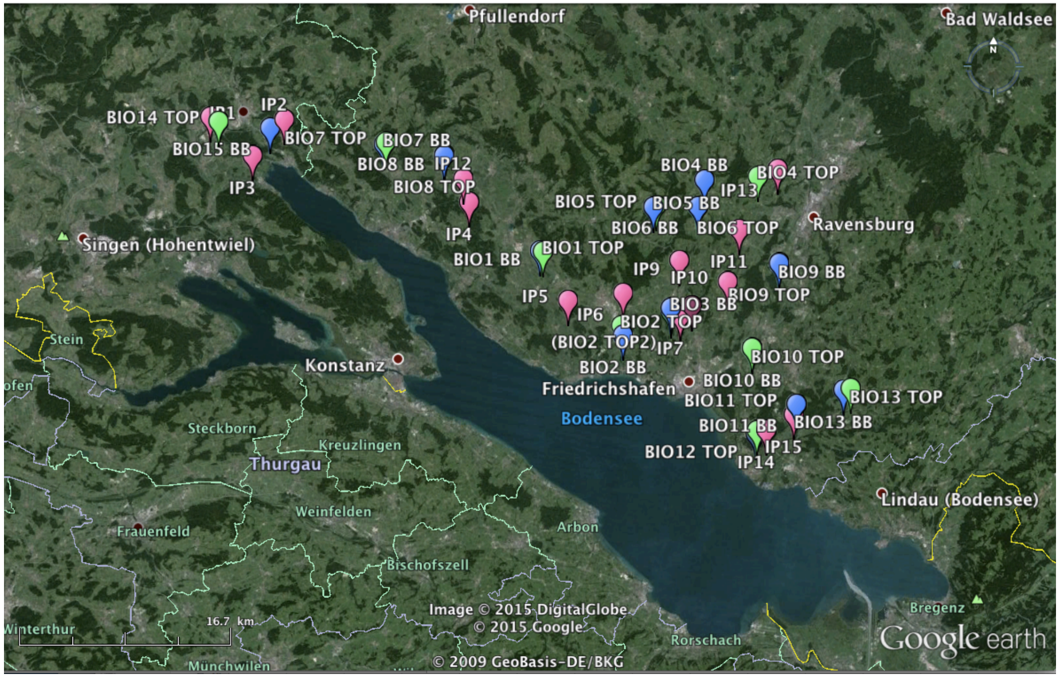
Spain

All 28
study orchards selected

5. Status quo

Germany

All 28
study orchards selected



5. Status quo

Sweden

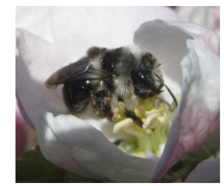
All 28
study orchards selected

5. Status quo

Field work started:

Spain:

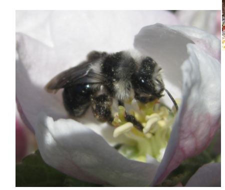
pollinator and flower count finished



Germany:

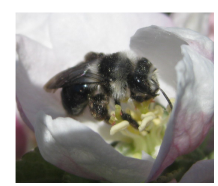
branch samples (pest winter stages) taken

pollinator and flower count running



Sweden:

pollinator and flower count starting soon



6. Stakeholder involvement / Challenges

Example Germany
Selection of apple cultivar and influence of growers

Planned: Braeburn (cultivar most commonly found in conventional and organic orchards)

Organic growers insisted on specific cultivar: Topaz

How to deal with such issues?

Currently: **organic** **conventional**

Thank you for your attention!