Collecting and Sharing Data on **bee health** Towards a European Bee **Partnership**

BRUSSELS, 26 JUNE '17

Honey-bee colony model (ApisRAM) for risk assessment *(and more)*

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European Crop Protection

European Beekeeping Coordination

OVERVIEW OF TALK

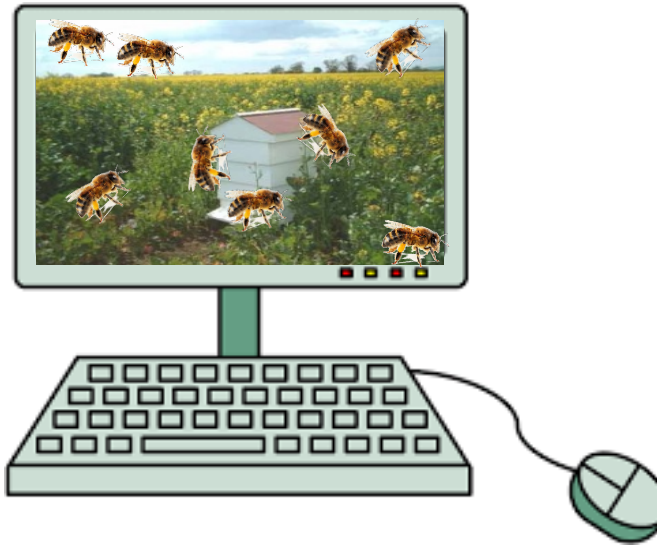
- Opportunities resulting from using a simulation approach

- Constraints (from the simulation point of view)
  - data availability and access (extended by Jane & Arthur)
  - data collection (extended by Magnus)
  - data collation and management (extended by Jane & Arthur)
  - data analysis (extended by Magnus & Arthur)
  - data communication (extended by Jane)

OPPORTUNITIES:

WHY A HONEY-BEE COLONY SIMULATION?

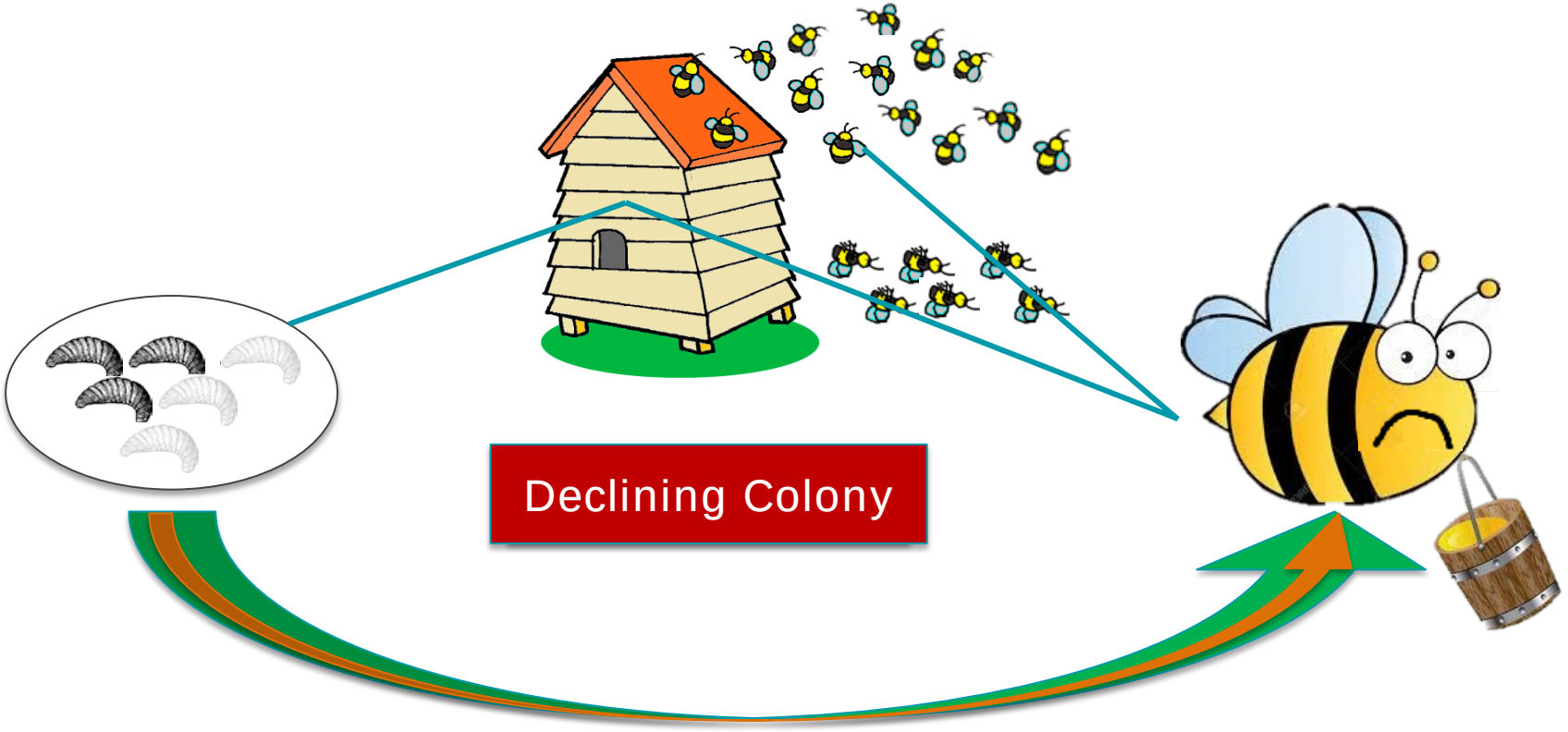
- Because it can:
  - Integrate multi-stressor impacts
  - Simulate interactions between components
  - Predict complex system-dynamics



- important because bee health is driven by multiple factors, changing in space and time.

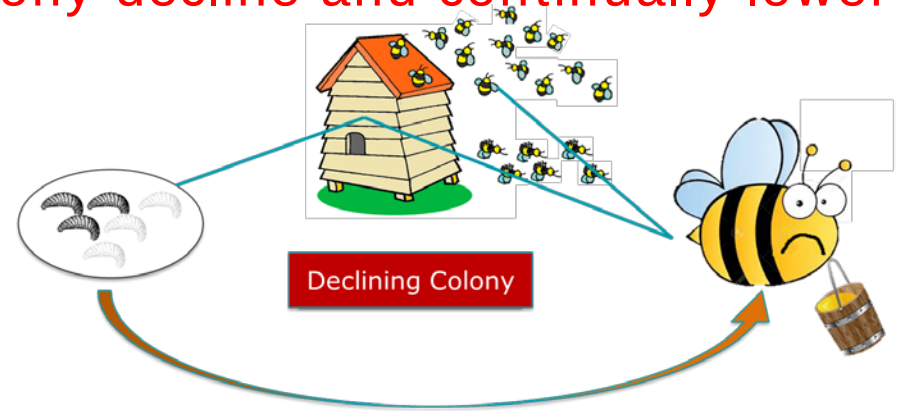
MULTI-STRESSOR IMPACTS

INTERACTIONS BETWEEN COMPONENTS



SIMULATE COMPLEX SYSTEM-DYNAMICS

+ Low Resource Availability + Low Temperature
= faster colony decline and continually lower forage rates



+ High Resource Availability + Good Temperatures
= colony recovers

These are ***not*** constant in time, and interact with each other and there are *Varroa* and diseases to consider.

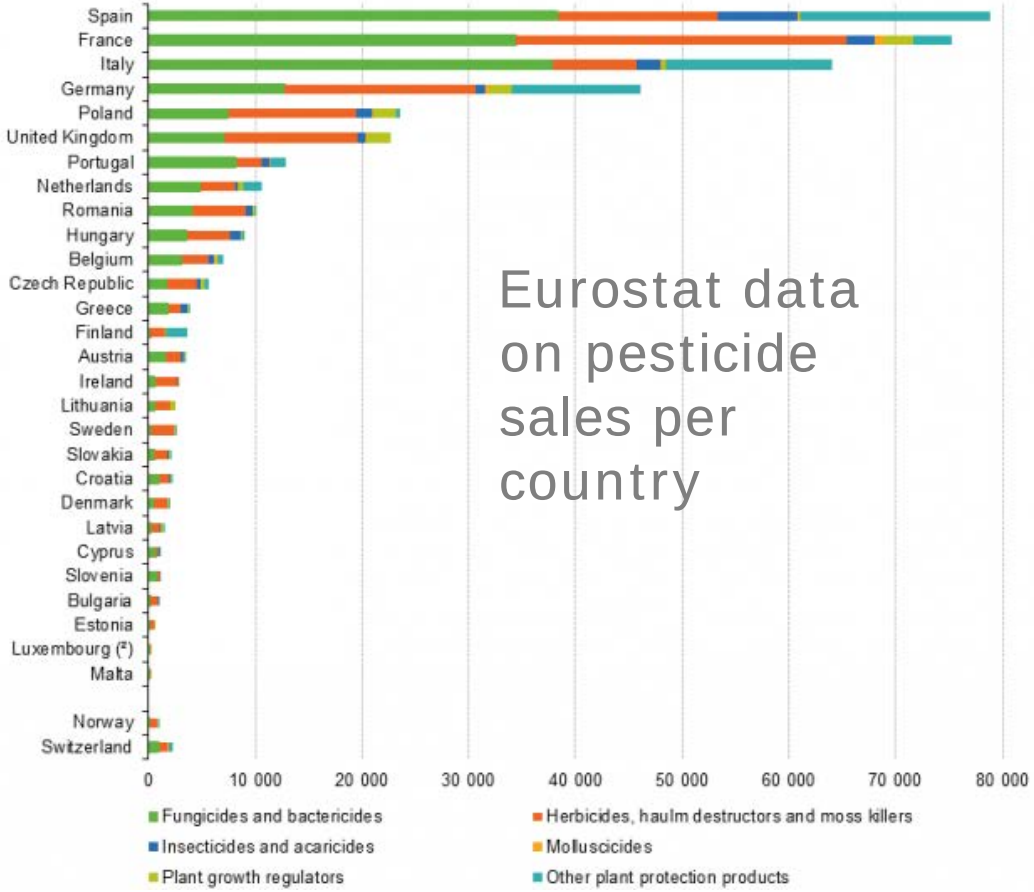
CONTEXT – THE LOCAL CONTEXT MATTERS

- Two 2.5 x 2.5km areas in Poland

Forage resources are likely to be very different in the two landscapes – but exactly how is hard to determine.

…but structure is not the only thing that is different

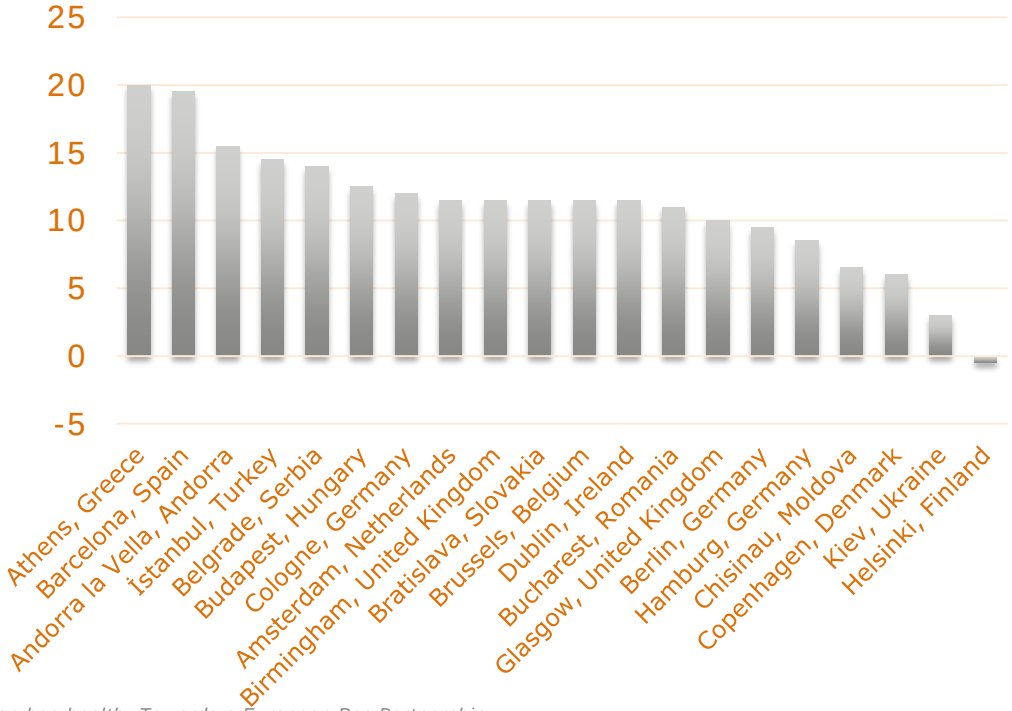
CONTEXT – THE LOCAL CONTEXT MATTERS



Eurostat data on pesticide sales per country

CONTEXT – THE LOCAL CONTEXT MATTERS

- Mean March temperature across Europe



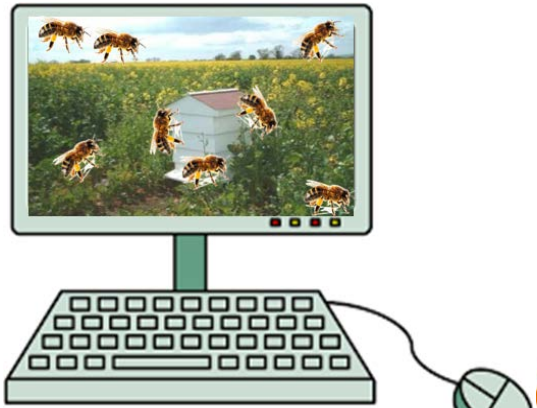
If you have bees in Helsinki, don't expect honey in May

…but you can get that in Greece!

WHAT IS SPECIAL ABOUT ApisRAM?

- Detailed representation of processes and structures: Beekeeping, biological agents, environmental conditions, bee behaviour, and colony structure
- ApisRAM is a simulation designed to copy reality as closely as possible
- Software engineering approach to implementation
- A highly detailed environmental simulator – ALMaSS
- Testing and verification planned for different EU regulatory zones

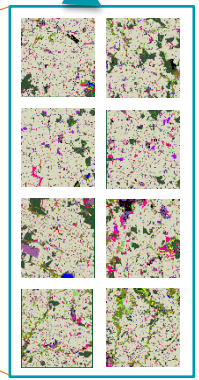
ApisRAM puts the colony into its context!



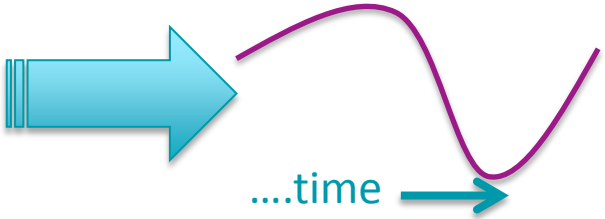
THE ApisRAM VISION

Biological agents
Beekeeping
Climate

Danish
Farming/
Environment



Bee health in Denmark



THE ApisRAM VISION

Biological agents
Beekeeping
Climate

Danish Farming/ Environment

Portuguese Farming/ Environment

Romanian Farming/ Environment

Spanish Farming/ Environment

Italian Farming/ Environment

German Farming/ Environment

Greek Farming/ Environment

Polish Farming/ Environment

French Farming/ Environment

....Etc.

THE ApisRAM VISION

Bee health in France

Danish Farming/ Environment

Portuguese Farming/ Environment

Bee health in Poland

Romanian Farming/ Environment

Spanish Farming/ Environment

Italian Farming/ Environment

Bee health in Germany

German Farming/ Environment

Polish Farming/ Environme

....time

....time

French arming/ ronment

....time

Greek Farming/ Environment

Bee health in Italy

Bee health in Spain

Bee health in Greece

....time

....time

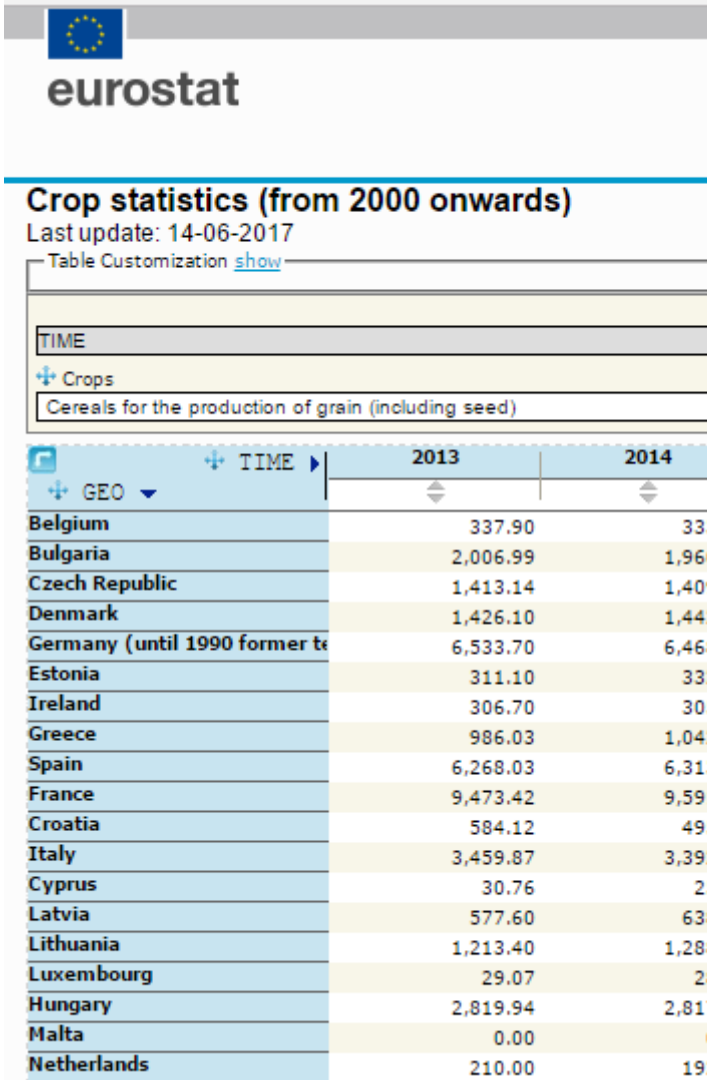
....time

DATA CONSTRAINTS

- Success with the ApisRAM vision depends on data - but there are associated constraints:
  - Data availability and access
  - Data collection
  - Data collation and management
  - Data analysis
  - Data communication

DATA AVAILABILITY & ACCESS

- Data needed for the bee model:
  - Farm subsidy data:
    - Crops grown per farm unit
    - Field maps for all farms
    - Organic status
  - Pesticide journals (Sustainability Directive):
    - Products and application rates/timing
  - Livestock
- Data collected in bee networks



eurostat

Crop statistics (from 2000 onwards)

Last update: 14-06-2017

Table Customization show

TIME

Crops

Cereals for the production of grain (including seed)

GEO \ TIME	2013	2014
Belgium	337.90	33
Bulgaria	2,006.99	1,96
Czech Republic	1,413.14	1,40
Denmark	1,426.10	1,44
Germany (until 1990 former te	6,533.70	6,46
Estonia	311.10	33
Ireland	306.70	30
Greece	986.03	1,04
Spain	6,268.03	6,31
France	9,473.42	9,59
Croatia	584.12	49
Italy	3,459.87	3,39
Cyprus	30.76	2
Latvia	577.60	63
Lithuania	1,213.40	1,28
Luxembourg	29.07	2
Hungary	2,819.94	2,81
Malta	0.00	
Netherlands	210.00	19

DATA AVAILABILITY & ACCESS

- Good news is that this national data is collected in most countries!

- Bad news is that with few exceptions data access is not easy.
  - It is possible to get farm subsidy data from ***some*** countries – collated in standard form to police subsidy claims – but not all
  - It seems impossible to access pesticide data – no standard formats, no centralised collection/analysis
- Variable interpretation of data protection legislation

DATA COLLECTION

- We can collect high quality data
- But we need good methods
- …and the information associated with it

–the context that colony finds itself

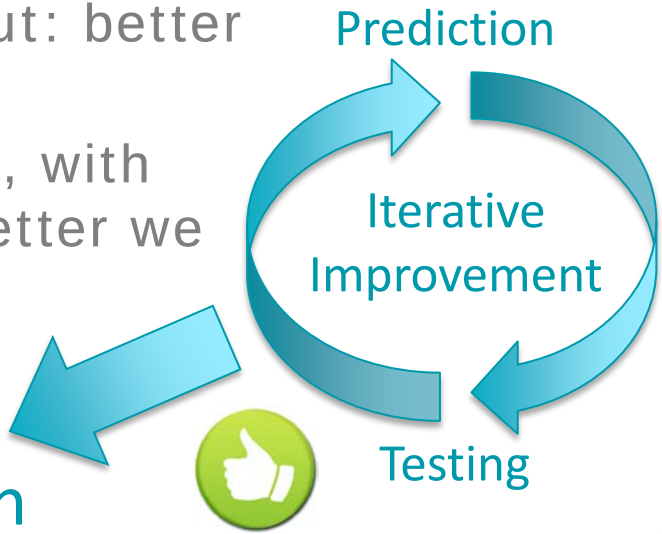
DATA COLLATION AND MANAGEMENT (& SHARING)

- Sharing and collation of data facilitates all data-based activities
- Constraints here are primarily of consistency and the need for technical solutions
  - Units must be clear
  - Classifications must be harmonised
  - The level of detail recorded matters and should not be lost (e.g. by aggregation of data).
  - Well organised, user-friendly databases

DATA ANALYSIS

- Simulation provides us with a powerful data analysis tool to ask ‘what if?’ questions

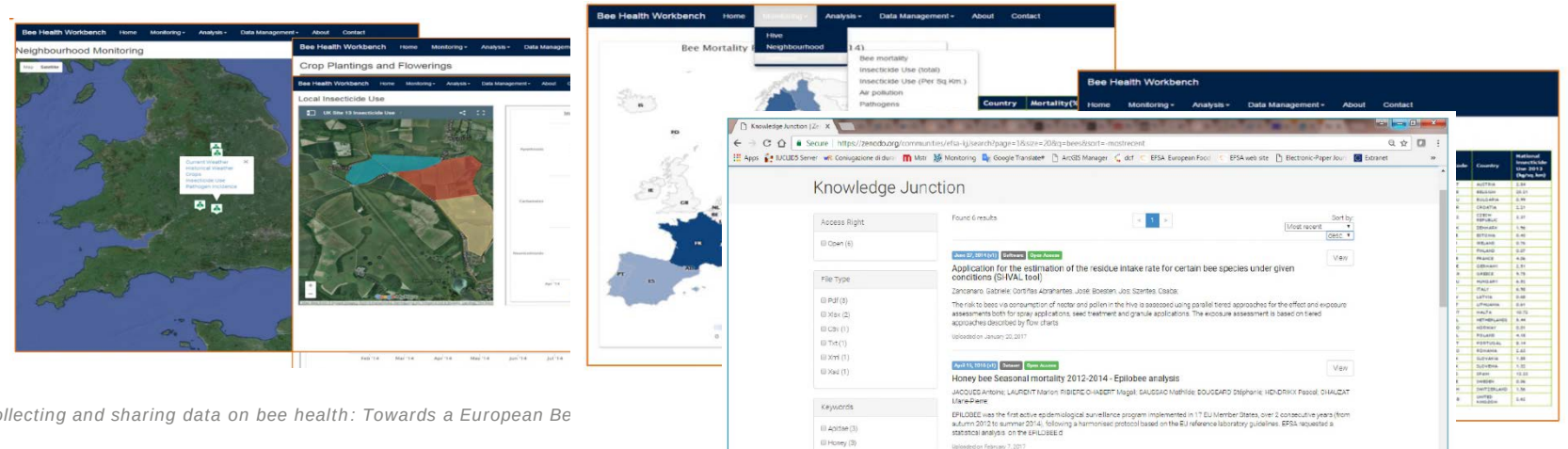
- But we are constrained by data input: better data in - better predictions out
- The more monitoring data available, with good information on context, the better we can test our predictive tools



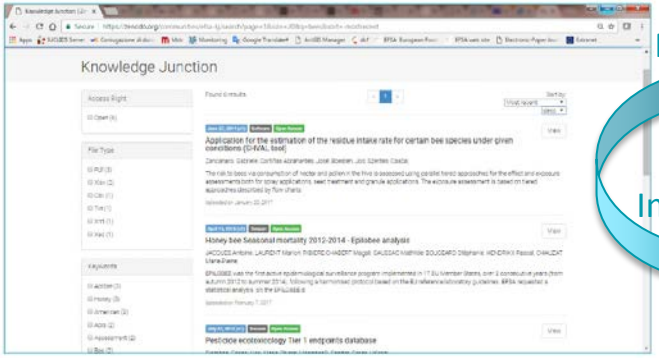
Better understanding and management of bee health

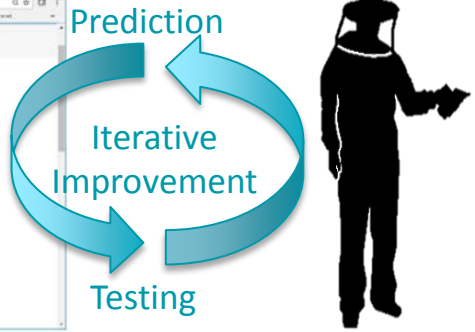
DATA COMMUNICATION (FOR UNDERSTANDING)

- Communicating what data actually mean is a critical task e.g. results of simulations provide information and beekeepers
- Constraints are the need for common platforms and media that do the job well



OPPORTUNITIES OUTWEIGH CONSTRAINTS





Sharing data and data products will increase our knowledge on bee health and help coordinate management/actions

….let’s make it happen!