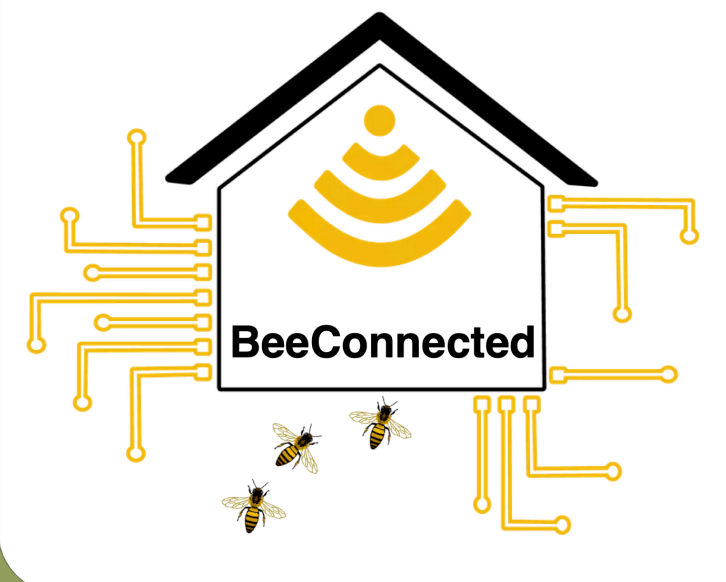# *BeeConnected* - Understanding and anticipating mechanisms of honeybee colony mortality with connected beehives
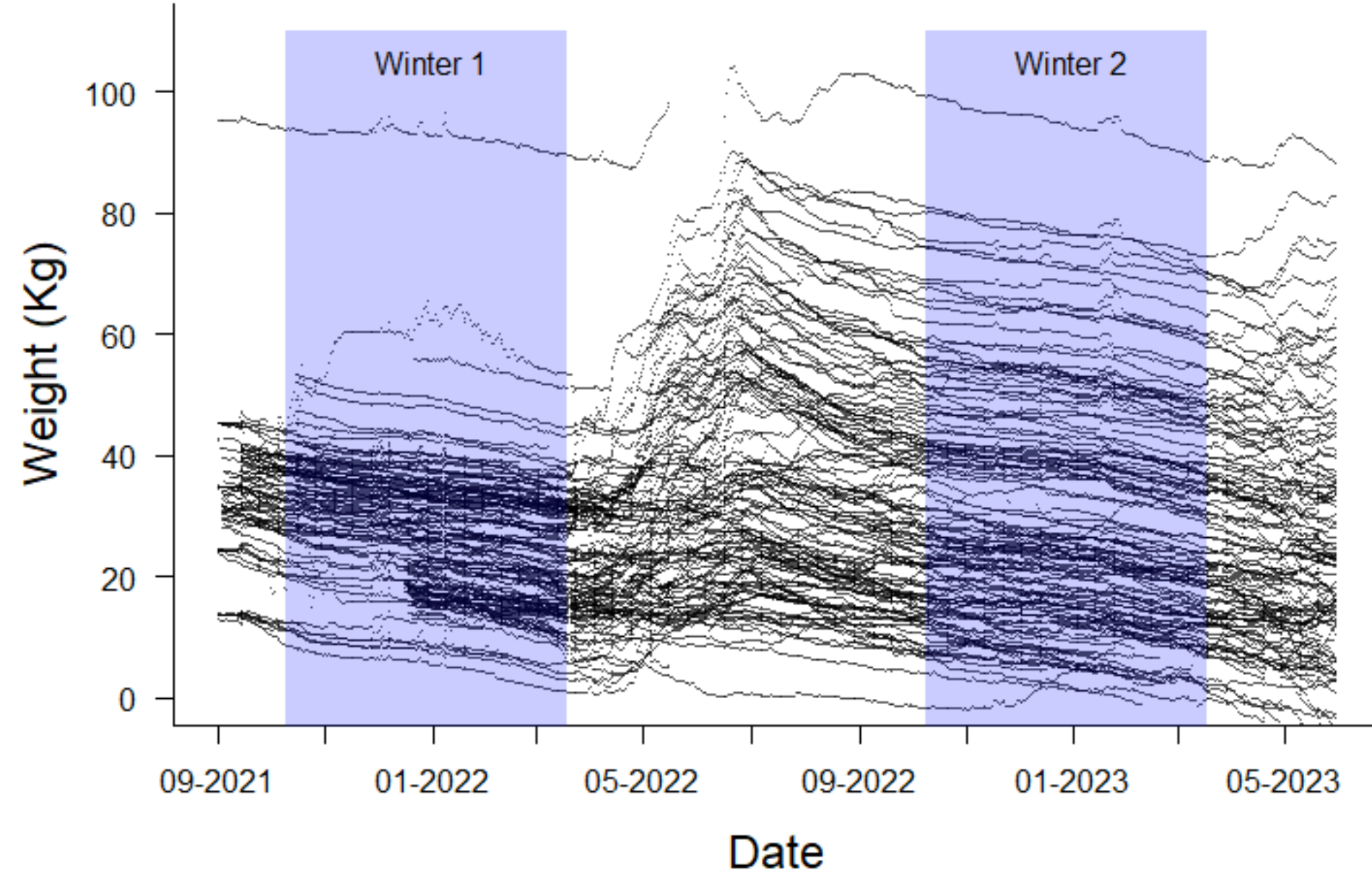
BeeConnected

Introduction

- Abnormal high mortality rates of honey bee colonies (25–50% every winter)
- Strong impacts on beekeeper economy and pollination services
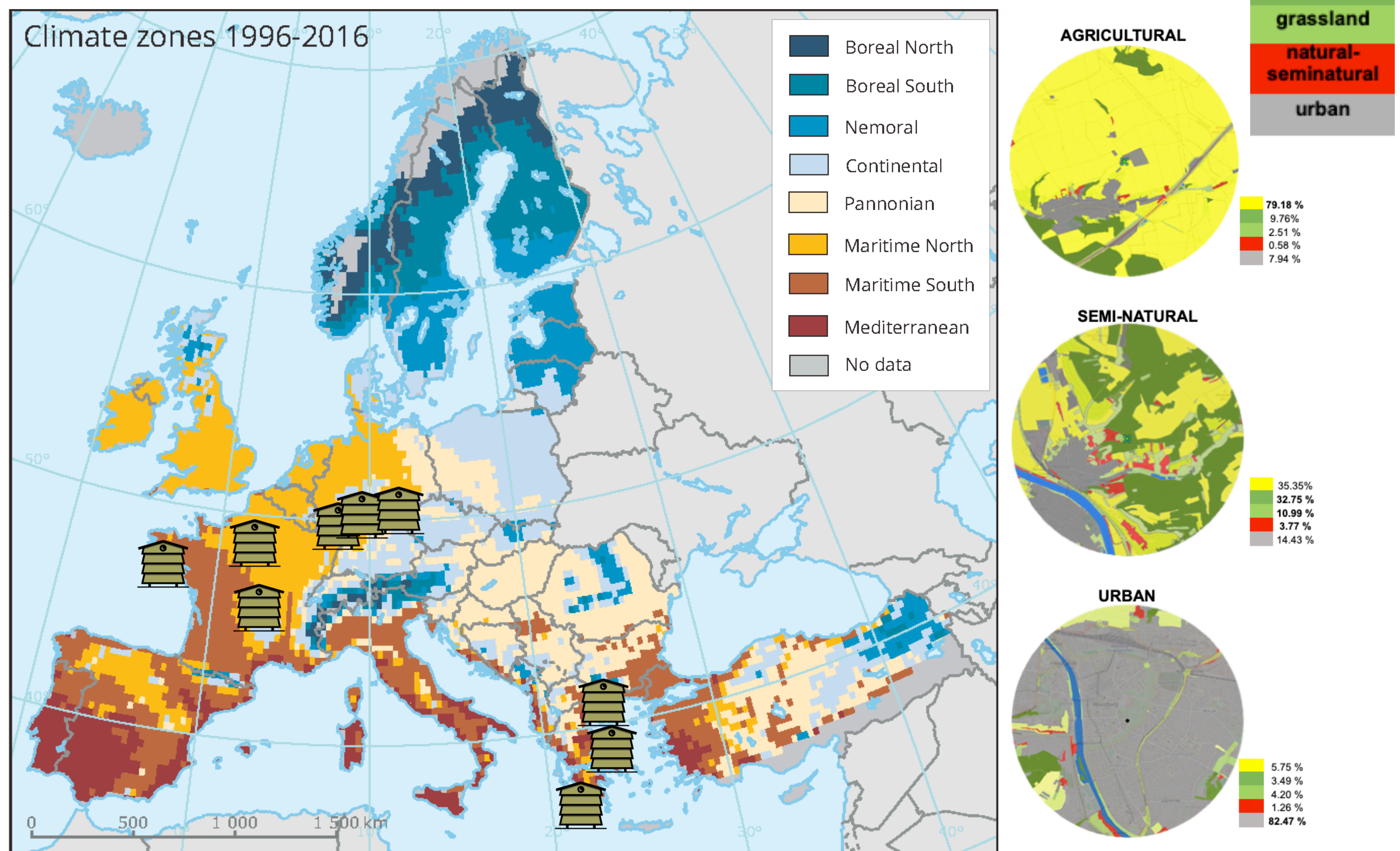- Beehives are black boxes during the winter

Goals of the project

- **Helping beekeepers limiting colony losses**
- Developing new digital solutions
- Delivering **early-warning signals** of honey bee colony mortality

Climate × landscape experimental design

Climate zones 1996-2016

- Boreal North
- Boreal South
- Nemoral
- Continental
- Pannonian
- Maritime North
- Maritime South
- Mediterranean
- No data

agriculture
forest
grassland
natural-seminatural
urban

AGRICULTURAL
79.18 %
9.76%
2.51 %
0.58 %
7.94 %

SEMI-NATURAL
35.35%
32.75 %
10.99 %
3.77 %
14.43 %

URBAN
5.75 %
3.49 %
4.20 %
1.26 %
82.47 %

Weight monitoring

Methods used in the project

International **climate × landscape monitoring** in 27 study sites in **France, Germany and Greece**

Weight, temperature and sound monitoring
- 135 hives with connected scales (*data every 15mins over 2 years, 137.83 Mo*)
- 1620 temperatures sensors (*data every 15mins over 2 year, 1.4 Go*)
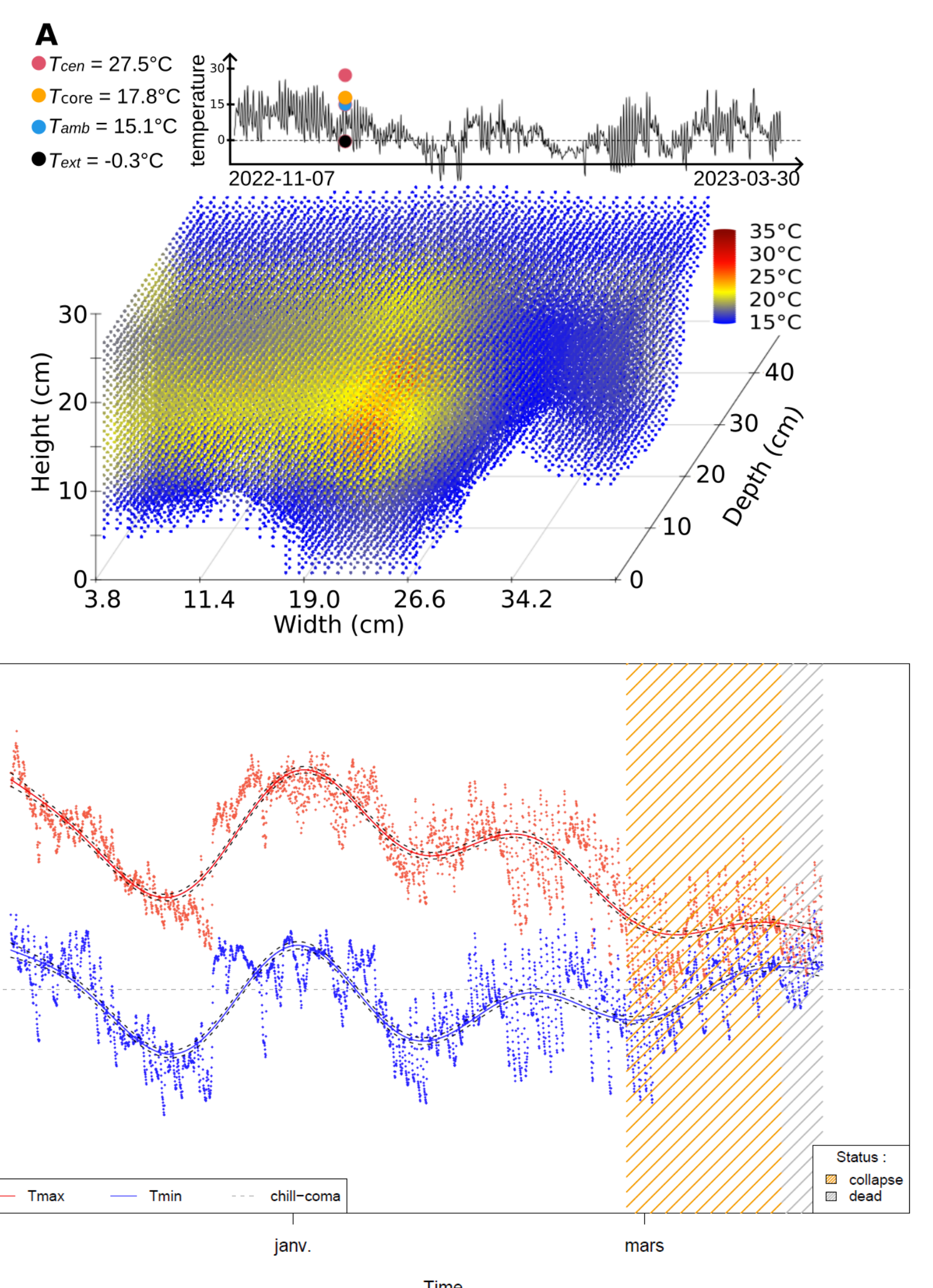- 15 hives with sound record devices (data recording over one winter, *30Tb*)

Results

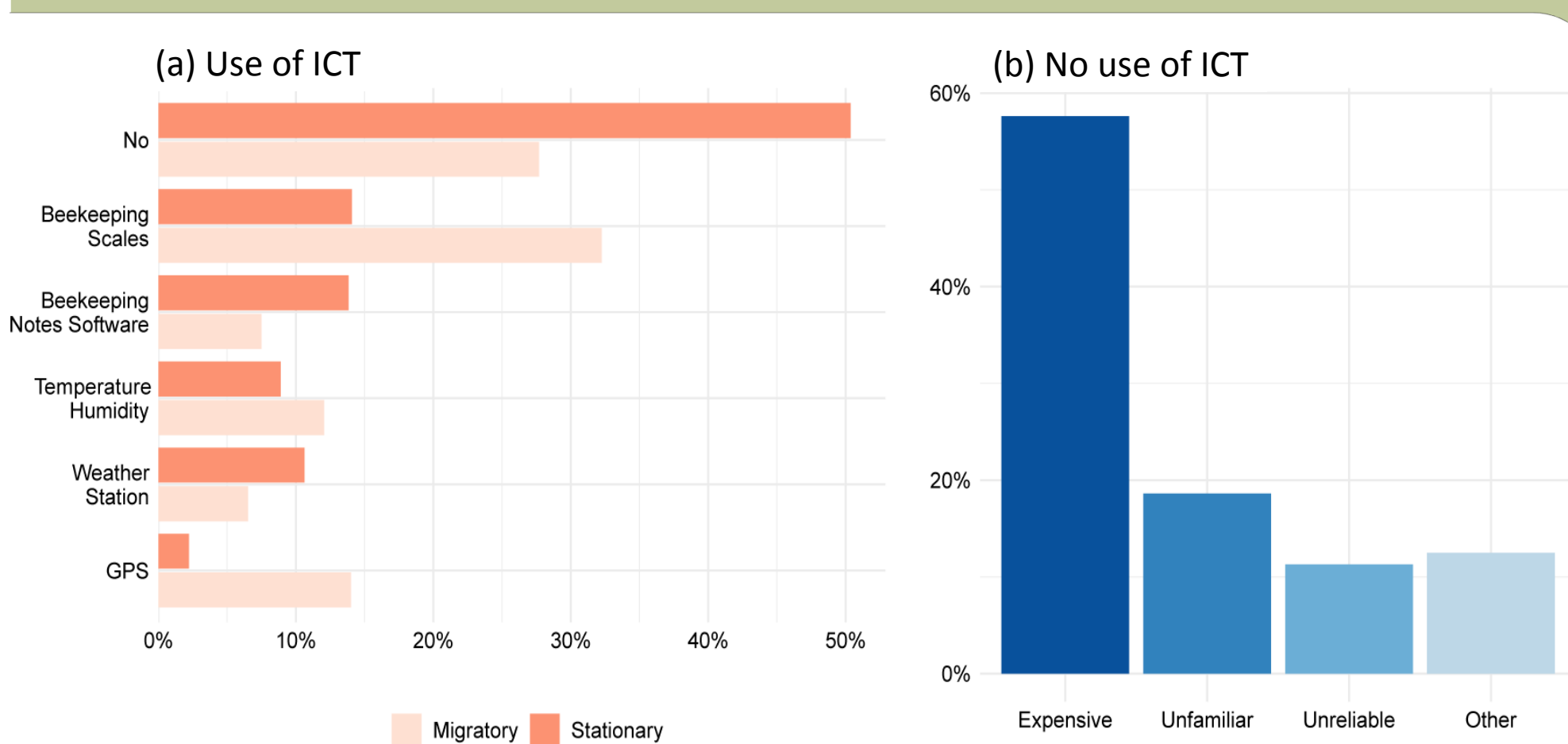BeeConnected has developed **low-cost tools** for ICT-connected hives that:

1) track the social **thermoregulation in three dimensions** (3D) and behaviour of honey bee colonies
2) detect **early warning signals** of colony health and winter mortality
3) provide a **decision-support tool** to help a wide range of beekeepers to sustain their professional activities by preventing colony losses

Temperature monitoring

(a) Use of ICT
(b) No use of ICT

No
Beekeeping Scales
Beekeeping Notes Software
Temperature Humidity
Weather Station
GPS

Migratory   Stationary

Expensive   Unfamiliar   Unreliable   Other

4) Collaboration with beekeepers (n=538) on an acceptability analysis of the use of ICT

T_{cen} = 27.5°C
T_{core} = 17.8°C
T_{amb} = 15.1°C
T_{ext} = -0.3°C

2022-11-07   2023-03-30

Tmax   Tmin   chill-coma

Status: collapse, dead

janv.   mars

Partners

EGCE — université Paris-Saclay CNRS IRD
Julius-Maximilians-UNIVERSITÄT WÜRZBURG

BeeConnected consortium: Requier, F., Davidson, P., Hatjina, F., Hotho, A., Krause, A., Mainardi, G., Minaud, E., Rebaudo, F., Steffan-Dewenter, I., Vardakas, P., Verrier, E.
https://www.beeconnected.online/

ERA-NET COFUND
ICT AGRI FOOD