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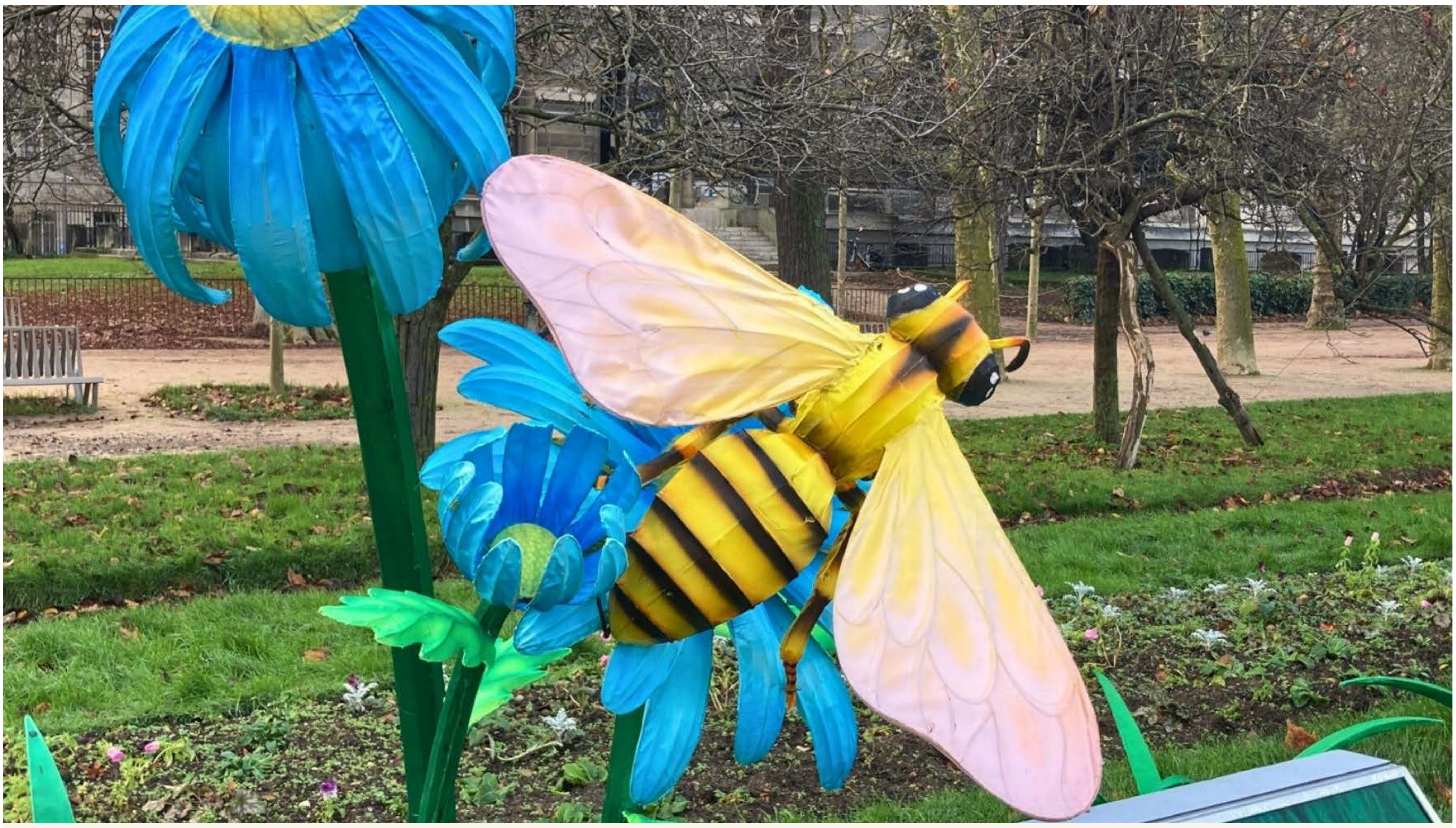

Assessing and Forecasting Climate Change and Its Impact on Pollinators' Health and Ecosystem Integrity

Thursday, 15 January 2026, 10.30-16.30

HONEY BEE VOLatility Project - Final Event

San Giobbe Economics Campus - Venice School of Management, Polo Rispoli (Cannaregio 873, Venice)

Also online via Zoom

Registration: https://forms.gle/Ao3BbAeEjyB8PfB97

Università Ca'Foscari Venezia VENICE SCHOOL OF MANAGEMENT | Università degli Studi Firenze DISEI Dipartimento di Scienze per l'Economia e l'Impresa

This event is part of the dissemination activities developed within the Project "Honey BEE VOLatility: An environmental index for assessing climatic risk impact on ecosystems service provision" prot. nr. P2022AX5TH and received funding from the European Union Next-GenerationEU - National Recovery and Resilience Plan (NRRP) – MISSION 4 COMPONENT 2, INVESTIMENT 1.1 Fondo per il Programma Nazionale di Ricerca e Progetti di Rilevante Interesse Nazionale (PRIN) – CUP N. H53D23009460001

10.30

Opening

Prof. **Maria Elvira Mancino**
University of Florence

10.35 - 11.35

Keynote speech

Prof. **Jennifer Castle**, Oxford University

Forecasting Climate Change using a Multivariate Cointegrated System

A cointegrated vector equilibrium correction model of key climate variables, including surface temperature, ocean heat content, Arctic sea-ice extent and sea-level change, is built, driven by radiative forcing in which a stochastic trend arises due to anthropogenic emissions of greenhouse gases. A valid and congruent statistical model requires saturation estimation to model breaks in trends, while also conditioning on natural radiative forcings and El Niño–Southern Oscillation. The model is stable over 150 years, reflecting the slow adjustment of the deep oceans to increased greenhouse gas concentrations, and predicts an equilibrium climate sensitivity of 2.5°C. Projections out to 2100 highlight the many uncertainties over the coming decades.

11.35 - 12.15

Presentation of the project results

Dr. **Federico Maglione** (University of Florence), ***High-frequency Climate Risk and Its Impact on Honey Bee Production***

This study investigates the impact of high-frequency climate risk, specifically temperature volatility, on honey bee production. Recognising the crucial role of honey bees as environmental sentinels and their sensitivity to climatic variables, the research extends beyond conventional analyses of long-term average temperatures to explore the effects of short-term temperature "surprises." Using high-frequency, irregularly spaced data from thousands of Italian beehives (2019-2024), combined with external temperature data, a non-parametric estimation of weekly integrated is provided. Then, using time-series regressions, we estimate the elasticity of beehive weight volatility to external temperature volatility. Further cross-sectional analyses examine how environmental factors, such as biodiversity and pollution, influence this elasticity. The findings indicate that a significant number of beehives are negatively affected by temperature shocks, particularly during spring and late summer. While biodiversity does not significantly mitigate temperature shocks for already affected beehives, it plays a crucial role in buffering "hedged" beehives against such volatility. Conversely, higher levels of PM10 pollution are strongly associated with increased vulnerability of beehives to temperature shocks. These results highlight that beehives in areas with lower biodiversity and higher pollution are more susceptible to high-frequency temperature volatility, whereas those in richer, cleaner environments show greater resilience. This underscores the critical importance of local environmental quality in mediating the impacts of climate risk on honey bee health and production.

12.15 - 12.55

Presentation of the project results

Prof. **Luca Di Corato**, Ca' Foscari University of Venice

Optimal Hive Management under Uncertainty: The Case of Migratory Beekeeping

This paper presents a stochastic dynamic model of beekeeping adaptation under climate uncertainty, formalising the beekeeper's choice as a reversible optimal switching problem between sedentary and migratory practices. Honey yields are modelled as regime-specific, correlated geometric Brownian motions, while switching incurs sunk costs that create state-dependent inaction regions and conversion boundaries. The model is solved numerically via collocation and validated through Monte Carlo simulation. Using hive-level data from 2019–2024 with hourly weight measurements and precise geolocations, we find highly persistent, non-stationary weight dynamics and predominantly south-to-north, upslope migrations. Estimated annual drifts and volatilities reveal a consistent migratory premium, with average value functions of €105–107 per hive-year compared to €82–84 for sedentary hives. Optimal policies predict infrequent switching and higher discounted payoffs for earlier transitions. Migration thus emerges as both a return-enhancing and risk-mitigating adaptation strategy for climate-resilient apiculture.

13.00 - 14.30

Light lunch

14.30 - 15.10

Presentation of the project results

Prof. **Edy Fantinato**, Ca' Foscari University of Venice

The biogeography of beekeeping

Honey bees (Apis mellifera) are widely recognised as bioindicators of ecosystem and climate health. In professional beekeeping, transhumance, i.e., the seasonal movement of hives to exploit different floral resources, is a common practice aimed at maximising honey production.

However, transhumance may also have ecological and pathological implications, such as facilitating the spread of pathogens, increasing competition with wild pollinators and increasing colony stress. In this study, we assessed the effects of transhumance on hive weight dynamics and examined how landscape composition influences the productivity of stationary colonies. Using continuous hive weight monitoring, we quantified honey production and identified the number of productive days across different biogeographic regions. Our analyses revealed that in the Alpine region, honey production per hive is generally higher than in other regions. However, the number of productive days is lower, suggesting a more concentrated flowering period. Conversely, in Continental and Mediterranean regions, which are dominated by agricultural and urban landscapes, productivity is reduced and more variable, likely due to habitat fragmentation and lower floral diversity resulting from intensifying agriculture and urban expansion. These findings highlight the synergy between mobility and productivity in beekeeping, with transhumance enhancing yield in resource-rich areas. However, landscape composition plays a key role in determining both the productivity and sustainability of beekeeping practices. Understanding these interactions is crucial for developing management strategies that reconcile economic efficiency with the conservation of pollinator health and ecosystem integrity.

15.10-16.10

Keynote speech

Prof. **Theodora Petanidou**, University of Aegean

Wild and honey bees in times of climate change in the Mediterranean

Global temperatures show a continuously increasing trend, which is expected to have a considerable effect on pollinator demographics and interactions with flowering plants, as well as on their distribution across climate gradients. This effect is expected to be more pronounced in the Mediterranean region, where climate change, i.e. temperature rise vis-à-vis the increasing uncertainty of the precipitation regime, is predicted to be particularly strong by the end of the 21st century, as compared to the second half of the previous century. Based on empirical work carried out in nature and in the lab since the 1980s, this talk will highlight documented findings regarding the effects of climate change on pollinators and their interactions in Mediterranean ecosystems, particularly focusing on wild pollinators, especially bees, and managed honey bees, as well as their interactions with wild plants. Specifically, the studies so far conducted focus on climate change effects on: (i) pollinator diversity and distribution in a wide area (the entire Aegean) and along an elevation gradient (Mt Olympus); (ii) plant–pollinator interactions across a climate gradient (islands across the Aegean climate gradient). The talk will also emphasise the effects of climate change on flowering plants, i.e. pollinators' partners, particularly their phenology (shifts of flowering phenology; contraction of floral anthesis and of population flowering span) and eventual temporal mismatches with pollinator activity. Most importantly, it will focus on how temperature rise may affect nectar secretion of the most important nectariferous plants flowering across a yearly gradient, something that is expected to affect (seasonally, geographically) the bee-keeping activities traditionally practised in the area. All the above are expected to worsen the interactions between honey bees and wild bees that have been shown to be antagonistic in the Aegean islands of intense bee-keeping activity.

16.10 - 16.20

Closing