

# Agriculture under pressure: spatiotemporal trade-off dynamics of nature's contributions to people in peri-urban agrarian landscapes

Matteo Riva<sup>1</sup> (✉ [rivam@ethz.ch](mailto:rivam@ethz.ch)), Adrienne Grêt-Regamey<sup>1</sup> and Felix Kienast<sup>2</sup>

<sup>1</sup> Swiss Federal Institute of Technology (ETH Zürich), Planning of Landscape and Urban Systems

<sup>2</sup> Swiss Federal Institute for Forest, Snow and Landscape (WSL)

## CONTEXT

Technological innovations and land transformation processes increase food production worldwide. However, a growing population, changing lifestyles, urbanization, land scarcity and climate change put **agricultural areas under pressure**. Apart from providing food, agricultural areas provide a variety of other services such as habitat for species, aesthetic values or recreational opportunities; so-called **nature's contributions to people (NCPs)** [1].

This research is part of **Future Cities Lab (FCL) Global**, in the module investigating "New Urban Agendas under Planetary Urbanization" [2].

Knowledge of **spatiotemporal fluctuations** in supply of and demand for NCPs is essential to inform **management strategies** that ensure coexistence of different functions [3,4].

Areas of supply and areas of demand are linked by specific types of **NCP flows** (commodity, biophysical process, ...), which also guide the focus of the respective analysis [5,6].

Both **local and global dynamics** are crucial to understand trade-offs and drivers of change over time [7].



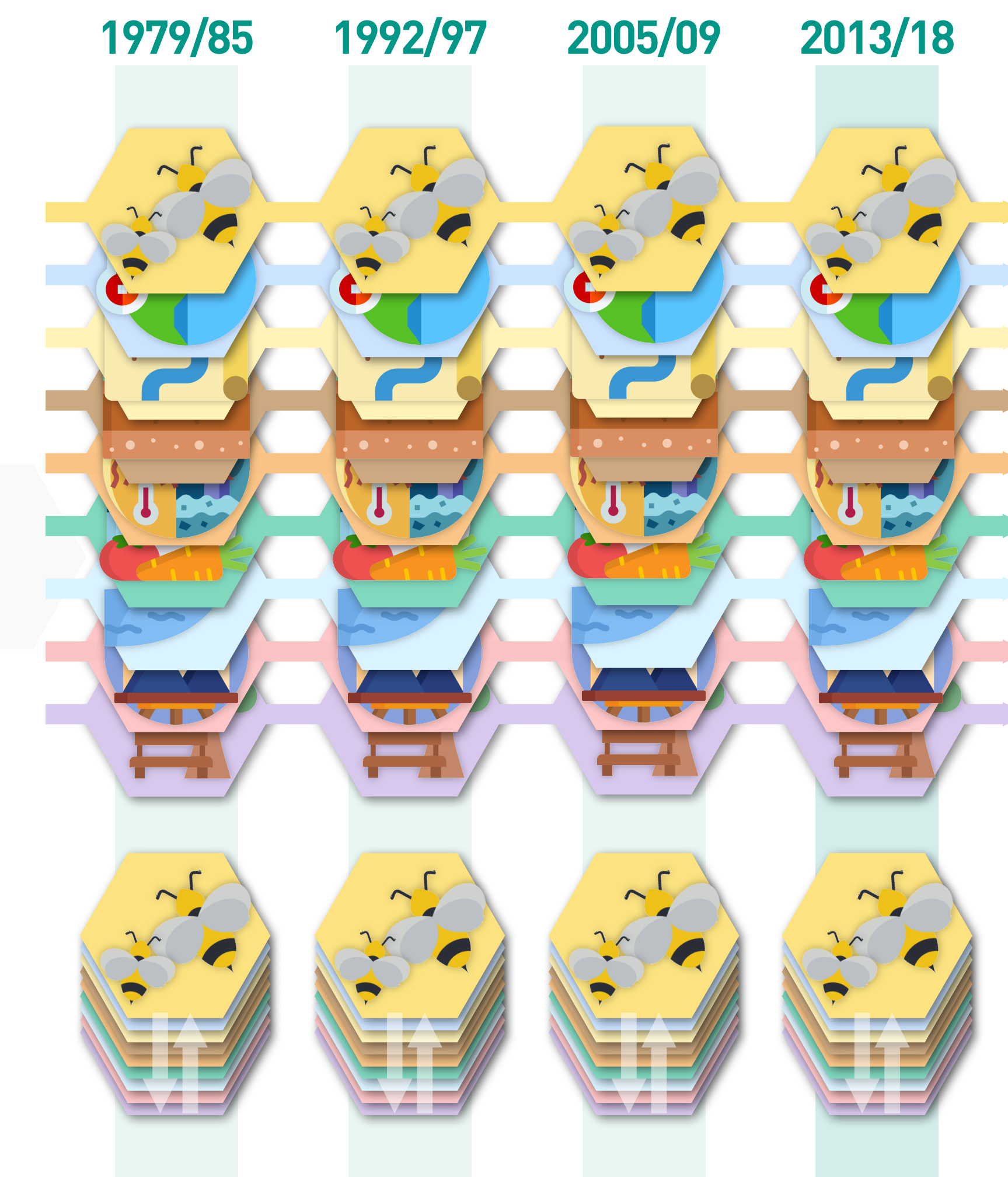
Click here to see the NCPs selection

**Qualitative content analysis** of cantonal and national planning strategies to filter relevant NCPs.

## METHODS

The goal of this research is to analyze supply of and demand for NCPs in order to uncover **spatiotemporal trade-offs** [5]. As the image on the right shows we aim to inspect trends in a single NCP over time (horizontal colored flows), as well as the combination of different NCPs in a specific moment in time (bottom stacks).

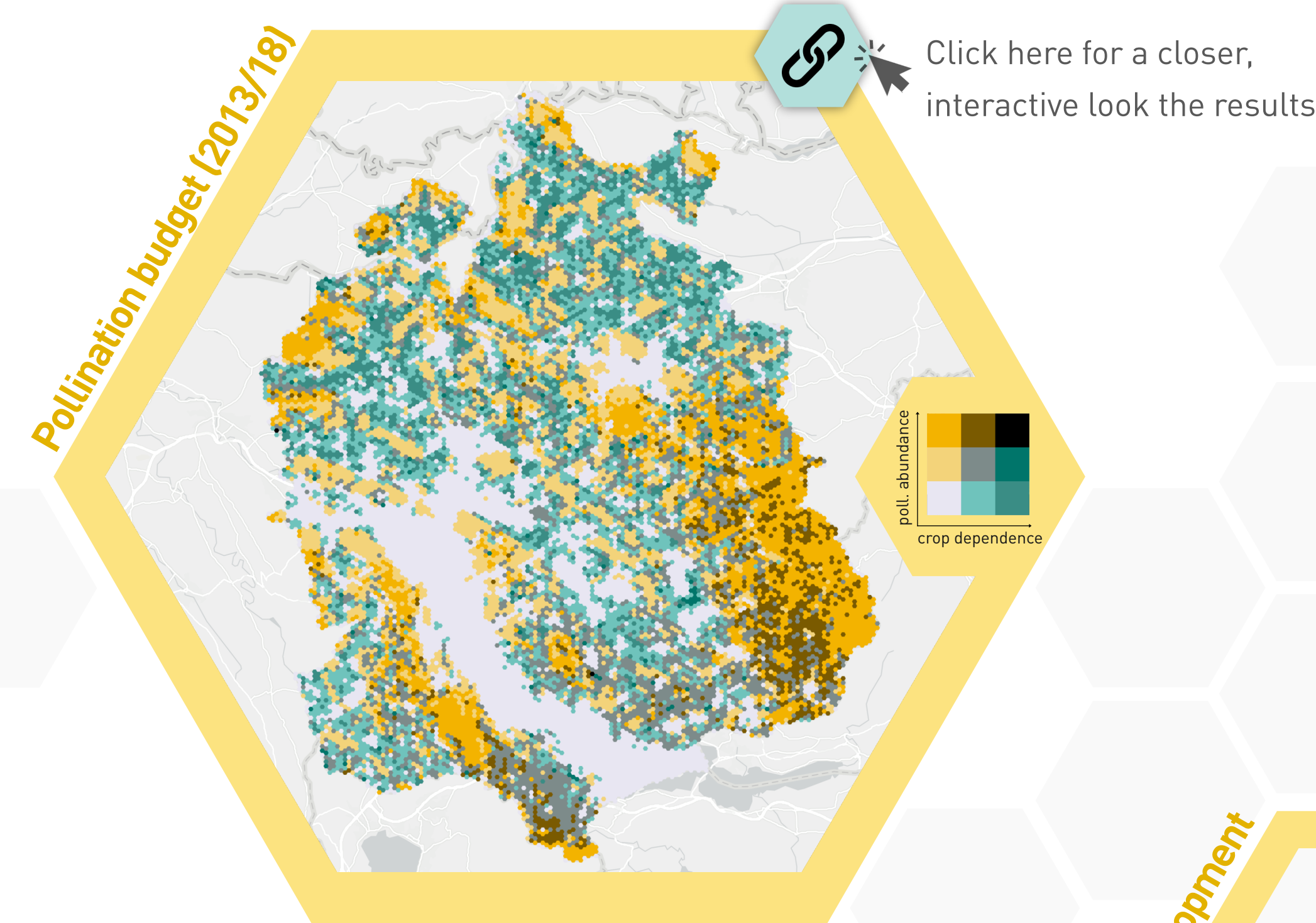
Each NCP is assessed with representative **indicators**, using land cover, socioeconomic and biophysical variables as well as agricultural production data. The precise methodology differs for each NCP depending on topic and data availability.



## RESULTS

While these results represent the NCP "Pollination", similar analyses are planned for the other selected NCPs.

The supply of pollinators is computed with the **InVEST Crop pollination** model [8] using literature-based biophysical information [9,10,11] and LULC data [12]. The demand for pollination is represented as the **crop pollination dependence**. This indicator is based on statistics of agricultural areas and LULC data [12], and information on pollination dependence of specific crop types [13,14]. For past time-steps, data are only available at municipal level.

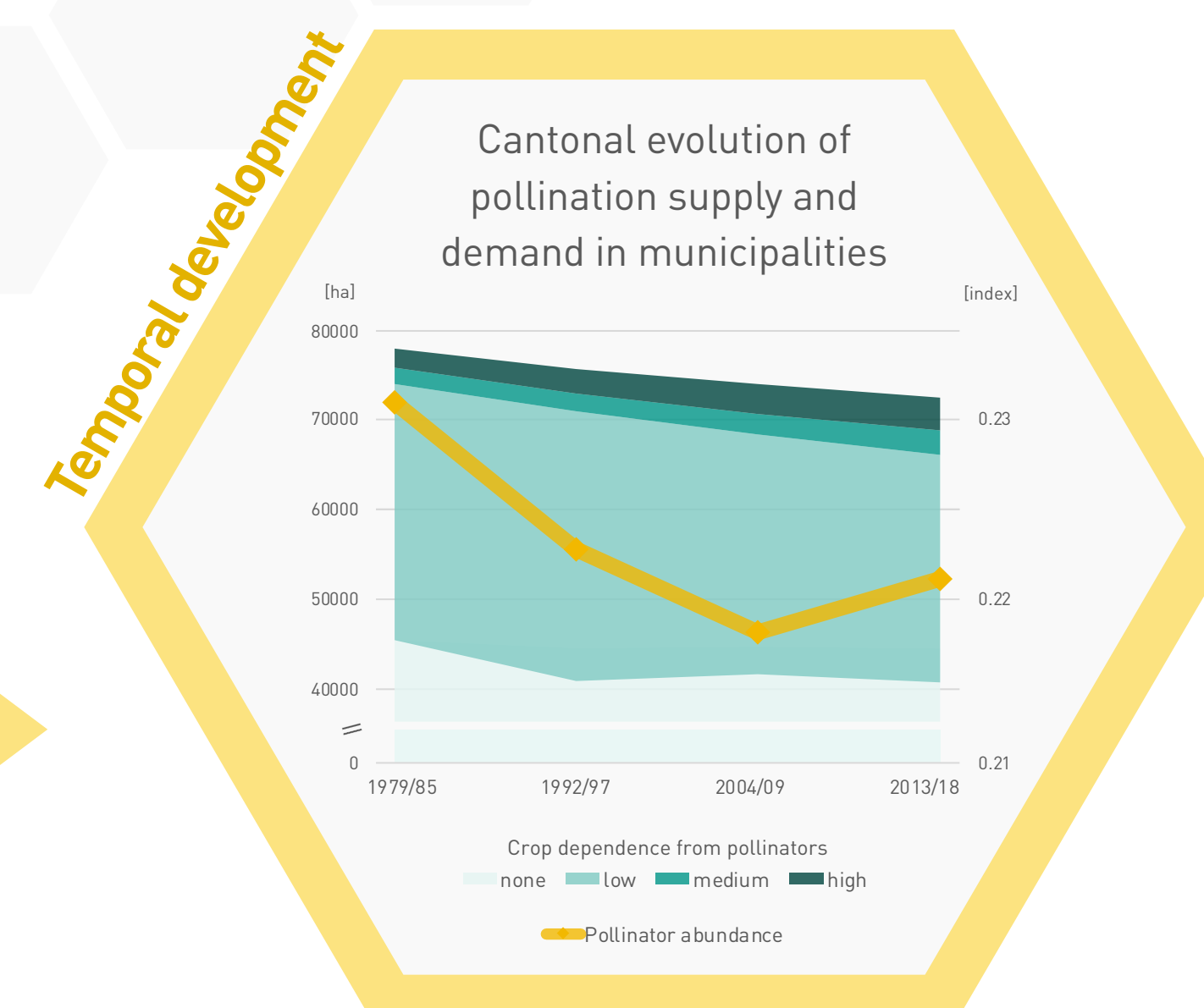


Click here for a closer, interactive look the results

## DISCUSSION

The distribution of supply of and demand for pollination shows clear **spatial patterns**. In the southeastern part of the canton we expect to find many active pollinators, but the crops in these areas show only low dependence from pollinator. A similar situation is visible also on the western lake shore. The central and northern part of the canton are characterized by lower pollination abundance values mirrored by higher demand of pollinator dependent crops.

Concerning the **temporal evolution**, there is an overall steady decrease in agricultural areas in the canton of Zurich. At the same time, there is an increasing amount of pollination-dependent crops grown on these areas. Moreover, we can observe a constant decrease in the pollination abundance index, with a slight increase in the last decade. While the change in pollinators abundance is mostly explained with changing landscape patterns, the shift in crop types is driven by societal demand, i.e. new lifestyles and consumption habits. This results in changing trade-offs dynamics over time.



## OUTLOOK

The next step is to understand these spatial and temporal patterns for each NCP. Following this task, we will combine knowledge of each NCP in order to assess **trade-offs both within** each NCP and **between** different NCPs.

Such a historical assessment of NCPs supply, demand and flows in peri-urban agrarian landscapes can help manage landscapes for **multifunctionality**, i.e. support the ability of ecosystems to simultaneously perform multiple functions, leading to a balanced provision of multiple NCPs [15].

## SOURCES

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