

Hedgerows as biodiversity-enhancing structures in the agricultural landscape of Schleswig-Holstein, Germany

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"Knick" in Schleswig-Holstein

Agroforestry systems like "Knick" (Fig. 1A) are a type of traditional landscape management that actively uses positive ecological interactions between woody and herbaceous plants. "Knick" often persist as the last remaining near-natural woody habitat in intensified agricultural landscapes. In Schleswig-Holstein, a total "Knick" length of 54,196 km remains, which accounts for 68 % of the total length from the 1940s (Lütt et al. 2022:23-24), resulting in a decreased average "Knick" density of 116 m/ha to

62 m/ha (Litza & Diekmann 2020:1189-1191) (Fig. 1B). Species-rich hedgerows have become rare and a study by Litza & Diekmann (2017) detected an overall decline in biodiversity of "Knick", especially for shrubs and herbaceous forest species. In addition to climate change, biodiversity loss is another most alarming challenge that we are facing as society. However, increasing effects on biodiversity can be achieved by structural enrichment of agroforestry systems (Reeg et al. 2009).

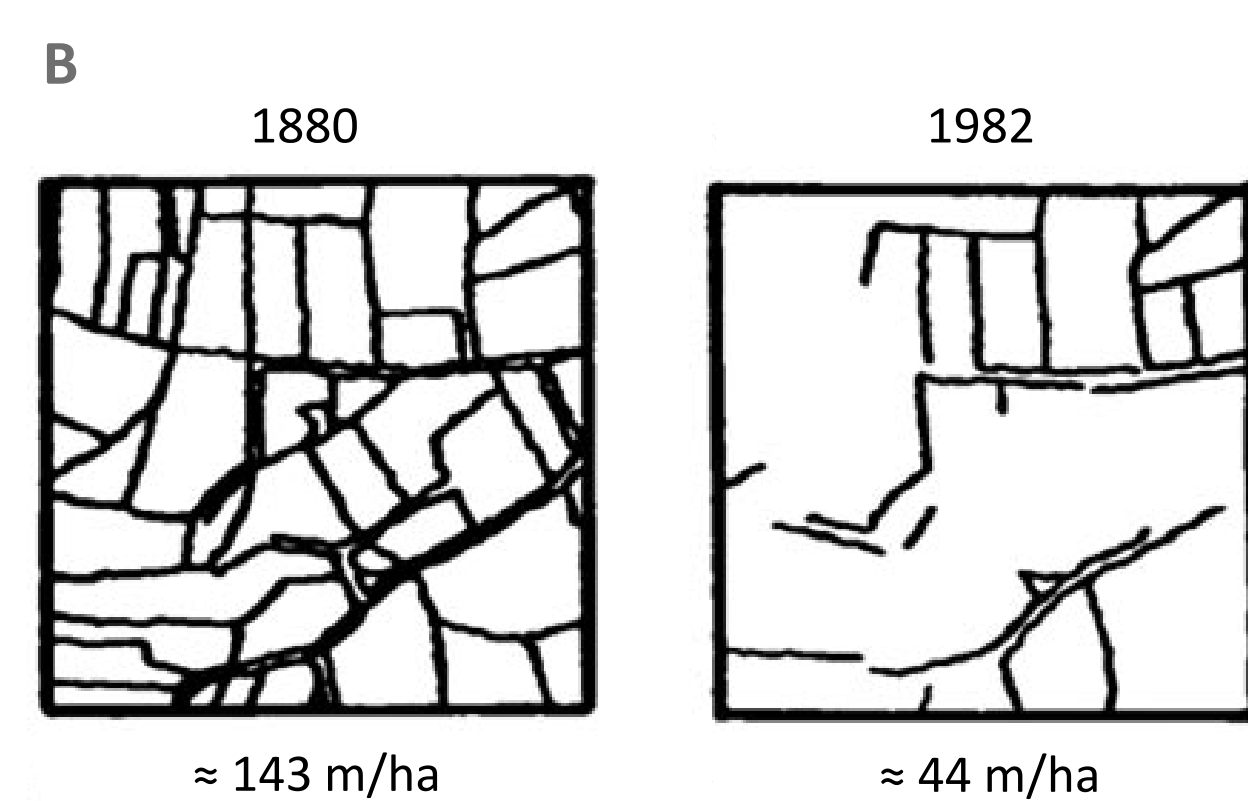


Fig. 1: A) A "Knick" in the agricultural landscape and B) a cartographic example of the decreased "Knick" density of Schleswig-Holstein (Lütt et al. 2022:118).

Structure and functions of "Knick"

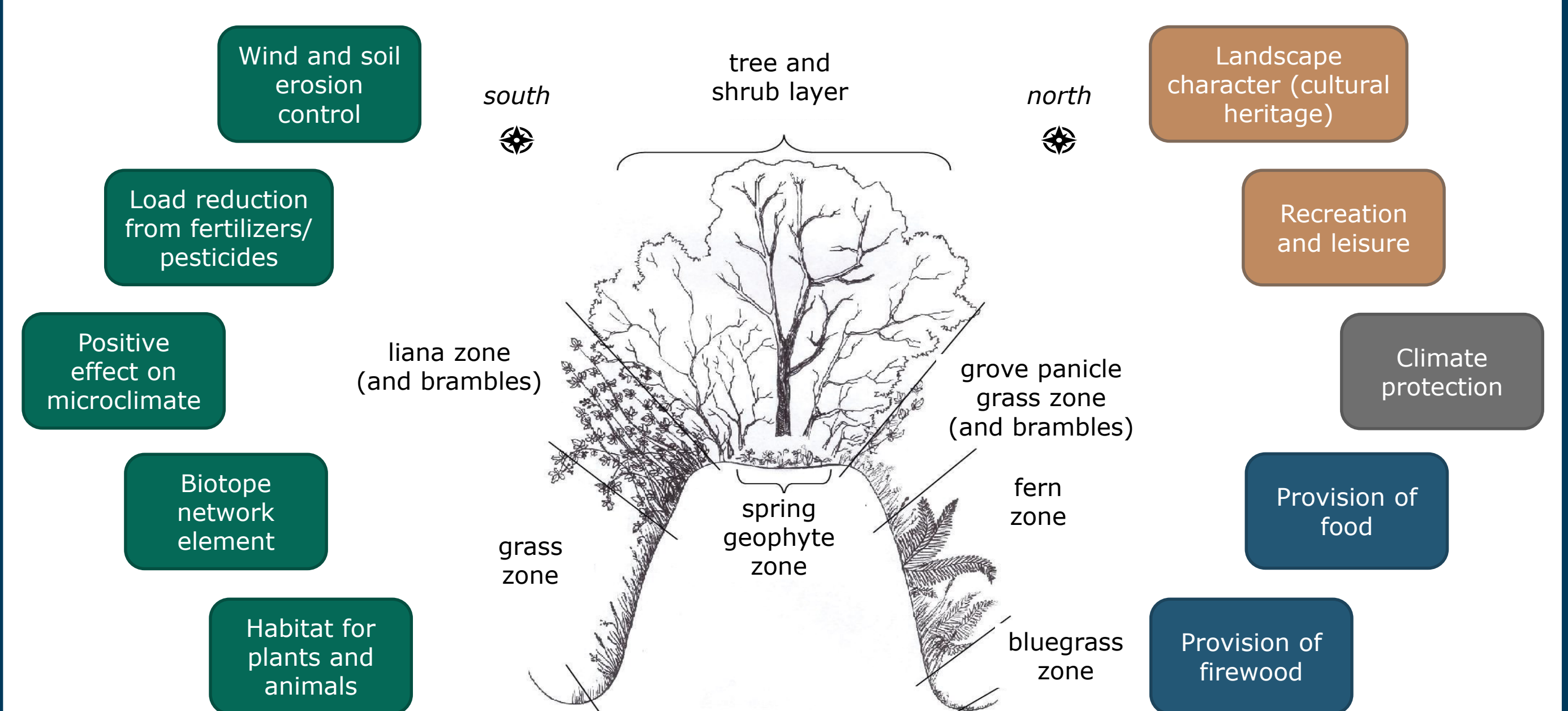
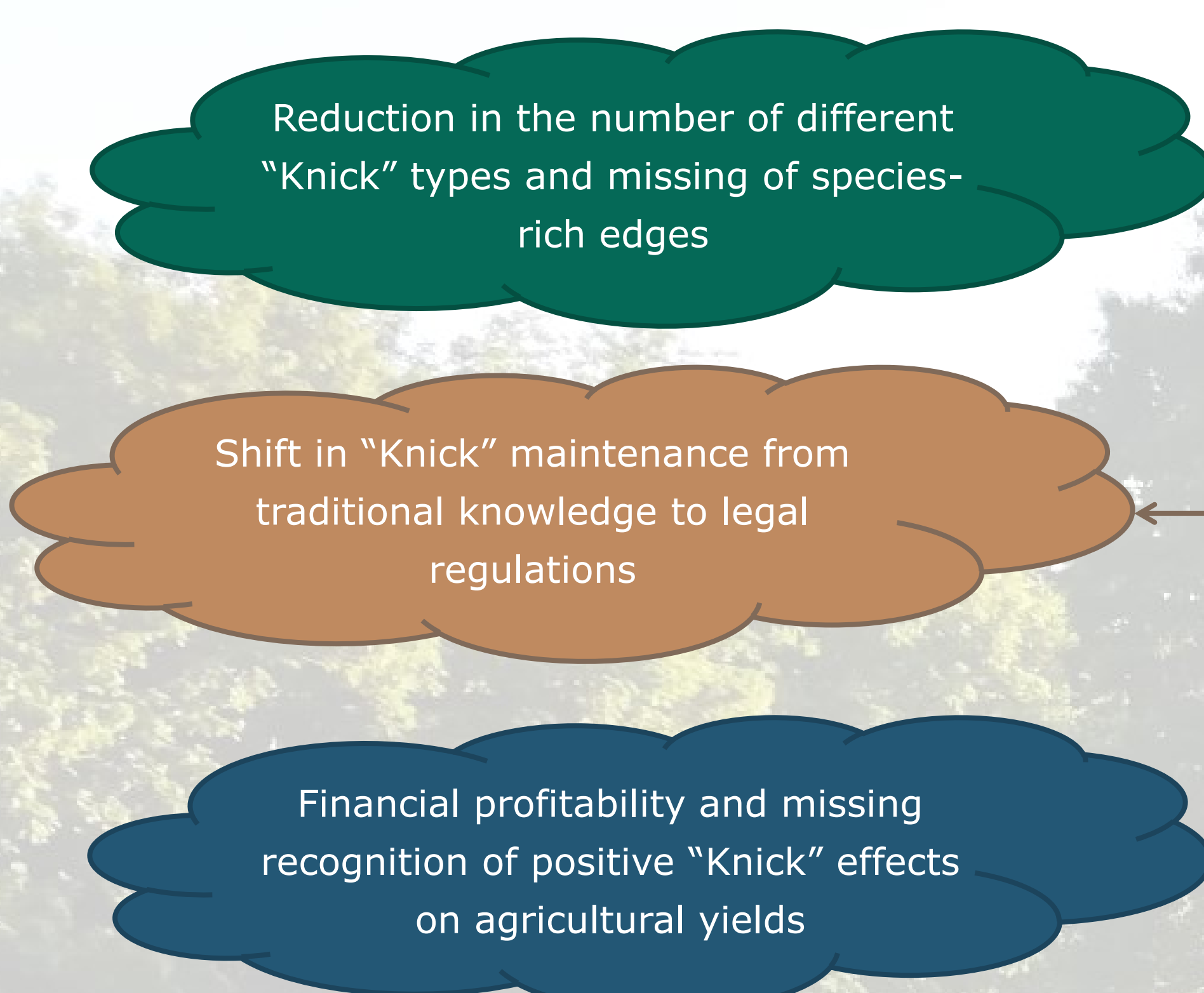


Fig. 2: The structure of a "Knick" with different zones. Color boxes represent functions of "Knick" assigned to the environmental (green), social (beige), and economic (blue) dimension, as well as a function with overall significance (grey) (changed after Kimmel 2015:27).

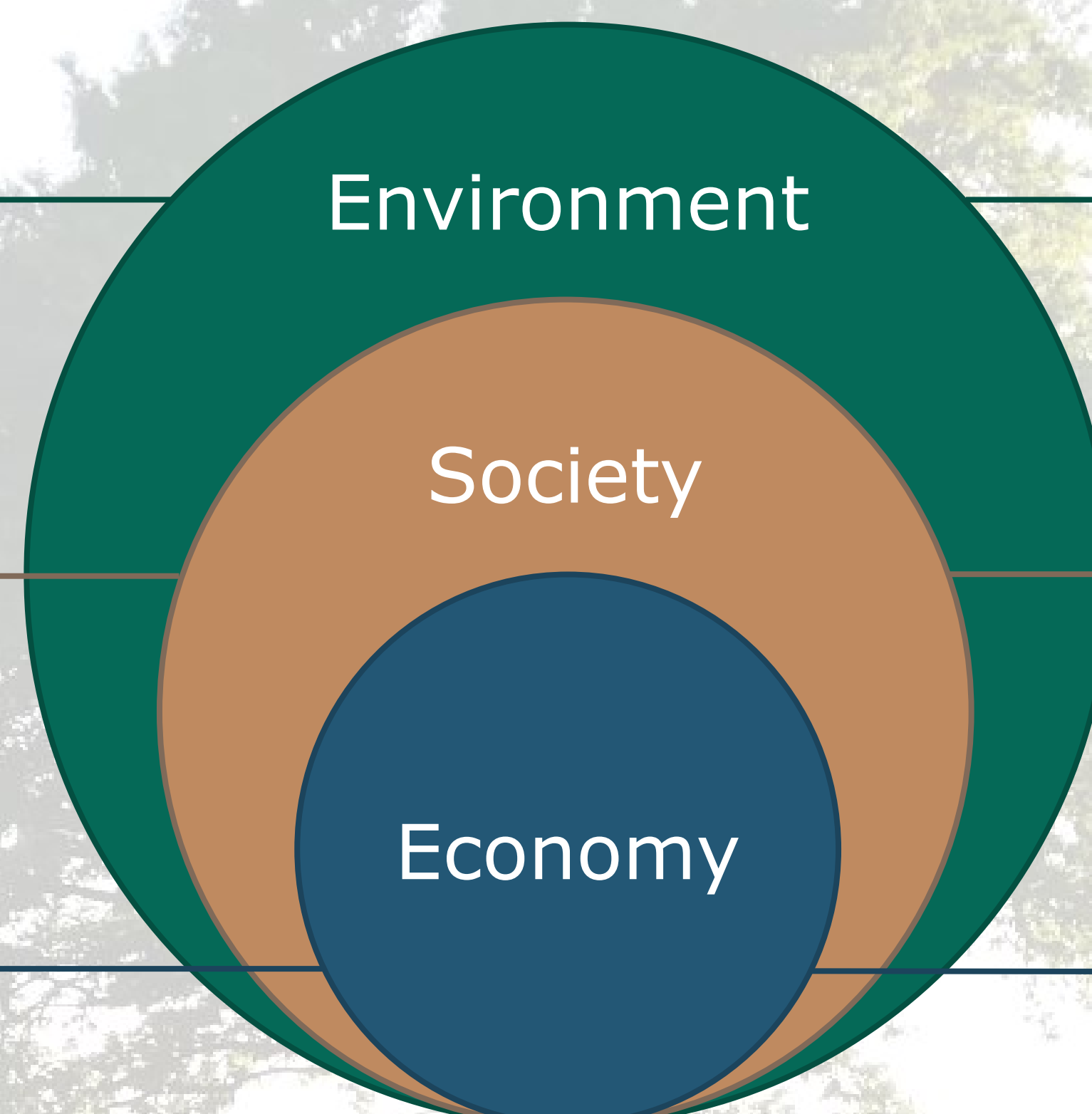
"Knick" are earth walls that were originally built up from excavation material of two trenches on both sides. Various woody and herbaceous plants overgrow the earth wall in different zones depending on the "Knick" position and exposition (Fig. 2). The top of the "Knick"

is covered by trees and shrubs while the "Knick" flank and foot offer habitats for herbaceous plants like lianas, brambles, grasses and ferns. A "Knick" resembles two forest edges moved together, which leads to a variety of functions (Fig. 2, color boxes).

Problems



Dimensions



Research questions

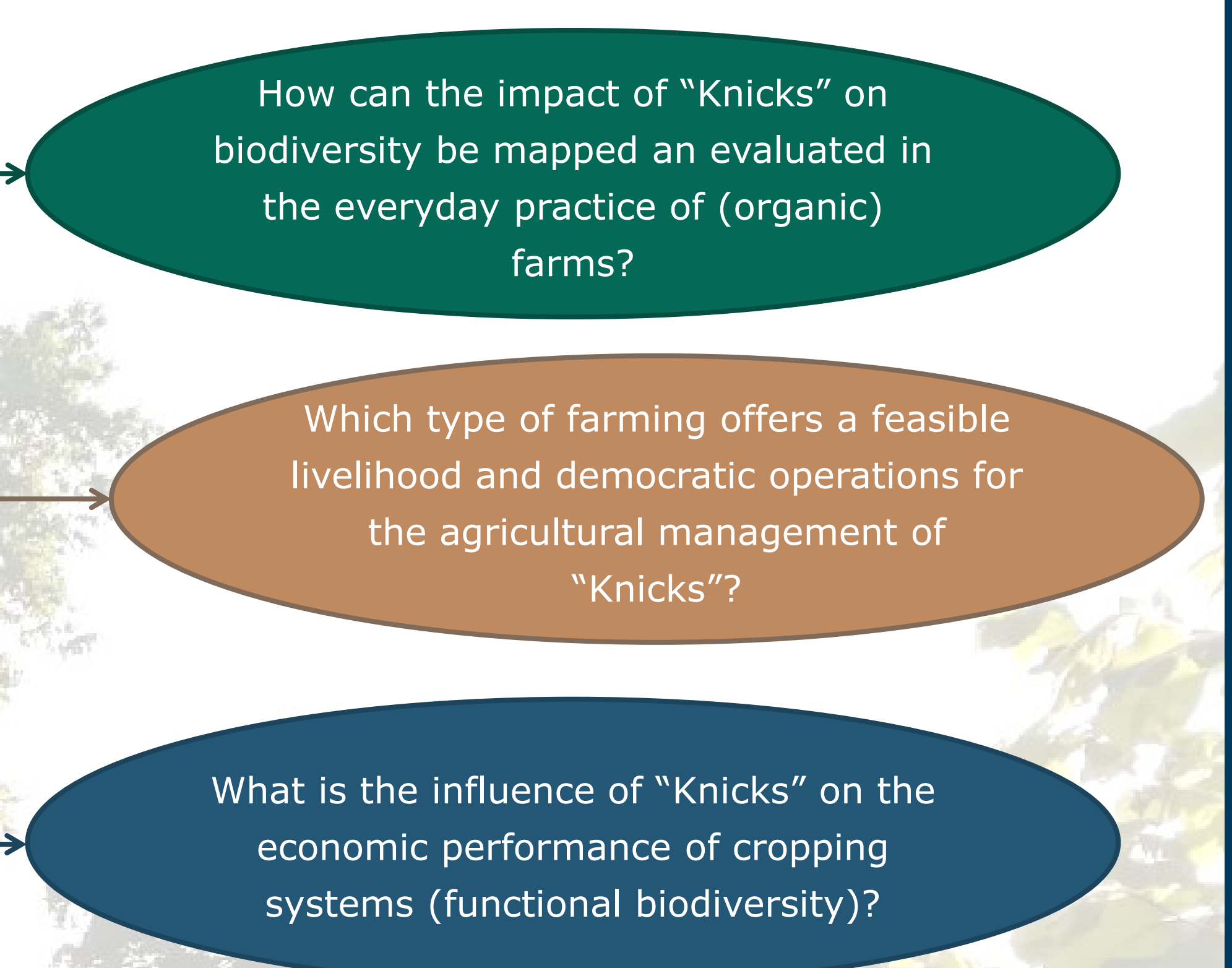


Fig. 3: The problems (left side), dimensions (center) and research questions (right side) for the sustainable development of "Knick" that are addressed by the inter- and transdisciplinary research project.

Project outlook

In Schleswig-Holstein "Knick" are well protected through legal regulations and declared as a cultural heritage site by the UNESCO. Nevertheless, there are a multitude of challenging problems (Fig. 3, left side) and this research project aims to contribute to the conservation, restoration, and implementation of "Knick" as biodiversity-enhancing agroforestry structures in Schleswig-Holstein. The BÖWL (2018) has listed research needs on the topic of biodiversity in agriculture from a practical perspective and thus provides orientation for the selected research questions (Fig. 3, right side).

The inter- and transdisciplinary research approach addresses a multidimensional focus on ecological, social, and economic aspects (Fig. 3, center). Within the ecological dimension, the mapping and evaluation of "Knick" biodiversity must be practical in order to serve the contractual nature conservation. Furthermore, it is necessary to assess the function of edges for the conservation of "Knick". Social aspects deal with differences between

farmers' traditional knowledge and legal regulations for the maintenance of "Knick", which potentially requires some form of communal management, e.g. agricultural cooperatives, that can provide a viable livelihood and democratic operation. For the recognition of benefits on agricultural yields through "Knick", effects of functional biodiversity on the economic performance need to be studied. Overall, the financial profitability of "Knick" must be balanced with environmental and social needs.

A network of stakeholders from science, nature conservation, agriculture, politics, local population, and education is the working basis for the project implementation. Their cooperation is essential for the consideration of different interests concerning the "Knick" and for the detection of conflicts and synergies. Due to regional differences in the density and structure of "Knick", the project will work with model regions aiming for a contribution to the sustainable development of "Knick" in Schleswig-Holstein.

References

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