SOME CHALLENGES IN THE ASSESSMENT OF ECOSYSTEM SERVICES PROVIDED BY AGROECOSYSTEMS AT DIFFERENT SCALES

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Ecosystem services (ESs) are goods and services provided by natural and semi-natural ecosystems that are beneficial to human society. Agroecosystems can also deliver several ESs ranging from provisioning (e.g. food, fodder), regulation and maintenance (e.g. pollination, natural pest control) to cultural (e.g. agritourism, landscape aesthetics) services. The assessment of ESs related to different ecosystems has been in the focus of research and policy for decades. Agroecosystems are also targeted but in their case ES assessments face quite a few challenges. Some of these challenges will be highlighted in the presentation using the results of recent doctoral research projects conducted at three scales: farm, village and landscape levels. The research projects were carried out in Hungary and, at the landscape level, partly in South Africa. Some regulation and maintenance services and - at the village and landscape levels - also some provisioning services were assessed using biophysical indicators combined with mapping at the village and landscape levels. At the farm and village levels extensive and intensive systems were compared. Here we list four of the challenges that were identified and give some examples from the studies. 1) The differentiation of ESs or between ESs and ecosystem state indicators might be problematic, especially in the case of some regulation and maintenance services. For example, soil carbon stock can be considered as an ecosystem state indicator but in some cases, as it was in our farm and landscape level studies, it can be also used for measuring global climate regulation ES related to soil. 2) The human influence on agroecosystems is substantial therefore, the contribution of nature in the provision of some ESs is quite difficult to quantify. Nevertheless, when we compare the ES provision of different farming systems we can see that less intensified farming systems give overall better results. In our studies permaculture and ecological farms performed better compared to conventional farms (e.g. regarding decomposition, global climate regulation, pollination and biological pest control) and ecovillages performed better compared to a non-ecovillage (e.g. regarding genetic resources, pollination and wind protection). 3) Data gathering and analysis are not straightforward and new methods might need to be developed for different scales. Our results show that soil sampling can refine calculations based on soil inventory data (e.g. regarding assessment of global climate regulation) at the landscape level. Indicators based on the qualitative characteristics of some provisioning services (e.g. number of local fruit varieties instead of the quantity of yearly harvested fruits) might be used when quantities are not measured and hard to estimate as it was in our village level study. 4) Aggregation of the results for more ESs might also require creative solutions. Based on field data and secondary data, a scoring system could be developed for the ES assessment at the village level that allowed comparison and aggregation of ESs as well. At the landscape level, maps of soil carbon stock, erosion control and crop production could be integrated assisting spatial planning. We can conclude that assessment of ESs related to agriculture is still in its development phase. Empirical studies at different scales can reveal some challenges but also show some solutions to overcome the obstacles. We

encourage further empirical studies and discussions among researchers about the methodologies and interpretations.