Towards a Indicator for High Nature Value Farmland Applicable for Ex-Ante Impact Assessment

- Maria-Luisa Paracchini and Wolfgang Britz –

The concept of HNV and available information for ex-ante assessment of policies

High Nature Value Farmland is a very challenging concept in the context of policy assessment. Land use of high value for nature must be scarce in the sense of either habitats provided by the farming system and/or farm crop and animal species found. It is clear that depending on the region or Member State, the notion of scarcity may be seen defined quite differently for a specific farming system. In Member States where low farming intensity is wide-spread, HNV may be attributed only to semi-natural farming practices whereas in highly populated Member States with in average highly intensive farming systems already medium intensive systems may be seen as scarce and therefore of a high value.

The indicator proposed so far build on quite different concepts. The first is based on actual observations of species, e.g. farm land birds. Such combination farming system and regions are declared HNV where scarce birds find their habitats and/or where a large number of species is present. The use of that indicator has the obvious advantage that it does not require complex cause-effect rules linking properties of farming systems to the presence or absence of specific species, and can point quite specifically to combination of landscape attributes (surrounding land cover, soil, climate, profile) and farming practices supporting scarce species.

However, as cause-effect rules are absent from such an indicator, impact of changes in farming practice cannot the measured from the indicator as such. Rather, it can be used to derive cause-effect results which then feed in the second group of indicators. Those try to link easily measurable attributes of farming systems as land use cover shares, bio-mass produced or input use intensity to the concept of “natural scarsity”. They have the clear advantage of being linked to available statistical information which is subject to forecasting and policy impact activities. There obvious disadvantage is that they are by far to general to allow direct assessment of impact on single species. In the following, we try to develop a HNV index along those lines, i.e. trying to exploit the available land use information from statistics. The index consists of two major pieces of information:

- An evaluation of how cropping shares affect bio-diversity and scarce habitats.
- An evaluation of on how management intensity interacts with the cropping shares.

The crop share evaluation for non-grassland

The crop share evaluation builds on the assumption that the richer the crop composition and the more equal the shares, the better for bio-diversity. It applies a modified Shannon index, which has the properties to give numbers between 0-1, and assign a value of 1 to crop rotations with more then 10 crops at less then 10%:

$$I_{crop\_rotation} = \min(1, \sum_{c \forall share_c \geq 0.1} share_c \log_{10}(share_c))$$

The crops available from the CAPRI land use map where grouped into 22 categories (see annex). When discussing that index, crop shares should not be confused with crop rotations. Some of the crops are stationary by definition, as e.g. olives, vineyards or orchards, and thus never part of crop rotations. Nevertheless they contribute to the index as they enrich crop geographic variance and lead to a more fragmented landscape.

The index is naturally sensitive to the size of the area under analysis. For small scale units, single farming system will dominant, and even under bio-logical arable farming, not too many crops may be found and the index value may be low. On the other hand, when the area is large, the local variance may be lost, and spots of a rich crop composition missed.

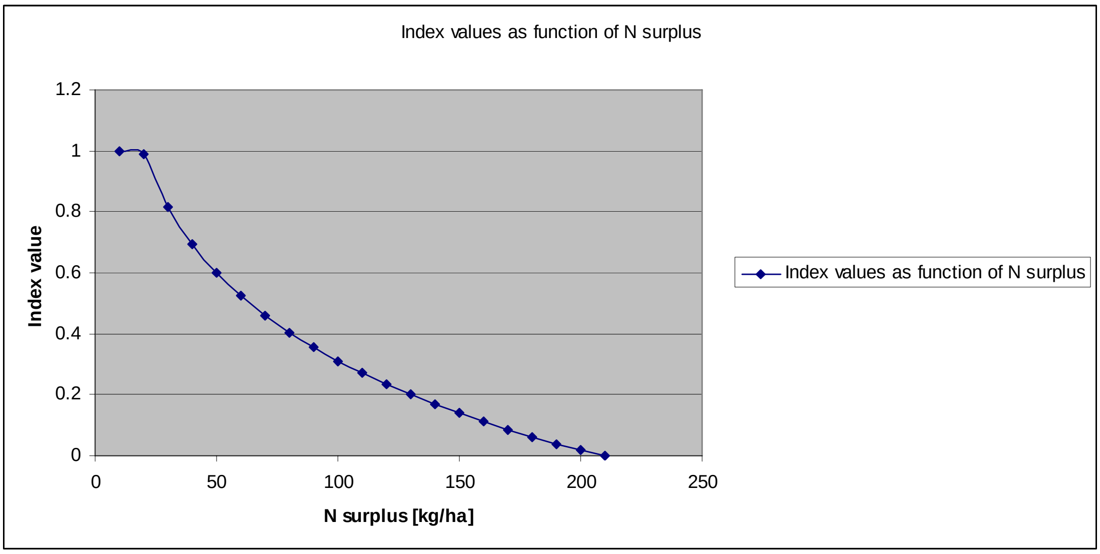
Taking into account management intensity on non-grassland

The potentially positive effect of a rich composition of crops in space is dampened if management practices generate cropping conditions only suitable for the crop grown in the current year by reducing water and nutrient stress and preventing growth of competing crops. By doing so, bio-diversity in the field is reduced.

There are several proposal how to measure management intensity (input costs per ha, yield differences to national averages, N-application rates), but we opted to use the nitrogen surplus as proposed in .. We started with an expert driven approach which would assign full benefits from a rich crop rotation – the index value explained above - under management practices generating a N surplus of 20 or less kilograms per ha. Such low surpluses are only feasible under very moderate fertilizing practices, with low yield expectations, and are typically coupled with low intensive farming system in general, especially regarding plant protection.

Under a surplus of 40 kg, we have chosen 2/3 as the multiplicator for the crop rotation effect, 1/6 at 150 kg and zero for 200 kg or above. Those classes where then smoothed with a function (2.25 – 0.97 $\log_{10}$(N surplus), and the result bounded to the 0-1 range. The graph below shows the resulting curve.

Management intensity index (0-1) derived from N-Surplus



The final index score for the non-grassland part of the crop rotation is the multiplication of the 0-1 index value for the richness and distribution of the crops times the 0-1 intensity index derived from the N-surplus.

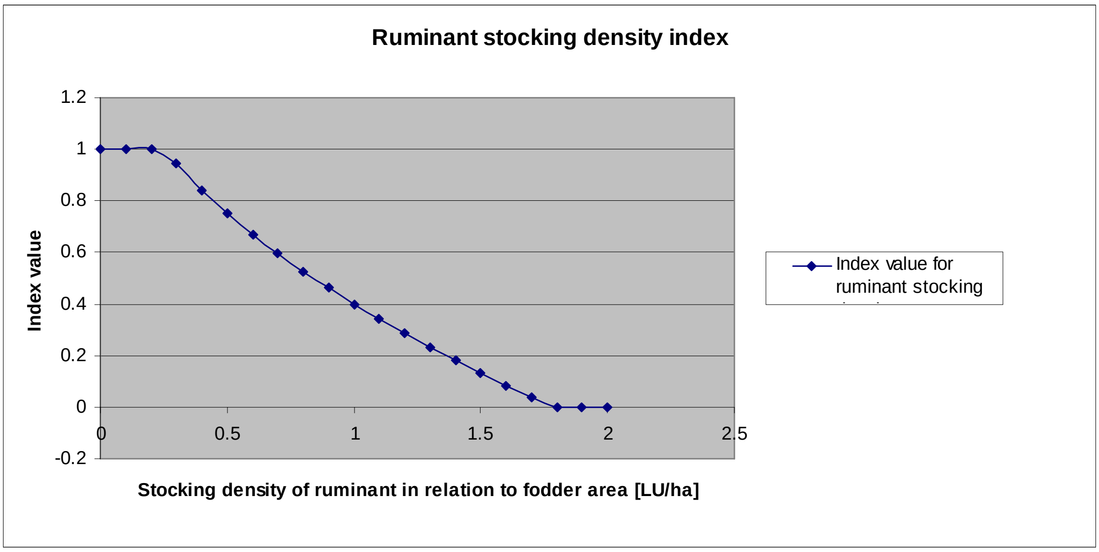
Grassland effect

General, all types of grassland where judged to be equally beneficial to a rich crop rotation regarding bio-diversity and scares habitats. However, as for non-grassland crops, that effect is heavenly influenced by management practice. Along with many publications (…), we have chosen stocking density as a proxy for management intensity. The density was calculated by converting the different types of cattle and sheep found in the CAPRI data to livestock units, and then relating the resulting livestock unit sum to the areas of fodder (all types of grassland, fodder maize, fodder root crops).

We opted to choose ruminant stocking densities of 0.3 as below to be fully beneficial (index value 1), assigned 0.5 to a stocking density of 0.5 and 0.1 to a stocking density of 1.5, and let it drop to zero for stocking densities of 2.0 or above.

Those classes were smoothed wit a function (1.6 – 1.2 * square root of the stocking density), whose result was bounded to the 0-1 range. Basically, any area with a stocking density above 1.7 would receive a zero score.

It would be more appropriate to change the index definition according the biomass grown per year under natural grassland vegetation at a specific spot, however, such an estimate is currently not available to us.



Combined index

The combined index adds up the crop rotation index times the intensity index, weighted with the share of non-grassland on the UAA plus the share of grassland times the stocking density index. It will take on a value of unity under a combination of a rich crop composition und very extensive management and extensively management grassland. It drops to zero under intensive management, or under not well balanced crop composition.

The index was constructed to allow measuring even of smaller changes which required applying continuous scales rather then classification.