IMPORTANCE OF AVIFAUNA IN HEDGES

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Abstract

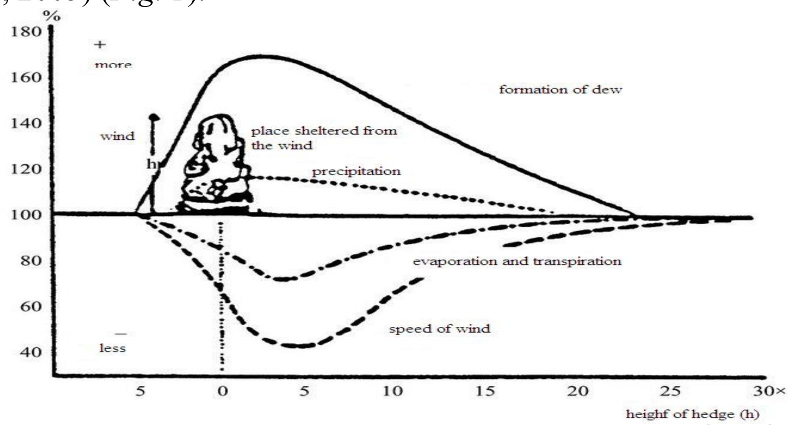
The hedges increase the diversity of arable lands which should lead out attention to creating and protecting these habitats. These structures provide shelter and food for different types of birds. Because of the agricultural advantages, an aim of creating a correlating biotope network should be set.

Taking the main aims in consideration, a natural system would form, out of forest belts and biotopes connected to them, which is capable of sustaining life of area-specific plant and animal species. By this it would increase the diversity of the area as well as enable us to maintain a close to nature, healthier agricultural farming.

Keywords: hedge, bird, diversity, sustainable agriculture.

ANTECEDENTS OF THE RESEARCH

As all-over Europe, the application of hedgerows in agriculturally cultivated territories has a great tradition in Hungary as well (GÁL – KÁLDY, 1977; BARNA, 1994; BARNA, 2003 b; DUTOIT et al., 2003). The maintenance of these structures in the arable lands is desirable for many reasons. Through the moderation of the wind, they help to create a favorable microclimate (DANSZKY, 1972; GÁL – KALDY, 1977; KROMP, 1998; BAUDRY et al., 2000; KUEMMEL, 2003; MARTON – CSIKÓS, 2004; SZÁSZ, 2005) (*Fig. 1*).



BROGGI, 1986 in ÁNGYÁN et al. 2003

Fig. 1: The impact of hedges on the microclimate of the environment

The smaller motion of air reduces evaporation and transpiration, but at the same time, trees bring a significant quantity of water from the deeper layers of the soil into the air (DANSZKY, 1972; GÁL – KÁLDY, 1977; BARNA, 1994; BAUDRY et al., 2000; FÜLÖP – SZILVÁCSKU, 2000). The distribution of precipitation also becomes more equilibrated and the formation of dew at dawn intensifies as well. Because of the higher humidity of the air and soil, the water-supply of the cultivated plants becomes better, which can increase the yield (GÁL – KÁLDY, 1977; RANDS, 1987; PFIFFNER - LUKA, 2000; BAUDRY et al., 2000; FÜLÖP – SZILVÁCSKU, 2000; LEE et al., 2001). The lower speed of wind helps satisfying biological necessities, e.g. stomas will not be closed so respiration and photosynthesis can be continuous and the chance of mechanical damage is also smaller (PETHŐ, 1993; KROMP, 1998; BARNA, 2004 a). Because of their buffering effect, rows of trees contribute to the forming of more equilibrated thermal conditions, which supports the functioning of plants (GÁL – KÁLDY, 1977; BARNA, 1994; MARTON – CSIKÓS, 2004).

Besides this biotopes with woody vegetation give place to countless animal populations. Many of these are useful for us because they feed on pests, by this cutting back on agricultural injury (RANDS, 1987; FARAGÓ, 1989; FARAGÓ, 1990; HERRMANN - PLAKOLM, 1991; BOZSIK, 1994; KERÉNYI, 1995; ALTIERI, 1999; BAUDRY et al., 2000; FÜLÖP – SZILVÁCSKU, 2000; PFIFFNER - LUKA, 2000; LEE et al., 2001; ÁNGYÁN et al., 2003; MAROSÁN – GÁL 2003; MARTON – CSIKÓS, 2004). If we give place for these very useful species, we can use less chemical pesticides. This has many obvious advantages: the comestibles become potentially less dangerous, if the amount of chemicals used is minimized. We can also reduce damage to the environment. Agricultural machinery would have to spend less time on the field, which could result in cost reduction as well as lightened soil compaction and dusting, less animals will be disturbed and noise levels will be reduced (THYLL, 1996).

In an ecological perspective, beyond agricultural interest, the existence of hedges are needed. The ecological diversity increases with this, animal and plant species can settle that would not in the agricultural ecosystem. This also helps the self sustainability of the area (HERRMANN – PLAKOLM, 1991; KROMP, 1998). As a green isle the forest would aid the migration and settlement of plants and animals therefore allowing the possibility for given populations to grow strong acting against the segregation of isolated species. This would make the area stable in the long run (BARNA, 1994;

ALTIERI, 1999; BAUDRY et al., 2000; FÜLÖP – SZILVÁCSKU, 2000; MARTON – CSIKÓS, 2004).

Other positive effects would be the amelioration of soil life, the increase of aesthetic and landscape values and the stabilization of climate. In an economical perspective it would supply timber, pasture for bees, small game, herbs and fruit (MÜLLER, 1991 in KÁTAI et al., 2002; ZSUPOSNÉ, 2002; BARNA, 2004 a; BARNA, 2004 b; MARTON – CSIKÓS, 2004).

In an optimal case a system could come to existence which is more natural and under no excess load (SÁRKÖZY et al., 1993; BÁLDI - KISBENEDEK, 1994; BARNA, 1994; FÜLÖP – SZILVÁCSKU, 2000; DUELLI – OBRIST, 2003; SAUBERER et al., 2004).

The actual status unfortunately does not show this. During the last decades many privately owned forests were cut out and not replaced (BARNA 2003 b, BARNA, 1994). During the industrialized agricultural farming the main aim was to create giant fields for crops, due to which forests were sacrificed (ÁNGYÁN-MENYHÉRT, 2004).

The question arises whether the advantages or the disadvantages of creating forest belts are stronger.

THE AIMS OF THE RESEARCH

During my research about characterizing forest belts, getting an insight to their ecology and their impact, I clarified the following aims:

1. Quest to find wheat fields bordered by hedges or line of trees.
2. Exploration of the forestry background of ligneous structures.
3. Ornithological exploration of the area. Looking for relationship with the botanical background.

METHODOLOGY OF THE RESEARCH

The ornithological monitoring of the hedges took place in three terms, approximately in two week intervals, early morning or late evening (*Fig. 2 and 3*). According to my experience these are the periods when these animals are most active. The time of monitoring was highly dependent on the weather, because in windy, foggy, chilly weather they can barely be seen. Occasionally we walked on either side of the given forest belt at a slow pace, with the speed of approximately 2 km/h. We identified and registered the birds taking wing from the neighboring trees. We identified them based on their flight or bodily characteristics. We put down their species and numbers. We ignored the ones flying high.

Tócó	TG I 2004	TG II 2004
2004. 05. 26.	2004. 06. 02.	2004. 06. 02
2004. 07. 01.	2004. 06. 26.	2004. 06. 26.
2004. 07. 09.	2004. 07. 12.	2004. 07. 12.

Fig. 2: Date and place of bird observing in 2004

TG I 2006	TG II 2006	TG II 2007
2006. 06. 15.	2006. 06. 15.	2007. 05. 17.
2006. 06. 27.	2006. 06. 27.	2007. 06. 07.
2006. 07. 20.	2006. 07. 20.	2007. 06. 20.
2006. 08. 03.	2006. 08. 03.	2007. 07. 10.
2006. 08. 25.	2006. 08. 25.	2007. 07. 26.
2006. 10. 03.	2006. 10. 03.	2007. 08. 15.
2006. 10. 31.	2006. 10. 31.	2007. 09. 20.

Fig. 3: Date and place of bird observing in 2006 and 2007

Short description of observed places:

1) Near Debrecen (Hungary), parallel the nr. 562 hedge to the East from that, between nr. 560 and nr. 564, without own code, included main species: *Gleditsia triacanthos, Robinia pseudo-acacia*. Notation: TG I 2004. Coordinate: 47^{o} 33' 27'' N, 21 ^{o} 34' 51'' E. Length: 600 meter, width: 11 meter, height: 8 meter.

2) Near Debrecen (Hungary), nr. 561/A, included main species: *Robinia pseudo-acacia*. Notation: TG II 2004. Coordinate: 47^{o} 33' 50'' N, 21 ^{o} 33' 55'' E. It has been cut in 2006. Length: 490 meter, width: 25 meter, height: 18 meter.

3) Near Debrecen (Hungary), next to brook Tócó, with main species: *Populus sp*., *Fraxinus angustifolia*, simple tree row. Notation: TÓCÓ. Coordinate: 47^{o} 37' 07'' N, 21 ^{o} 34' 07'' E. Length: 800 meter, height: 20 meter.

4.) The same than paragraph 2, nr. 561/A, with main species *Robinia pseudo-acacia*, notation in this season: TG I 2006. Coordinate: 47° 33’ 50’’ N, 21 ° 33’ 55’’ E. It has been cut in 2006.

5) Near Debrecen (Hungary), close to 561/A, nr. 562/A, 562/B, 562/C hedge with main species: *Robinia pseudo-acacia*, *Fraxinus excelsior*, *Acer platanoides, Quercus robur*. Notation: TG II 2006 and TG II 2007. Coordinate: 47° 33’ 35’’ N, 21 ° 33’ 55’’ E. Length: 1500 meter, width: 43 meter, height: 18 meter.

The evaluation of bird communities were done by biometrical methods frequently used in ecology, using general indexes and procedures:

- Shannon- Weaver diversity index (HUTCHESON, 1970 in TÓTHMÉRÉSZ, 1996; CHANG, 2002).
- Equitability (KREBS, 1998).

The data of the diversity index were compared with t-test (SVÁB, 1981). For the calculations of the distances of bird communities we used the Bray-Curtis function. Based on these we performed a hierarchal cluster analysis, which resulted in a division average (UPGMA). From the distance matrix a tree diagram aka. dendrogram was created (PODANI, 1997).

ORNITHOLOGICAL RESULTS

In 2004 throughout the 3 areas (which were winter wheat fields bordered by hedges or line of trees) we have observed 193 birds from 22 different species (*Fig. 4*). Most of the species were ordinary songbirds but in small numbers there were Falconiformes, Galliformes, Columbiformes and Cuculiformes. Out of the songbirds in two of the hedges we have met a large number of *Passer domesticus* and in the third one with *Parus major*. In the last one next to the tits we found more than 10% *Oriolus oriolus* and *Lanius collurio* and almost 10% of the *Carduelis chloris*. Obviously the season (the ripping period of crops, sunflower and different fruits) and the surrounding flora have an effect on the results.

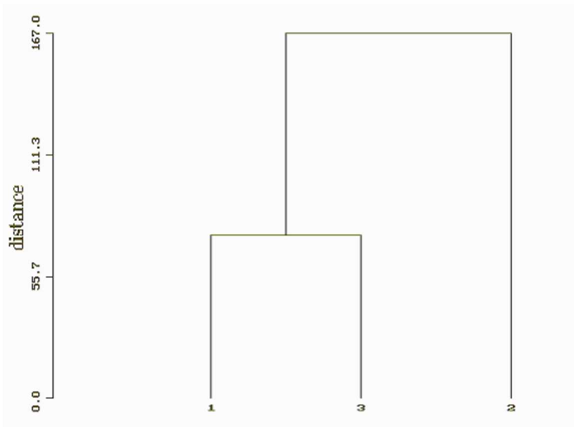
Observed areas	Number of individuals	Number of species	Sum. species	Sum. individuals	H	Equitability
TG I 2004	73	11	22	193	1,2705[a]	0,5459
TG II 2004	32	15			2,2169[b]	0,8970
TÓCÓ 2004	88	16			1,2731[a]	0,4742

(H = Shannon-Weaver diversity. Letters ‘a’ and ‘b’ show that there is significant difference on level P=5% between the areas.)

Fig. 4: Division of individual and species number of observed birds in 2004, and main structure parameters

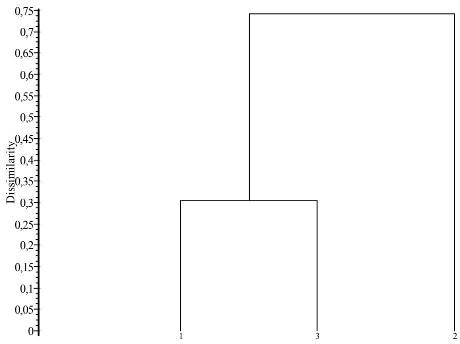
The ornithological parameters of the three areas showed some similarities and differences as well. Looking at the simplest indicators such as number of individuals and number of species, one area is differed from the others, which can be explained with its botanical characteristics. Based on cluster analysis the dendrogram of birds is similar to that of the flora. Although this is not sure because on the distance scale we can see its value is very small.

The figures of the wood and shrub population are similar without question (*Fig. 5 and 6*). Based on the data, we can state it is possible that there is a connection between the wood and shrub flora and the bird fauna of the areas.



Hierarchical cluster analysis, fusion: group average (UPGMA), distance function: Euclidian distance; 1:TG I 2004; 2:TG II 2004; 3:TÓCÓ 2004)

Fig. 5: Similarity of wood and shrub layer of studied areas



Hierarchical cluster analysis, fusion: group average (UPGMA) distance function: Bray-Curtis function; 1:TG I 2004; 2:TG II 2004; 3:TÓCÓ

Fig. 6: Similarities in the bird populations of the areas

During two following seasons (2006 and 2007) in the observed areas we have seen altogether 2079 birds of 52 species (*Fig. 7*). In the first year we observed two forest belts close to each other, next year we did the same with only one of these – the other one was cut. Mostly songbirds were dominant in these areas as well, but in smaller numbers we found Galliformes, Columbiformes and predator birds too. The most frequent ones were the *Passer montanus*, *Parus major* and the *Columba palumbus*. In one case the aggregation of the *Sturnus vulgaris* was noticeable. We almost only met with frequent species.

We have found notable differences in the ornithological structures (specimen number, number of species, diversity, similarity, equitability) of the areas, which was partly due to the different flora present (*Fig 7, 8, 9 and10*).

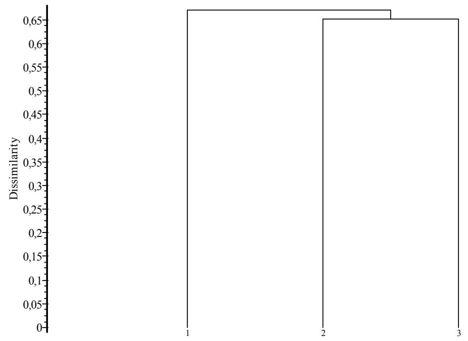
	TG I 2006							TG II 2006							TG II 2007						
	observing occasions in a year							observing occasions in a year							observing occasions in a year						
Nr. of individuals	35	119	42	18	11	47	24	23	26	4	10	388	99	22	150	185	162	162	155	151	246
Nr. of species	12	19	10	4	3	8	3	12	11	1	3	13	9	9	20	17	18	16	14	17	23
Sum. species	29							35							41						
Sum. individuals	296							572							1211						

Fig. 7: Species and individual number of observed areas in 2006 and 2007

Observing places	H	Equitability
TG I 2006	2.56611	0.7620
TG II 2006	2.1154	0.5950
TG II 2007	2.9619	0.7976

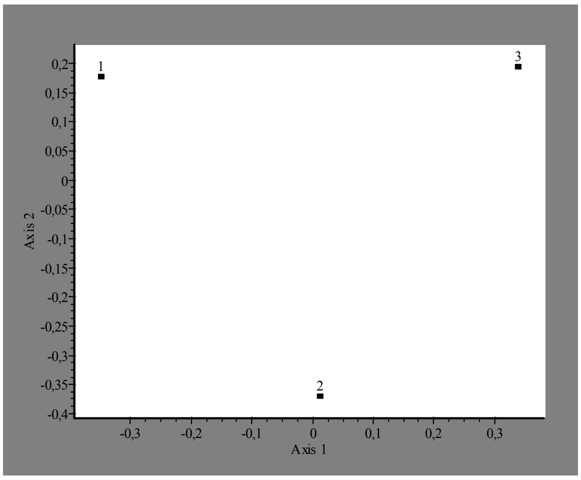
(H = Shannon-Weaver diversity)

Fig. 8: Main structure parameters of observed bird communities



Hierarchical cluster analysis, fusion: group average (UPGMA) distance function: Bray-Curtis function; 1:TG I 2006; 2:TG II 2006; 3:TG II 2007

Fig. 9: Similarities in the bird populations of the areas



Principal coordinates analysis, distance function: Bray-Curtis function; 1:TG I 2006; 2:TG II 2006; 3:TG II 2007

Fig. 10: Similarities in the bird populations of the areas

CONCLUSION, NEW SCIENTIFIC RESULTS

The results of ornithological observations showed that most of the birds present are ordinary songbirds. The diversity indices are closely correlated to the botanical characteristics, in the sense that botanical diversity is followed by that of the birds. Forest belts with larger areas, older trees and more vegetation provide a living habitat for more bird species and entities as well. We had a very interesting observation when the number of species increased by almost 20% and the number of birds more than doubled in a period of one year, when the neighboring hedge was cut down and part of the avifauna moved over.

From an ecological perspective these forest belts model the forest edges, where both sylvan and arable (meadow-like) species exist. As a whole it is more rich and diverse than only one of these habitats, because the characteristics are more diverse as well. They provide more possibilities, there is more niches to settle. The diversity of the area helps to create stability on the one hand. On the other hand beyond the agricultural advantage, it might be a member of a habitat network which permits the movement of more sensitive species (both plant and animal populations), the possibility of interconnection to the area (e.g.: species that can settle difficultly can grow in the area if the conditions are stable for a period of time; or omnivorous insects do not move when there is not enough insect prey if they have access to blossoming flowers).

These hedges have great relevance in the growing of cultivated plants. This is due to the creation of a more stable and balanced habitat because of the tree row, as well as decreased number of pests because of the carnivorous and omnivorous insects living there. The final result of this is the increase in the quantity of the grown crops and a more balanced agriculture.

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