METHODS OF BIRD SOCIOLOGICAL SURVEY, ON THE BASIS OF SOME TIHANY COMMUNITIES INVESTIGATED.

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With 9 Figures and 3 Tables in the text.
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The task of bird sociological research leads, in the last resort, in two directions. The one is sociological zoo-geography: We must describe bird populations of the biocoenosis living in the different regions of the world and the regularity in their existence, origin, extent; and changes which occur in these in place and time. The other general aim of investigations of this nature was formulated by PALMGREN (1930). He considers the production-biology of natural communities the most important synecological task. But the direction of production-biology in terrestrial synecology has not developed nor enlarged sufficiently in the past 15 years to advance investigations in bird ecology very much or to attempt to systematize the relations of bird populations in a metabolic system in some sort of biotic community.

Until now, however, while attaining one level with ecologists of other animal groups and being able to unite with them in common work, two fundamental tasks have remained to the ornithologist.

The one: population census work. We must express through statistical data the bird populations of the different community types, whether by individual count or with the aid of weight-quantities, more important from the standpoint of production-biology; and we must clear up the relation of these numbers to the changes due to ecological factors (PALMGREN, 1930, p. 79—80).

The other: On the basis of the necessary population surveys, we must describe the bird sociations existing in the communities of the larger districts investigated, and their characteristic qualitative and quantitative composition, together with data on their geographical extent.

Investigations of this nature have scarcely been undertaken in

Central Europe (SCHIERMANN, 1930. 34, 39. WÜST, 1931, STEINBACHER, 1942. SRÁMEK-HUSEK 1944.). The material I gathered during the war in the open woodlands of the Hungarian plain was unfortunately destroyed before publication.

In my present working territory, the Tihany Peninsula of Lake Balaton, ornithological research has been going on since 1938. In 1941 the Royal Hungarian Ornithological Institute established a permanent observation service on the peninsula which, in the later difficult years, limiting itself to the most important seasons, held out until the autumn of 1944 (KEVE, PÁTKAI, VERTSE, 1942, 1943, KEVE, PÁTKAI, UDVARDY, VERTSE, 1947,). PÁTKAI (1942) supplied useful assistance in many respects by his estimation of the 1941 breeding population which, without ecological or sociological evaluation, was published simply as raw census material.*

RELATIONSHIP OF THE ECOLOGICAL AND FAUNISTIC CONDITIONS DURING THE PERIOD INVESTIGATED.

The peninsula is one of the oldest parts of the Balaton district to submit to cultural influences. Since the middle of the 11th century it has constantly been inhabited and it can be assumed that cultivation of the fields, later of the vineyards, continued uninterruptedly on the peninsula's inner plains. In consequence of the economic methods employed the fields which submitted to grain and hoe-crops, the pastures and fallow ground were constantly interchanging, the orchards and vineyards increasing gradually in extent. On the uncultivatable slopes the forests also died out in consequence of pasturing. In the last half century forestry has been carried on upon these slopes and on the summits of the hills, so that the forests of today are, except for some smaller spots, relatively young and, because of the quality and lie of the land, as well as the climate, they reach no great heights.

Physiographically the peninsula consists of a basin cut in two and surrounded by wooded hills. In the smaller part is the "Inner Lake"; the "Outer Lake" is today replaced by a marsh-like meadow. The hill-tops are on an average 100 m higher than the surface of the water of Lake Balaton (the highest point is 232 m above sea level). The lakeside slopes are steep, with rifts and rocky walls and dense, bushy forests.

* In what follows the sociological terminology is after PALMGREN (1930), the avifaunistical after SALOMONSEN (1946). The "population" (sociation auct.) denotes the animal members of a systematic group of an association. Biochorion = habitat auct., biocoenosis = biotic community (biome S HELFORD'S), its unit is the association.

On the inner slopes the remains of dying forests, gardens and pastures mingle with cultivated areas. The cultivated units make an intricately detailed mosaic.

Of 12 sq. km. on the peninsula, except for the more or less adjacent grain fields, the greatest single unit is the Outer Lake meadow, about 70 ha, about 650x1000 m in greatest length and breadth, the greatest scrubby pasture is the Szarkád balk, about 65 ha, roughly 800x1100 m. The largest adjacent forest areas are about 20 and 14 ha, or 550x300 m and 800x350 m in extent. The largest orchard (lavender plantation with almond trees) about 26 ha, 800x300 m; the largest vineyard about 6 ha, 300x150 m; reedy pond 30 ha, about 800x600 m.

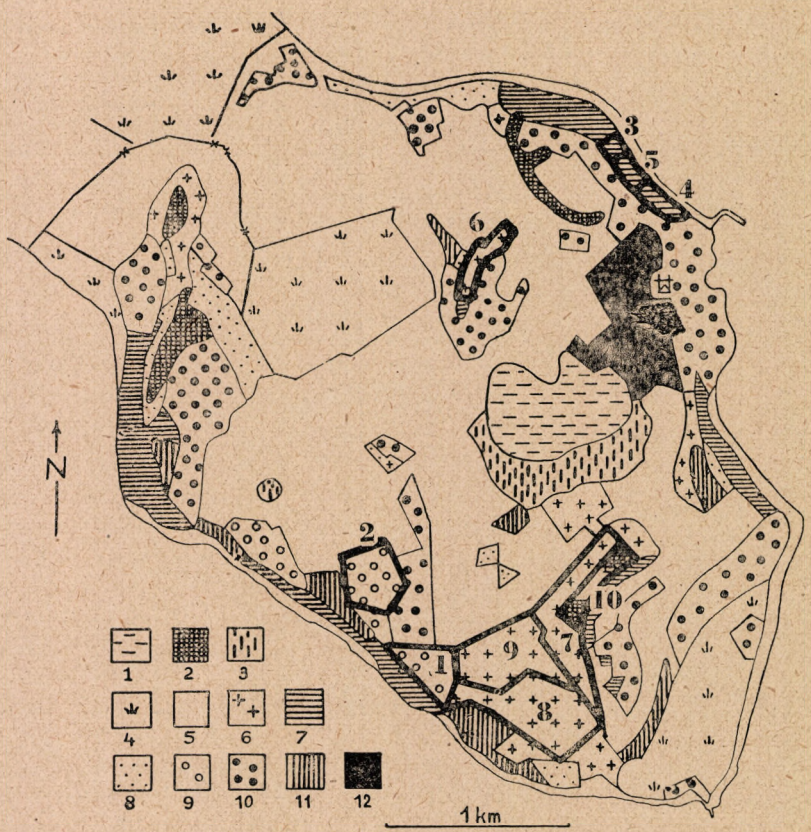


Figure 1. — Biochoria of the Tihany Peninsula from the standpoint of bird ecology, with the stations in the 1946 quantitative surveys. 1. Lake. 2. Grassy hilltops. 3. Pasture. 4. Meadow, marshy meadow. 5. Arable land. 6. Scrubby pasture. 7. Closed forest. 8. Shrubbery. 9. Open woodland. 10. Gardens, vineyards, orchards. 11. Cultivated forest. 12. Tihany village.

TABLE I.

Grouping of landscape elements of the Tihany Peninsula, from the standpoint of breeding bird populations.

Biochorion-types:		Plant association groups:	Characteristic association:
1	Reedy pond.	Phragmition	Scirpeto-Phragmitetum (Consoc. Typhetum)
2	Rocky- and loess cliffs, bare rocks, larger quarries.	Without macrovegetation	
3	Rocky tops covered with grassy vegetation.	Festucion sulcatae	Festucetum sulcatae (stipetosum) Festucetum pseudovinae
4	Pastures.	Lolion perennis Festucion sulcatae	Lolieta Festucetum pseudovinae
5	Meadows, marshes.	Agrostidion albae Magnocaricion elatae	Agrostideta
6	Arables.	Secalinion	
7	Ruderalia.	Lolion, Poligono-Chenopodion, Onopordion, Hordeion murini	
8	Scrubby pastures.	Complexes of Lolion-Festucion sulcatae-Prunion spinosae	
9	Gardens, vineyards, orchards.		
10	Shrubberies.	Orneto-Ostryon (and complexes with Festucion sulcatae	Querceto-cotinetum
11	Open woodlands.	Quercion pubescentis-sessiliflorae	Quercetum stepposum
12	Closed forests.	Fraxino-Carpinion	Acereto-Fraxineto-Ulmetum.
13	Cultivated forests, hedges, groves, groups of trees.		Robinieta, Pineta Pinetum cultum juv. etc.
14	Houses, buildings, and other structures.		

The areas heavily outlined on the map and numbered 1—10 are the stations of the quantitative survey (See Table III.)

I group the principal landscape types which serve as habitat to the biotic communities from the standpoint of the breeding birds under Table I. which follows. If they are covered with vegetation I mention the plant associations or their systematic category. The distribution of the biochorion types is to be seen on the map of the peninsula (Figure 1).*

Table II. shows the distribution of the breeding birds of the peninsula in the breeding season according to separate biochorion types. Those which did not breed during the year of my investigations are shown in parenthesis.

The faunistic picture of the area in the period of my investigations, in the breeding season of 1946, should be completed with those sorts which then resided there as regular summer visitors but which did not nest on the peninsula but in the neighbouring districts:

Coccothraustes coccothraustes L.
Apus a. apus L.
Falco p. peregrinus TUNST.
„ *ch. cherrug* GRAY.
Buteo b. buteo L.
Accipiter g. gentilis L.
Milvus m. migrans BODD.
Ardea c. cinerea L.
Anser anser L.

I must remark that the 5 sorts of birds of prey probably nest in the mountainous woods of the immediate neighbourhood in the Balaton uplands, the peninsula belonging to their normal feeding ground.

Also nesting in the closest vicinity but occurring on the peninsula only during migration or during their autumn and winter dispersion are:

Serinus canarius serinus L.
Lululla a. arborea L.
Certhia f. familiaris L.
„ *b. brachydactyla* BREHM.
Parus c. caeruleus L.
Phylloscopus c. collybita VIEILL.
Phylloscopus trochilus fitis BECHST.
„ *s. sibilatrix* BECHST.
Locustella fluviatilis WOLF.
Monticola saxatilis L.
Dryobates m. medius L.
Falco v. vespertinus L.

Breeding during the last 10 years but not observed to breed in 1946:

* On the basis of Professor SOÓ'S (1931, 32) works on the vegetation of the peninsula and of subsequent changes due to cultivation, personally conveyed by L. FELFÖLDY.

TABLE II.

The distribution of breeding birds according to biochorion-types.
( ) = In parenthesis those which did not breed in 1946. Nomenclature according to HARTERT (1903—22).

	1. Reedy pond.	2. Rocky and loess cliffs.	3. Grassy hilltops.	4. Pastures.	5. Marshy meadows.	6. Arable land.	7. Ruderalia.	8. Scrubby pastures.	9. Gardens, vineyards.	10. Shrubberies.	11. Open woodlands.	12. Closed forests.	13. Cultivated forests.	14. Houses, structures.
Corvus corone cornix L.											+	+	+	
Coloeus monedula turrium BREHM		+									+			
Pica p. pica L.												+	+	
Garrulus g. glandarius L.												+		
Sturnus v. vulgaris L.											+			
Oriolus o. oriolus L.									+	+	+	+	+	
Chloris c. chloris L.									+	+	+	+	+	
Carduelis c. carduelis L.									+			+	+	
Carduelis cannabina cannabina L.								+	+				+	
Fringilla c. coelebs L.									+	+	+	+	+	
Passer d. domesticus L.														+
Passer m. montanus L.									+		+		+	+
Emberiza c. calandra L.					+	+								
Emberiza c. citrinella L.								+		+	+	+		
Emberiza schoeniclus stresemanni STEINB.	+													
Galerida c. cristata L.							+							
Alauda a. arvensis L.			+	+	+	+								
Anthus c. campestris L.			+											
Anthus t. trivialis L.											+			
Motacilla f. flava L.					+									
Motacilla a. alba L.		+												+
Sitta europaea caesia WOLF.											+			
Parus m. maior L.									+	+	+	+	+	+
Parus palustris communis BALDENST.											+	+		
Aegithalos c. caudatus L. & Aegithalos caudatus europaeus HERM.									+			+	+	
Lanius minor GM.											+	+	+	

	1. Reedy pond.	2. Rocky and loess cliffs.	3. Grassy hilltops.	4. Pastures.	5. Marshy meadows.	6. Arable land.	7. Ruderalia.	8. Scrubby pastures.	9. Gardens, vineyards.	10. Shrubberies.	11. Open woodlands.	12. Closed forests.	13. Cultivated forests.	14. Houses, structures.
Lanius c. collurio L.								+		+	+	+	+	
Muscicapa s. striata PALL.									+		+	+		
Lusciniola m. melanopogon TEMM.	+													
Locustella l. luscinioides SAVI.	+													
Acrocephalus a. arundinaceus L.	+													
Acrocephalus s. scirpaceus HERM.	+													
Acrocephalus schoenobaenus L.	+													
Hippolais i. icterina VIEILL.									+			+		
Sylvia n. nisoria BECHST.								+		+			+	
Sylvia b. borin BODD.										+				
Sylvia a. atricapilla L.											+	+		
Sylvia c. communis LATH.								+	+	+		+	+	
Sylvia c. curruca L.								+	+	+		+	+	
Turdus ericetorum philomelos BREHM.												+		
Turdus m. merula L.											+	+		
Oenanthe o. oenanthe L.		+					+	+						
Saxicola r. rubetra L.					+			+						
Saxicola torquata rubicola L.								+		+				
(Phoenicurus p. phoenicurus L.)									+					
Phoenicurus ochruros gibraltariensis GM.									+					+
Luscinia m. megarhyncha BREHM								+		+	+	+		
Erithacus r. rubecula L.											+	+		
Troglodytes t. troglodytes L.												+		
Hirundo r. rustica L.														+
Delichon u. urbica L.														+
(Riparia r. riparia L.)		+												
Caprimulgus europaeus meridionalis HART.												+		
(Merops apiaster L.)		+												
Upupa e. epops L.		+						+	+	+	+	+		
Coracias g. garrulus L.											+			
(Alcedo atthis ispida L.)		+												
Picus v. viridis L.											+			

	1. Reedy pond.	2. Rocky and loess cliffs	3. Grassy hilltops.	4. Pastures.	5. Marshy meadows.	6. Arable land.	7. Ruderalia.	8. Scrubby pastures.	9. Gardens, vineyards.	10. Shrubberies.	11. Open woodlands.	12. Closed forests.	13. Cultivated forests.	14. Houses, structures.
Dryobates maior pinetorum BREHM.											+			
Jynx t. torquilla L.									+		+	+		
Cuculus c. canorus L.								+		+	+	+		
Otus s. scops L.												+		
Asio o. otus L.												+		
Athene n. noctua SCOP.											+	+		
Strix a. aluco L.												+		
Falco s. subbuteo L.											+			
Falco t. tinnunculus L.		+												
Circus ae. aeruginosus L.	+													
Accipiter n. nisus L.												+		
(Ciconia c. ciconia L.)														+
Ixobrychus m. minutus L.	+													
Anas platyrhyncha L.	+				+									
Anas querquerdula L.	+													
Anas strepera L.	+													
Nyroca f. ferina L.	+													
Podiceps c. cristatus L.	+													
Podiceps g. griseigena BODD.	+													
Podiceps n.nigricollis BREHM.	+													
Columba oe. oenas L.											+			
Columba p. palumbus L.												+		
Streptopelia t. turtur L.										+	+	+	+	
Vanellus vanellus L.					+									
Tringa t. totanus L.					+									
Capella g .gallinago L.					+									
(Larus r. ridibundus L.)	+													
Rallus a. aquaticus L.					+									
Porzana porzana L.					+									
Crex crex L.					+									
Gallinula c. chloropus L.	+													
Fulica a. atra L.	+													
Perdix p. perdix L.						+		+						
Coturnix c. coturnix L.					+	+								
Phasianus sp.										+			+	

Emberiza hortulana L.	1936*	*Alcedo atthis ispida* L.	1936*
Phoenicurus ph. phoenicurus L.	1941**	*Ciconia c. ciconia* L.	1942**
Merops apiaster L.	1943***		

On the other hand, towards 1941** there were new breeding species. Indicating the minimum number of pairs which, according to my estimation, bred on the peninsula:

Anthus trivialis	2	*Caprimulgus europaeus*	1
Sitta europaea	1—2	*Picus viridis*	8
Aegithalos caudatus	8	*Asio otus*	1
Muscicapa striata	1	*Columba oenas*	2
Sylvia borin	7	*Tringa totanus*	1
Turdus ericetorum	2	*Perdix perdix*	10—12
„ *merula*	30—40		

Those which towards 1941 increased in numbers (compared with PÁTKAI's data):

	1941	1946		1941	1946
Sturnus vulgaris	1	8—10	*Parus palustris comm.*	1	2—3
Galerida cristata	3	6—8	*Erithacus rubecula*	1	4
Anthus campestris	1	2			

In what follows I do not concern myself with the water and cultivated biochoria. Rifts on the tops and slopes of rocky and loess cliffs looking on the Balaton are so numerous that the *kestrel* uses them exclusively as nesting places, whereas in other hilly regions it uses the nests of the magpie and crows which it also finds there plentifully. *Jackdaws* nest here also in colonies of 30—40 pairs, scattering for food in all biochoria with the exception of closely settled human habitations. The pastures and arable fields are poor in kind and quantity, in consequence of being divided up in small areas.

In the more natural biochoria we can establish the following order on the basis of pedological and microclimatological relations, descending from optimum to pessimum: open woodland; closed forests; shrubberies; scrubby pastures; grassy, rocky hilltops. There are on the peninsula 2 smaller individuals in the way of open woodland; among the old oaks here (about 80 years old) are many sorts of birds which are hole-breeders. 41.5% of the species here found are hole-breeders, while in the closed forest only 20%, but the latter are also more euryoecic species, content with temporary quarters. The closed forest is extremely varied, with a mixed forest growth: *Fraxinus ornus, Acer campestre* and *platanoides, Ulmus glabra* and *scabra, Quercus sessilis* and

*HOMONNAY, 1938, l. c.

**PÁTKAI, 1942, l. c.

***KEVE-PÁTKAI-UDVARDY-VERTSE 1947, l. c.

lanuginosa, Carpinus betulus, Pirus piraster, Cornus mas. Among these are planted *Pinus silvestris* and *austriaca, Robinia, Ailanthus,* which are sometimes found in quite separate groves (13. biochoria). In the shrubberies are the *Quercus lanuginosa, Cotinus coggygria, Fraxinus ornus, Crataegus monogyna, Prunus spinosa, Cornus sanguinea,* etc. The last degree of destruction of the forests, in consequence of pasturing, is the scrubby, thorn-bushed pasture *(Crataegus monogyna, Prunus spinosa, Rosa sp.* etc.). On the driest, warmest, sunniest places, the hilltops generally, the shrubbery gives way to grass. These biochoria make small individual mosaics on the peninsula which often interchange with one another or overlap.

In regard to breeding birds these 5 biochoria can be established in similar order, with the difference that in respect to qualitative and quantitative distribution the closed timber forests stand out foremost. I have not yet sufficient data to present the quantitative relations; the qualitative distribution and the relation between the 5 biochoria can be seen in Figure 2. The change in order is explained in its quantitative aspect on the Figure by the physiognomic profile of the biochoria: the plant community of most strata and of the most varied life form structure is the closed forest. The order is changed by the relative distribution of the species, because of the numbers of stenoecic species of the closed forest, in respect to which it must be remarked, however, that the open forests, as has been stated, consist of few and small individuals. Therefore of the characteristic sorts* only the largest „K" values could be considered in my investigations.

On Figure 2. I have distinguished the hole-breeders because of their special ecological claims.

The physiognomic profile seen from the viewpoint of bird ecology explains again the relation between the 5 biochoria and the placing on the Figure of the bird species belonging thereto. The hole-breeders live in the 2 forest communities, proportionally to the development of the trunk strata in the forest.** (Groups L — 0). From this exclusive mass stand out the 2 most stenoecical species, the *Parus maior* and the *Upupa epops,* which go so far as to find nesting places in root holes and rifts in rocks. The other group of forest species extends together with the completely developed high tree-canopy, that is, with the real forest (Group A). Group B is found really everywhere where we find

* Characteristic sort = highest degree of fidelity (F.)

** Felföldy 1943.

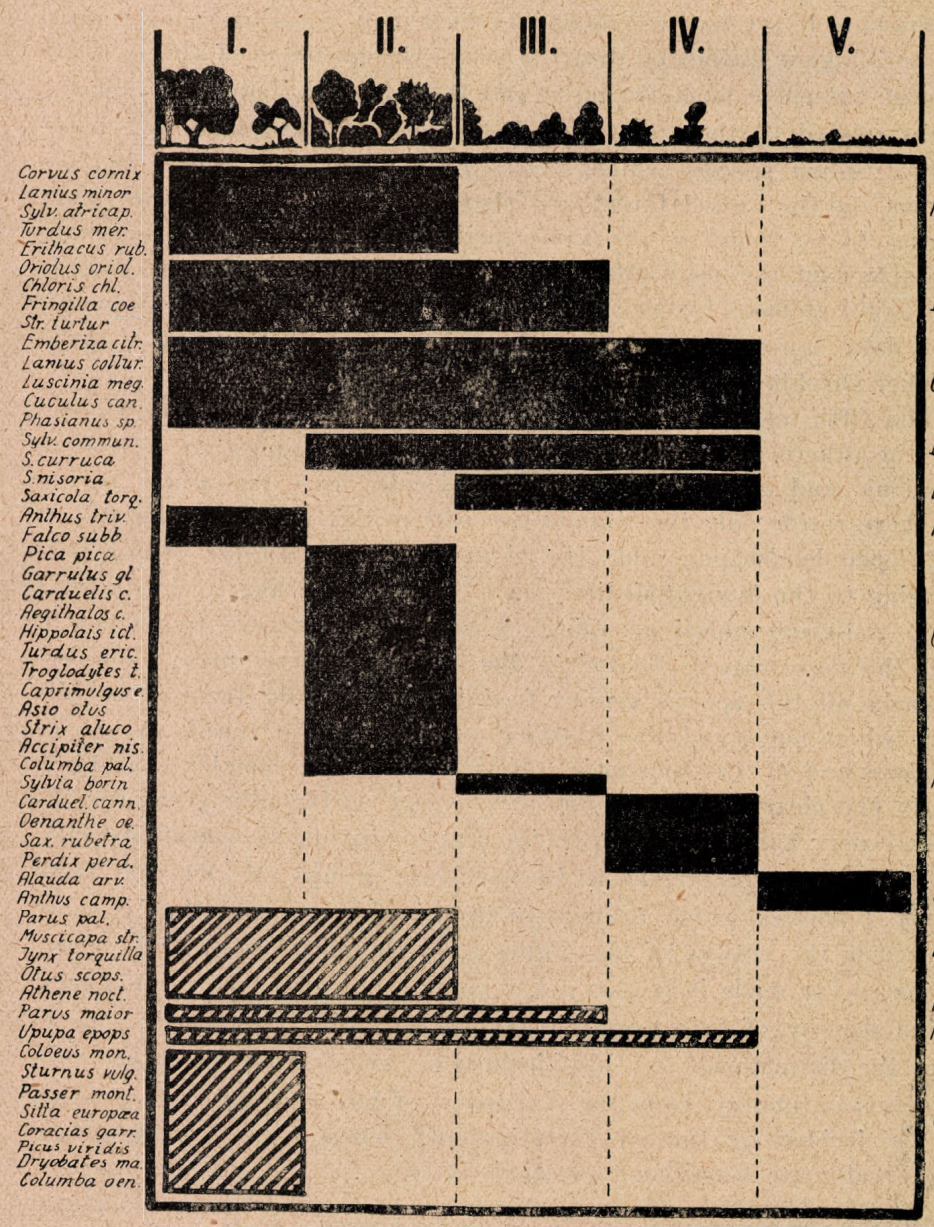


Figure 2. — The bird ecological relation in the biochoria resulting from the half-wild plant communities, based on the qualitative investigations of breeding fauna in 1946 (and partly combined with PÁTKAI's 1941 data). A—E = species groups which extended over several biochoria (euryoecic species). F—K = species groups which live in only 1 biochorion (stenoecic species). L—O = hole-breeders in similar groupings.

tree crowns. It settles also in shrubberies if it finds canopies formed by 2 or 3 higher bushes or dwarfed oaks. The members of Group C are the most extensive bush-dwellers (and their nest-parasite, the *cuckoo).* Closely related to them is Group D, formed of the commonest bush-dwelling *Sylvia* species which, however, do not live under closed canopies. In the closed forest are also the inhabitants of the forest margins, to be found in the same quality in the open woodland individuals beyond the peninsula. They are lacking only in the records which serve as basis for the present Figure. The not-indicated quantitative data, however, show that those belonging to Group C demand a thicker shrubbery, especially the *Luscinia megarhyncha.*

The fifth, merely grass-covered biochorion differs in every respect from the others on the Figure. Here too it is a question of nesting conditions, and on the mountains' ecologically least favourable barren tops there reside only the *Alauda arvensis,* which with us adapts itself to all open landscapes, and the steppe-dwelling *Anthus campestris* belonging to the Mongol-Mediterranean group, according to STEGMANN's (1938) zoo-geographical grouping. (Group K.) In regard to feeding it is all the more closely related to the other biochoria: many members of nearly all the species groups feed here, especially from those biochoria which one could also consider as complexes of forest, shrubbery and grassland (I, IV. Biochoria). However in these complexes no birds nest in the clearings; the perspective is not sufficiently great for the grassbreeders, and the thickets are too near to providie a sense of security.

It is worthy of remark in the stenoecic groups (F—K) that there is only 1 species which belongs to the shrubbery, and that is more attached to the crowns of the higher trees therein. According to observations so far made it is also not a regular breeding bird in this area. So the paucity of this group in comparison with the others puts in doubt the distinctness of this biochorion, respectively the *Querceto-Cotinetum* shrubbery, from the standpoint of bird ecology. This question will be decided by further investigations, when I can compare data from greater areas and longer periods of time.

Weather conditions. The weather in general in the Hungarian plains falls between the oceanic and the continental climate, the climate of the Balaton district being characterised also by dryness, with wide extremities in temperature (RÉTHLY, 1940). In the first half of 1946 there was warmer and drier weather than usual. Below I give the principal data, comparing the average and mean values over a period

of 10 years (from the data of the Meteorological Station of the Hungarian Biological Research Institute, contributed partly by BACSÓ, l. c.).

	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1931—40
Mean yearly temperature °C	10.3	10.7	10.0	12.4	11.0	11.5	11.6	11.4	11.5	8.9	10.9
Annual mm rainfall	606	410	590	539	462	762	795	434	600	832	603
			I.		II.	III.	IV.		V.	VI.	I—VI.
Monthly mean temperature °C	1931—40		—1.0		0.6	5.5	10.1		16.5	20.1	5.2
	1946		—2.8		3.4	6.9	14.1		18.8	21.5	6.2
Monthly rainfall mm	1931—40		31		39	38	32		77	59	276
	1946		20.3		40.6	31.3	1.9		72.4	69.6	236

As we see, April, 1946, was remarkably dry and was also relatively the warmest month.

THE SOCIOLOGICAL SURVEY.

Among previous bird census methods only those based on a square unit could considered, as my aim was to achieve absolute values. Because of its sociologic usefulness I used the quadrat method. In most cases I did not work in a regular, exactly measured square area, but in irregulary formed areas bounded by topographical features or by the limits of the biocoenosis itself, whose dimensions were easy to read off, or to reckon, from the land register or from the numerous large-scale maps at my disposal (maps at the scale of 1:5000, 1:20,000, 1:25,000, etc.).

I made quantitative investigations in 10 stations, in all on 28 occasions, the first on April 9th, 1946, gathering information, the others between April 26th and June 12th. The surveys were made from sunrise, or, according to Middle European time, from about 4 to 8—9 a. m. In May and June, because of the great heat, complete surveys cannot be made after 9 or 10 o'clock. No surveys were made during rainy or very windy weather. The greatest extent covered during one survey was about 17 ha in the scrubby pastures, about 9 ha in the open woodland, and about 2 ha in the closed forest.

I found that in our circumstances a larger area could not be controlled on one occasion. The net system observation hypothesis was modified by topographical conditions and in reality could be carried

out completely only in the open woodland. In the scrubby pastures where the bushes rose above eye-level I counted always only in one direction, towards the area already counted, in order not to inscribe the same bush twice in the midst of wandering among the thorn bushes. In dense undergrowth of the closed forest I guided myself by compass.

The open woodland (1st and 2nd stations) provided the easiest work; the oak trees standing apart from one another not making a really closed canopy and 12 to 15 m high could be seen through easily. The clearings among them were in general composed of low *Festucetum pseudovinae* turf with few and scattered bushes. On the other hand, the closed forest (3. 4. 5. stations) in places covered steep and gullied hillsides, with closed canopy stratum 15—20 m in height, under or between which were often the closed crowns of young trees 6—10 m in height. Here and there the undergrowth is scarcer and only 2—3 m high. In other places the blackberried elder especially makes a canopy closed together with the tops of the trees, under which the vegetation of the herbaceous stratum is often lacking, while on the contrary there is an entanglement of decayed leaves, rocks and dried shoots. In these places the counting is the most difficult. Here continuosus advance in a given direction is impossible. In all such small thickets it took 5--10 minutes until I could identify the 8—10 singing birds which all at once appeared in my sphere of observation, and could establish which were the examples which had accompanied me from neighbouring, already examined, areas by hearing their notes of alarm or song; these after a few minutes returned to their own territories. Thus especially on one occasion 5—6 males of the chaffinch *(Fringilla coelebs)* accompanied me. If I stood still and ceased moving the colour of my clothing merged with that of my surroundings, their feeling of danger diminished, and they immediately began to quarrel with one another, making their control still more difficult. It soon developed in the course of my experiences that here one cannot, as PALMGREN recommends, work with a previously prepared notebook in which one must merely make a stroke after the name of the species. This makes easier the working up of a still larger territory. Here we must choose a small area and therein also distinguish small, detailed parts. In so thick a wood we must repeat the survey more than three times rather than less. On the second or third occasion the topographical features are not so troubling and the orientation is easier. And if the data of the notebook are prepared in the order of what is seen and this is in the hand during the control it makes the later surveys less difficult. On the

other hand, the mapping of the nests or territories (VÄLIKANGAS, 1937) in such a dense bird population is a much greater undertaking. I call attention to the fact that in a similar physiognomic but level *Quercetum convallarietosum* (the forest of Ohat on the Hortobágy steppe, in the summer of 1943) the surveys involved just such difficulties.

The 6th station was a mountain slope bounded by a rocky ridge and, in one small part, cultivated spots and vineyards, with closed shrubberies and forests in the parts falling outside the area of my station. The station investigated stands physiognomically closer, partly to the scrubby pasture and partly to the closed shrubbery. It was not regularly used for grazing. The turf of the clearing consists of *Festucetum sulcatae stipetosum;* its bush groups are more united, most of them higher than 1.5 m, and the thorny species have a more subordinate role.

The 7th, 8th and 9th stations abut on one another. Cattle graze in these shrubberies in summer, in spring and autumn the swine. The surface is irregular with heights of 30—50 m which are full of limestone rocks 3—5 m high (cones of ancient geysers.) The tuff-rocks are here and there hollowed out and *Oenanthe oenanthe* and *Upupa epops* use them for nesting. On about a third of all three territories the bushes are lowered to about 1.20 m, that is, chewed away, with clearings which extend to 60—100 m in diameter. The other part has clearings at most 40 m in diameter with groups of bushes about 2 m in height, most of them *Crataegus monogyna* and *Rosa sp.* Arable fields bound a third of the scrubby pastures, forests a further half, while the rest is vineyards. Of the third of the 8th and 9th stations bounded by open woodland the shrubbery is almost entirely cleared, indeed remains of former forests are to be found there with groups of 2—3 oak trees, the highest reaching 8 m. These peculiarities and the effect of the neighbouring biochoria can be demonstrated in the qualitative composition too by the presence of the accessory and accidental elements. In the part bounded by the closed forest and the *Pinetum cultum Chloris, Fringilla,* and *Turdus merula* are numerous and in the neighbourhood of the open woodland the *Oriolus, Falco subbuteo* and *Pica* were often to be seen. The 10th station belongs to the same shrubbery but is surrounded by stone walls and thus is not used for pasture. In it is a long ridge with plantations of *Pinus austriaca* in places 1—1.20 m in height and poor in birds, with single *Ailanthus glandulosa* shoot-growths, remains of shrubbery not higher than 1 m and, in general, barren rubble or rock surfaces richly covered with grass. The two

grass-inhabiting sorts, the *Alauda* and the *Anthus* can breed in security here in the protection of the stone walls and for that reason do not breed in the similar neighbouring bare grassy tops of the 7th station.

For all stations except the 3—5th closed-forest stations I give 2 columns of figures. In Column A are the total original data, including all the individuals of all species seen during the surveys. In Column B only those individuals which in that time nested there. I shall return to this later.

From the known sources of error of the quantitative surveys (PALMGREN, 1930, I. VÄLIKANGAS, O. KALELA, J. SOVERI, l. c.) there are eliminated as far as possible those arising from measurements of the territory, the weather, the disposition and experience of the observer. I determined whether some doubtful individuals seen at the boundaries of a station belonged therein or not on the basis of whether the center, or at least the greater part, of their breeding territory lay within the station or not. In characterizing the wooded stations I have already spoken of the too great forest and bird density of which Eastern Europe is capable and which are sources of error obliging departures from habitual methods.

To the question whether in the breeding period we count the pair or the individual, I have two observations to make: The one, that on the 14th of May in the 7th station on an area of 2 ha I found 6 male *Lanius collurio* among which were 3 which behaved as if they belonged there. On the 28th of May in the same place I found 2 nesting pairs. In the first half of May the migratory-passage of the *Lanius collurio* was still going on over the whole peninsula, thus certainly 3 passage visitor males belonged to the quantitative survey made on the 14th of May, indeed, as I counted in pairs, 3 pairs. The other case, to which I shall refer again, was that in the same place, also on the 14th of May, there was present a flock of about 150—160 *Coloeus* which were not to be seen afterwards. These too are given in pairs wherever indicated.

To control the suitability of the quadrate method I made an oft-repeated count in 3 stations of the closed forest. In spite of the fact that these repeated surveys lasted over a long period, during which qualitative and quantitative changes could certainly have taken place in that area I carried out this control in respect to such numbers of pairs, that is, the suitability of counting a given abundance of birds thus.

The evaluation was carried out entirely after PALMGREN's statistical method (1930, p. 84—91). I reckoned the increase in abundance-values occasioned by the repeated counting from the register of each station; that is, by what percent the total is increased due to divergences between I and the total and II and the total*; by what percent the abundance increases in the I + II + III total in comparison with the I + II, I + III, II + III; and so on. Combining all the possible cases I got the relation between the results of the single cases counted (I + II, II + III, III + IV, and so on) as a percentage of the smaller values. These percentages I ranged in 5% divisions. I reckoned their median. (In the 3 stations from the results of 17 surveys I got between the 1 and II counts 84% values, between the II and III 177, between the II and IV 204, IV and V 135, V and VI 48. Between the VI and VII I got only 6 values, therefore I did not concern myself further with this one.) Expressing these media on a logarithmic scale I got the following value-range:

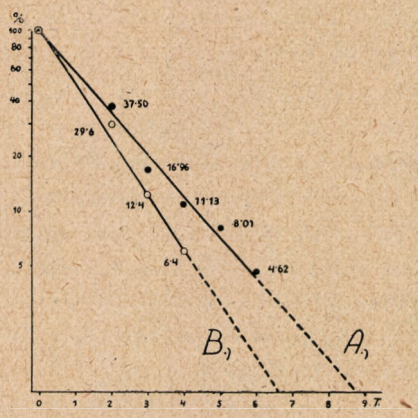


Figure 3. — The percentual increase of bird density count made by repeated surveys. Abscissa (T) = number of surveys made. Ordinate (%) = the graphing of the percentual increase of bird density counts made in comparison with the results of previous surveys, drawn with the median of the cases on simple logarithmic scale. Line A = the values obtained from the surveys of the closed forests of Tihany (Stations 3, 4, 5). Line B = the graphing of the values counted from PALMGREN's control material (1931, l. c. p. 84—91) which he got from surveys made in the forests of Åland.

* As the result obtained is a minimal number, the sum of 2 or more countings, it was so made that in all species the greatest number found was calculated PALMGREN, 1930, p. 84).

In comparing my results with PALMGREN's, the discrepancy is not so great as to prohibit the use of his method. I abstained from further use of this reckoning and the use of a correction. In the case of the present research this attitude towards the correction is specially justified (VÄLIKANGAS, 1937, p. 49 SOVERI, 1940 p. 13—14) insofar as it gives an incorrect picture of the qualitative distribution and among other things it changes the values of the individual dominance which I had also reckoned. It appears from my surveys that the qualitative composition from station to station is diverse enough within the same community; but my records were insufficient to express with sociologically relative figures the small value of the homogeneity.

Reckoning briefly the results of the percentual differences between the I and I + II estimated result got from the 3 surveys of the scrubby pasture, the average of the 6 values is 22.25%. In the same case the median according to PALMGREN is 29.5%, in my results in closed forest 37.5%. This reckoning confirms my experience that the scrubby pasture is easy to see through and in the period of the survey the species living therein lived a life predominatingly bound to their territory, loud and active; that is, easy to count.

In my researches difficulties arose not hitherto encountered in the literature, in that the ornithological aspects merged into one another during the periods of my surveys. From the standpoint of quantitative records therefore the most important is the population census made in the principal growth period (that is to say, the breeding period) because a.) technically it is the easiest to count at such times the pairs which are bound to their nests, i. e., to their territory; b.) we can establish from our knowledge of the breeding-bird population, with the help of brood-biological data, the probable number of the estival population which is more difficult to count. Moreover, in our zoogeographical units, except the steppes, the most characteristic biocoenetically is the avifaunistical category "nidiates" after SALAMONSEN (1946, p. 42.). To explain the difficulties mentioned I show below the ornithophaenological spectra of the closed forest community of Tihany (the area of stations 3.—5.) and the scrubby pasture (area of stations 7.—9.) in the period of my surveys in their vernal and pre-estival aspects (Figures 4 and 5).

53% of the nidiates of the closed forest are residents and begin their nesting in March, at least in its second half; or at least choose and occupy their territory. At this time a good many of the winter visitors are still here too. The greater part of the summer residents

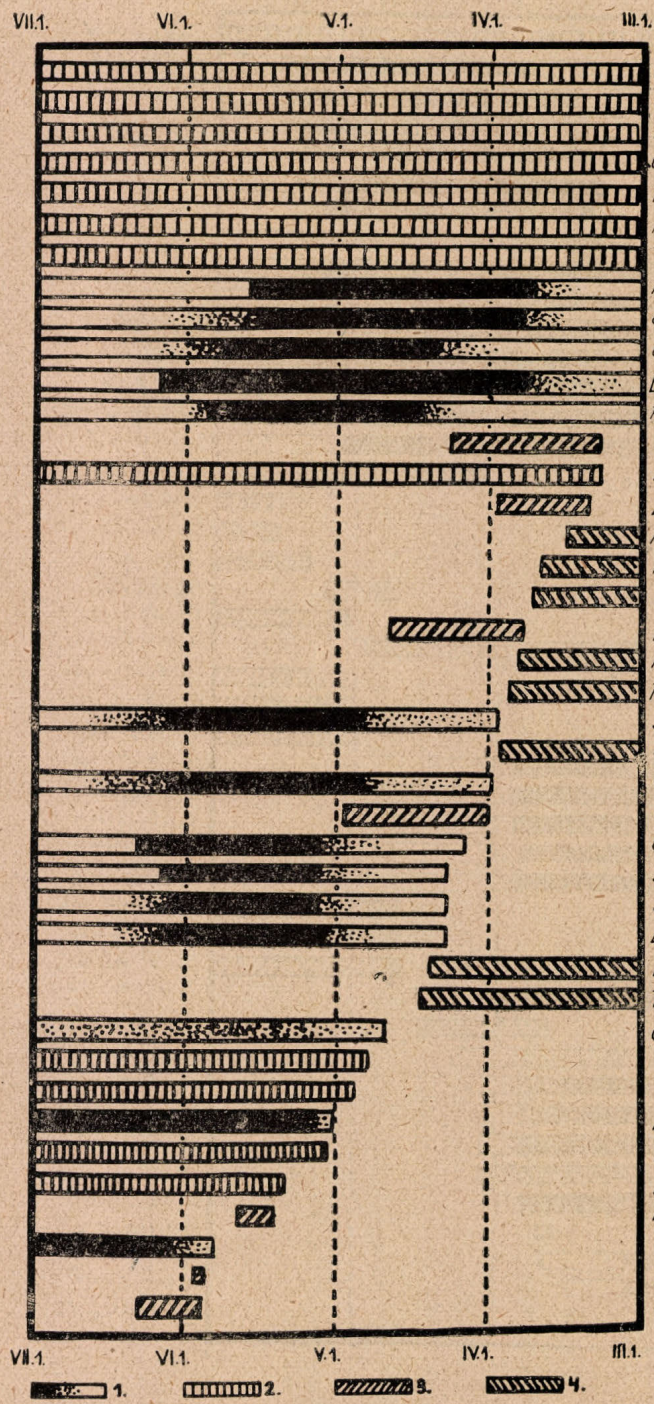
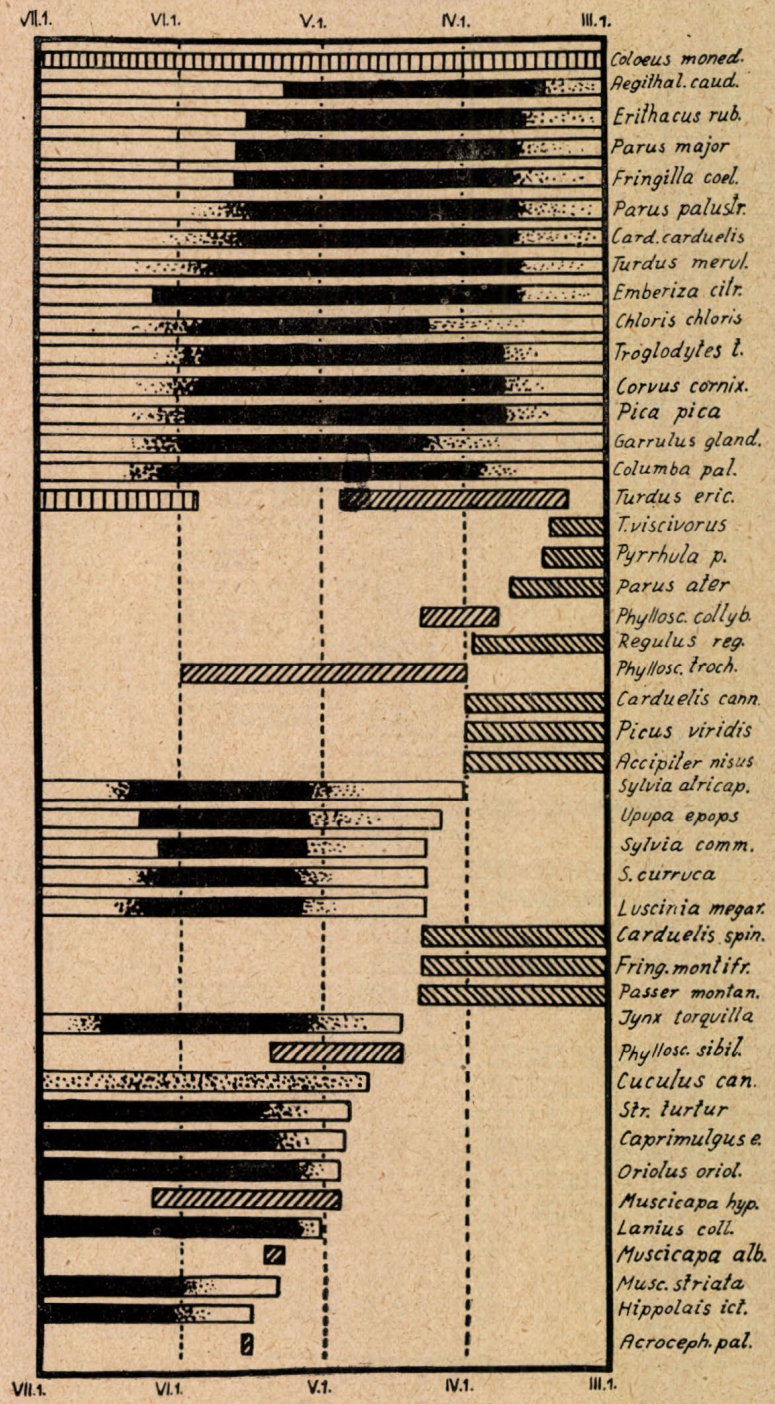


Figure 4. — The bird phaenological spectrum of the *Aceretо-Fraxineto-Ulmetum* (closed forest) of Mt. Óvár in Tihany between March and June, 1946. For explanation of symbols see Figure 5. p. 79.


VII.1.
VI.1.
V.1.
IV.1.
III.1.
Coloeus moned.
Aegithal. caud.
Erithacus rub.
Parus major
Fringilla coel.
Parus palustr.
Card. carduelis
Turdus merul.
Emberiza citr.
Chloris chloris
Troglodytes t.
Corvus cornix.
Pica pica
Garrulus gland.
Columba pal.
Turdus eric.
T. viscivorus
Pyrrhula p.
Parus ater
Phyllosc. collyb.
Regulus reg.
Phyllosc. troch.
Carduelis cann.
Picus viridis
Accipiter nisus
Sylvia atricap.
Upupa epops
Sylvia comm.
S. curruca
Luscinia megar.
Carduelis spin.
Fring. montifr.
Passer montan.
Jynx torquilla
Phyllosc. sibil.
Cuculus can.
Str. turtur
Caprimulgus e.
Oriolus oriol.
Muscicapa hyp.
Lanius coll.
Muscicapa alb.
Musc. striata
Hippolais ict.
Acroceph. pal.
VII.1.
VI.1.
V.1.
IV.1.
III.1.

(Fig. 5.)

arrive during April. Those arriving early in the month are already bound to their nesting territory by the latter half of the month. Passage visitors are relatively few; on the other hand most of those which pass over stop for a lengthy time in the community. As the forests come into leaf the last winter visitors disappear. In the first half of May the late-comers arrive and by the end of the month all have taken up their breeding territories. But looking at the beginning of the spectrum we see that the earliest breeders have already got their young out of the nests, which from the standpoint of quantitative records brings their localized habits to an end. If we had made quantitative records in March it would have been interesting only in respect to abundance of residents. The animal and plant life which begins after the snow melts has, according to my observations, no influence on the abundance of birds, because, as I saw, one can see neither new species nor an increase of the old ones to any great extent. Indeed, the diminution of the winter visitors must result in a reduction of the bird population. The optimal time of quantitative recording of the hibernating residents is April. But at that time the quantitative picture of the whole bird population changes from day to day as the migrators arrive one after the other; indeed from among the migrants there remain for a time with us groups or examples which do not breed in the area. (See the flocks of *turtle doves* flying through the scrubby pastures observed until the end of May and the already mentioned passager *red-backed shrike* males.) The first 3 records of the 4th station show that the bird population observed increased almost by 100% from the beginning of April to the beginning of May, and by 288% of the total result of the 3 surveys (calculated by the method described in the footnote on

Figure 5. — The bird phaenological spectrum of the *Pruneto-Crataegetum+Festucetum pseudovinae* (scrubby pasture) of the Szarkád balk. March-June, 1946. 1. Breeding species. The period when they are most closely attached to the territory (occupation, laying of eggs, hatching, care of young birds) is drawn in black; the time of slacker localization is shaded. A sharp limit is shown as end of the localized period in those cases when I knew the day the young left the nest. Among the early breeding sorts the first half of the second breeding cycle falls into this period (March-May), but this is not shown on the Figure because at that time the quantitative values are confused by the young birds flying about, thus as far as these species are concerned the principal spring quantitative investigation period is ended. 2. The species which normally live and feed on this area at this time but which do not breed there. 3. Passage visitors. 4. Winter visitors. Each species is graphed in a column of equal width whose beginning and end show the extent of its stay in the area.

page 77.); whereas the number of species by 88.9%. With the quantitative records for May we can reckon more exactly the population of the earlier arriving summer residents in the beginning of the month and the later arrivals at the end of the month. The *owls* do not occur in the spectrum, no more do they have a place in the quantitative surveys, partly because of their rarity in the territory and partly because they conceal themselves by day. I saw the *Asio otus* and the *Strix aluco* only in March and the *Athene noctua* and the *Otus scops* only in July.

The foregoing supports the evidence of the phaenological spectrum of the scrubby pasture. Here are few hibernating residents. That group, however, has a great role which in the closed forest is represented only by the *jackdaw;* the species not breeding in the community but feeding there, residents as well migrants. Otherwise in this spectrum there is not so remarkable a contrast between the breeding period of the residents and that of the migrants.

I find this mode of representation suitable for expressing total yearly qualitative and, combined with the individual dominance values, the quantitative changes of the bird population of a community; and therefrom the characteristics of the aspects of the bird population can be read.

Returning to the interplay of the limits of the vernal-preestival aspects on the basis of the spectra, I emphasize the fact that — referring to the other, not represented communities too — *that epoch when the localized period of most bird species coincided and was the most easily counted, lasted in our surroundings at the most for a week or 10 days. This caused a great difficulty in recording the population by the methods hitherto employed,* from which we must also gain sociological zoogeographical results besides the quantitative numerical data which are our production-biological aim. This difficulty — judged from the literature (PALMGREN, VÄLIKANGAS, SOVERI, KALELA, etc.) — does not arise in the research of the biotic communities of Northern Europe.

Another difference from northern conditions is the presence of non-breeding species, as can be seen from the scrubby pasture spectrum. These without doubt have another sociological role than that of nesting and feeding there. On the other hand, in those communities where they nest, they have also not the same value as the species

bound to the same communities in all phases of their lives. *So in a sociological characterizing of the bird population of a biotic community we must indicate with different marks whether the species is breeding or feeding, or both, locally — that is, in a separate, observed community — or in the entire biotic community surveyed,* and which phase of life, in which biocoenosis, has the greater significance in the life of the entire community.

Further investigations are necessary to clear up this sociological characteristicness. But until then I shall not use the term fidelity (exclusiveness of a species in an area of a community) nor the term character-species, because the species mentioned can nowhere be classified in the exclusive plant sociological ranks adapted by PALMGREN. Seeing that the presence of these species also influences the individual dominance values in the Table showing the quantitative surveys, I have expressed in the records where such species occurred, besides the column of the original abundance values (A) in a separate column (B) the quantitative data determined from the species nesting in the area; and thus in Columns A and B are expressed the dominance values pertaining thereto.

Similarly unexplained in the communities examined is the role of the larger birds of prey. According to my observations, in the 2 forest communities in the nesting season this role was very insignificant. The *Falco tinnunculus* which nests in the stone walls of the forest as well as the *Falco subbuteo* feed in the open biochoria. One pair of *Accipiter nisus* nested on the peninsula in a forest of the *Acereto-Fraxineto-Ulmetum* type, but the feeding territory of this pair was not included within my stations. Neither did the *Accipiter gentilis,* which bred not far from the peninsula, feed in these forests. On the other hand, I observed in all the other biochoria regularly, if not from day to day, the *Buteo, Accipiter gentilis, Milvus migrans,* breeding in the woods 3—4 km distant and sometimes also the *Falco peregrinus* and *Falco cherrug.* Therefore all biochoria of the peninsula which are not closed forest belong to their regular feeding territory and thus they belong to them in sociological characterizing; but their role cannot be expressed with the sociological data thus far employed. In these species with us the use of the belt transect survey method („Linientaxierung" PALMGREN's) is the right one. It is more exact for searching out the biochoria which provide a possibility for breeding and for the counting there of every single nest. The investigaton of the role of the birds of prey led me to the reflection that *the constancy term of plant*

sociology is also not to be used regardlessly in bird ecology. Because, for example, during the qualitative observations the *Buteo buteo* occurred almost without exception on the scrubby pastures, that is, it was present on all of them every day. But it fell within the quantitative surveys only once, on the 5th of June, 1946, in the area of station 9. If then I want to express its constancy on the basis of the records, this value would be very small, differing from its, in reality, truly great constancy. However these birds which live in a territory with a greater radius of activity can have quite as great a constancy as the small singing birds which are to be seen easily and at any time. *From the standpoint of the expression of constancy, therefore, the quantitative methods nowadays employed are incomplete. The same is true of the local constancy as the term is used by plant sociologists.* For example, in the closed forest individual examined, which extend over 15 ha, there nested 2 pair of *magpies.* These could be found at their daily activities in one part or another of the forest or in the neighbouring biochoria. So that no matter how many stations I had investigated in the forest the *magpie* would never have seemed locally constant as it never occurred in 80—100% of the investigations, though it is certain that it was present daily in every part of the forest. And if I consider the previous examples from the standpoint of local constancy it appears that in all the scrubby pastures of the Tihany Peninsula it is the same specimen of *buzzard* which is active. It is in each place locally constant but I cannot establish this from my records. *The same incompleteness in method makes it impossible to reckon the minimi-areal.* Neither can the frequency scale worked out by Soveri (1936, p. 17) nor the Lindsdale-Compton scale he mentioned be employed in our country, consisting of mosaics of small individuals of plant societies. Lindsdale's frequency-scale was based on the time unit (unfortunately I don't know more of it); it shows the right tendency inasmuch as the significance of the difficulties described above is always *that the individual members of a population pertain at different times to different parts of the area: thus one must employ the time factor in their sociological characterizing method, in contrast to that of the localized plants.*

THE RESULTS OF THE SOCIOLOGICAL INVESTIGATIONS.

In the tabulated summarizing of the quantitative surveys, are given the abundance and individual dominance of the species for all stations, as well as the population density count per km^2, by adding the abundance values of all species. In the biochoria from which I have more

records the average density of population was counted as well as the average values of individual dominance.

Per km² the density of bird population in nesting pairs is:

Open woodland	690
Closed forest	4056
Scrubby pasture	410

All pairs observed in the area:

Open woodland	750
Scrubby pasture	695

Comparing these with the results of other researches (LACK, 1937, PALMGREN 1930, 1931, 1933, 1938, SOVERI, 1940) the too high density values of the closed forest stand out. According to the authors just mentioned the greatest value so far found was, in Finland 719, in England 2000. My high figure can be explained by the geographical lay, the more advantageous climate of the area investigated, as well as the diverse strata and variability of the closed forest which with us is the climatic-climax community; indeed, in some of our woods ecologically even more favourable, the bird population is probably still denser..

The bird population of the 3 biochoria examined in most detail can be classified in the following categories, with the help of individual dominance groups (PALMGREN, 1930, p. 172,). Only the nidiates were taken into consideration.

THE BIRD POPULATION OF THE OPEN WOODLAND.

Dominance groups: > 5% dominant, 5—2% dominant, 5—2% influent, 2 > % accessoric.

Dominant	D
Fringilla coelebs	13.8
Streptopelia turtur	12.3
Emberiza citrinella	11.2
Sturnus vulgaris	7.4
Parus maior	7.3
Influent	D
Mucicapa striata	4.5
Oriolus oriolus	4.5
Corvus cornix	3.9
Sylvia nisoria	3.3
Luscinia megarchyncha	3.3
Turdus merula	2.8
Upupa epops	2.5
Sylvia atricapilla	2.3
Jynx torquilla	2.2
Lanius minor	2.2

Accessoric	D
Falco subbuteo	1.7
Passer montanus	1.6
Anthus trivialis	1.2
Cuculus canorus	1.2
Coloeus monedula	0.6
Dryobates maior	0.6
Coracias garrulus	0.6
Sitta europaea	0.6
Picus viridis	0.6
Columba oenas	0.6
Erithacus rubecula	0.6

THE POPULATION OF THE CLOSED FOREST.

Dominant	D	*Accessoric*	D
Streptopelia turtur	9.9	*Corvus cornix*	1.9
Fringilla coelebs	9.2	*Sylvia curruca*	1.8
Emberiza citrinella	8.8	*Cuculus canorus*	1.8
Luscinia megarchyncha	8.3	*Garrulus glandarius*	1.5
Parus maior	7.6	*Aegithalos caudatus*	1.5
Sylvia atricapilla	5.8	*Parus palustris*	1.3
Turdus merula	5.8	*Sylvia communis*	0.7
Oriolus oriolus	5.3	*Jynx torquilla*	0.7
Lanius collurio	5.0	*Muscicapa striata*	0.7
		Upupa epops	0.7
Influent	D	*Hippolais icterina*	0.7
		Pica pica	0.6
Chloris chloris	3.8	*Erithacus rubecula*	0.6
Carduelis carduelis	3.3	*Troglodytes troglodytes*	0.6
Columba palumbus	2.0		

THE POPULATION OF THE SCRUBBY PASTURE.

Dominant	D	*Accessoric*	D
Sylvia communis	24.8	*Fringilla coelebs*	1.5
Emberiza citrinella	21.0	*Alauda arvensis*	1.2
Saxicola torquata	10.9	*Streptopelia turtur*	0.9
Luscinia megarhyncha	9.7	*Cuculus canorus*	0.6
Carduelis cannabina	7.4	*Perdix perdix*	0.6
Oenanthe oenanthe	5.0	*Anthus campestris*	0.6
Influent	D		
Lanius collurio	3.6		
Saxicola rubetra	3.4		
Sylvia nisoria	3.0		
Sylvia curruca	2.1		

SUMMARY.

1. The graphing of the ecological relation between forest and shrubbery types of the area on the basis of qualitative distribution (See Table I., Figure 2.).

2. Calculation of the sociological values from repeated spring surveys of 19 stations (altogether 76 ha) as follows: density of the total population per km^2, abundance of the species, individual dominance of the species, dominance-groups. (Table III.).

Population studies made in one season and over a limited area are open to much criticism. I present the foregoing, however, for different reasons — for 1946 and for the Tihany peninsula they are accurate, and they give a good basis for methodical reflections, as follows:

3. Palmgren's quadrate method was sufficient in the open wood-

land and the more open shrubberies. The density of the closed forest and the large quantity of birds therein, on the other hand, caused great difficulties. Here it was necessary to repeat the survey 3—4 times, and to form small stations not more than 2 ha in extent.

4. The aspect of propagation (considering only the first breeding) extends to different epochs in the hibernating residents among the early arriving (beginning of April) and late (at the turn of April-May) summer residents. Therefore we have no standard period in which all members of the population are bound to their territories and thus easily countable. In April some dominant species are still absent; again, by the middle of May the earliest breeders have got their young out of the nests, thereby finishing their localised season. All these relations are explained by the phaenological spectra (Figures 4, 5).

5. The nesting and feeding territory is not the same place for the greater part of the species of the shrubby pasture and forest. In the sociological characterising of these we must express, with a special relative figure, that the species nests or feed, or both, locally, in the community individual recorded, or generally, that is, in the whole community. Because of these species I could not employ the term character-species („Karakterart" of the botanists) nor the degrees of Fidelity (exclusiveness).

6. This method is not suitable for calculating degrees of constancy. The correct establishment of constancy and frequency must take place in connection with the time factor — and attempts are being made in this direction — because the role of the bird is periodical in the different biotic communities.

Grateful acknowledgment is made to my colleague Dr. L. Felföldy, who assisted me with the figures and made map No. 1, as well as the photographs; to Mrs. J Thompson Vass for the English translation; to Mr. F. Holly for the meteorological observations and to Miss M. Fenyvesi for the other technical help.

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EXPLANATION OF TABLE III.

The quantitative data for each station and the values reckoned therefrom. () In parenthesis those of accidental character. The 4 rows at top of Table: A = data for all pairs found. B = data for only the pairs which bred on the area. Indications given in last row of upper section: I—VII = survey number. Σ = No. seen on each of the repeated surveys. Ab. = abundance (No. of pairs/km^2). D = Individual dominance (%ual role of each species, reckoned in pairs, of the entire bird population of the area.

Number and character of station given in top row of upper section: O = open woodland. F = closed forest. P = scrubby pasture. S = shrubbery. T = grassy hilltops.

TABLE III. The quantitative data for each station and the values reckoned therefor.

No. and charakter of Station	1. O	2. O	3. F	4. F	5. F	6. S—P	7. P	8. P	9. P	10. P—T
Date of the survey	V. 10.	V. 20.	V. 9, V. 11, V. 23, VI. 12.	IV. 9, IV. 26, V. 8, V. 11, V. 18, V. 23, VI. 12	IV. 26, V. 8, V. 11, V. 18, V. 23, VI. 12.	VI. 1, VI. 6.	V. 10, V. 15.	V. 14, V. 28.	V. 17, VI. 5.	V. 12.
Size of the area (ha).	7'38	9.33	0'75	1'91	0'88	2'27	15'83	16'95	16'33	6'54
Bird density pro 100 ha	469 414	1031 965	6143	2948	3076	3300 1716	504 411	1034 448	546 342	40 34
	A B	A B				A B	A B	A B	A B	A B
Total number in pairs	34 30	95 85	46	56	27	75 39	68 56	174 75	88 60	19 17
Total number of species	17 14	32 26	22	24	16	25 13	21 12	21 13	30 13	9 7
	I. Ab D I. Ab D	I. Ab D I. Ab D	I. II. III. IV. Σ Ab D	I. II. III. IV. V. VI. VII. Σ Ab D	I. II. III. IV. V. VI. Σ Ab D	I. II. Σ Ab D I. II. Σ Ab D	I. II. Σ Ab D I. II. Σ Ab D	I. II. Σ Ab D I. II. Σ Ab D	I. II. Σ Ab D I. II. Σ Ab D	I. Ab D I. Ab D
Corvus cornix	2 28 8'8 2 28 6'7	1 11 1'0 1 11 1'1	1 1 1 134 2'2	2 1 1 1 1 2 105 3'6		1 1 44 1'3	2 2 15 2'9	3 2 3 18 1'7	2 2 13 2'3	
Coloeus monedula		1 11 1'0 1 11 1'1			1 1 53 1'8			80 80 472 46'0		
Pica pica					1 1 53 1'8				1 1 6 1'1	
Garrulus glandarius			1 1 1 134 2'2	1 1 53 1'8						
Sturnus vulgaris	1 14 2'9 1 14 3'3	10 108 10'6 10 108 11'2								
Oriolus oriolus	1 14 2'9 1 14 3'3	5 54 5'3 5 54 5'6	2 2 1 2 2 267 4'3	4 4 3 3 3 4 210 7'1	2 1 2 2 1 2 228 7'4	1 1 44 1'3		1 1 6 0'6	1 1 1 6 1'1	
Chloris chloris			1 1 134 2'2	1 1 1 1 53 1'8	1 2 1 2 228 7'4	1 1 44 1'3	1 1 8 1'5	2 2 12 1'2	2 2 13 2'3	
Carduelis carduelis			2 1 2 267 4'3	1 1 1 1 1 53 1'8	1 1 1 44 1'3	2 1 2 88 2'7	1 1 8 1'5			
Carduelis cannabina						2 1 2 88 2'7	6 6 6 44 8'8			
Fringilla coelebs	5 68 14'7 5 68 16'7	11 118 11'6 11 118 12'4	5 6 6 5 6 800 13'0	1 2 4 3 3 3 4 210 7'1	1 1 2 2 1 1 2 228 7'4	1 1 1 44 1'3	6 6 6 44 10'1	4 3 4 24 2'3	4 4 4 25 4'6	1 3 5'3
Passer domesticus				(1) (1) 53 1'8		1 1 1 44 1'3	1 1 6 0'6	1 1 6 0'6	4 4 4 25 6'7	1 3 5'9
„ montanus		3 33 3'2 3 33 3'2		(2) (2) 105 3'6					2 2 13 2'3	
Emberiza citrinella	4 55 11'8 4 55 13'3	8 86 8'3 8 86 9'0	2 2 3 3 3 400 6'5	4 5 4 3 3 2 2 5 263 8'9	1 1 1 1 3 3 341 11'1	10 8 10 440 13'0	10 8 10 440 26'0	4 2 2	2 5 5 31 5'7	
Alauda arvensis								1 1 1 8 1'5	9 14 14 86 15'9	4 7 21'0
Anthus campestris		2 22 2'1 2 22 2'3						12 19 19 113 10'1	12 19 19 113 25'3	6 10 31'6
„ trivialis		1 11 1'0 1 11 1'1								1 3 5'3
Sitta europaea										4 7 23'5
Parus maior	3 41 8'8 3 41 10'0	4 43 4'2 4 43 4'5	3 3 2 2 3 400 6'5	3 3 4 3 5 3 3 5 263 8'9	2 2 1 2 228 7'4	1 1 44 1'3				6 10 35'3
„ palustris			1 1 134 2'2	1 1 53 1'8						
Aegithalos caudatus			1 1 134 2'2	1 1 53 1'8						
Lanius minor	1 14 2'9 1 14 3'3	1 11 1'0 1 11 1'1								
„ collurio	3 41 8'8 2 28 6'7	3 33 3'2 3 33 3'4	1 1 1 134 2'2	1 3 2 3 158 5'4	2 1 1 2 228 7'4	1 1 1 44 1'3	1 1 1 44 2'6			
Muscicapa striata	1 14 2'9 1 14 3'3	5 54 5'3 5 54 5'6	1 1 1 134 2'2							
„ hypoleuca	1 14 2'9	1 11 1'0								
Phylloscopus trochilus			(2) (2) 267 4'3		(1) (1) 114 3'7					
„ sibilatrix	(1) 14 2'9	(1) 11 1'0		(2) (1) (2) 105 3'6	(2) (2) 228 7'4					
Locustella naevia		(1) 11 1'0								
Acrocephalus palustris									1 1 6 1'1	
Hippolais icterina			1 1 134 2'2						1 1 6 1'1	
Sylvia nisoria	2 28 5'8 2 28 6'7							2 3 3 18 1'7	2 3 3 19 3'4	3 5 15'8
„ borin						3 3 132 4'0	3 3 132 7'7			
„ atricapilla		4 43 4'2 4 43 4'5	3 3 1 2 3 400 6'5	2 4 3 4 1 4 4 210 7'1	1 1 1 114 3'7					
„ communis			1 1 1 134 2'2			6 3 6 264 8'0	6 3 6 264 15'4	17 17 17 101 9'8	17 17 17 101 22'7	3 5 17'6
„ curruca				1 1 53 1'8	1 1 1 114 3'7			2 1 2 12 1'2	2 1 2 12 2'7	
Turdus merula	1 14 2'9	5 54 5'3 5 54 5'6	2 3 2 3 3 400 6'5	4 1 1 3 4 210 7'1	1 1 1 1 1 114 3'7			1 1 6 0'6		
Oenanthe oenanthe						2 2 88 2'7	2 2 88 5'1	2 2 12 1'2	2 1 2 13 2'3	1 3 5'3
Saxicola rubetra								4 3 4 29 5'9	1 1 1 6 1'1	1 3 5'9
„ torquata						1 1 1 44 1'3	1 1 1 44 2'6	7 6 7 51 10'0	5 4 5 31 5'7	
Luscinia megarhynchos	6 65 6'4 6 65 6'7	4 2 1 1 4 534 8'7	2 5 5 5 4 1 5 263 8'9		2 2 228 7'4	2 3 3 132 4'0	2 3 3 132 7'7	4 3 4 29 5'9	5 3 6 37 6'8	1 3 5'3
Erithacus rubecula	1 11 1'0 1 11 1'1			1 1 53 1'8				7 6 7 51 12'3	6 3 6 37 10'0	
Troglodytes troglodytes				1 1 1 53 1'8				9 3 9 54 5'2		
Hirundo rustica								9 3 9 54 12'0		
Delichon urbica						3 8 8 352 10'7		8 9 9 54 5'2		
Apus apus						15 10 15 660 20'0		8 9 9 54 12'0		
Upupa epops	1 14 2'9 1 14 3'3	2 22 2'1 2 22 2'3	1 1 1 1 134 2'2			4 4 176 5'3				
Coracias garrulus		1 11 1'0 1 11 1'1				1 1 44 1'3	1 1 1 8 1'5	1 1 6 0'6	2 2 13 2'3	
Picus viridis		1 11 1'0 1 11 1'1								
Dryobates maior		1 11 1'0 1 11 1'1							1 1 6 1'1	
Jynx torquilla	1 14 2'9 1 14 3'3	1 11 1'0 1 11 1'1	1 1 134 2'2	1 1 53 1'8	1 1 114 3'7					
Cuculus canorus		2 22 2'1 2 22 2'3								
Falco cherrug									1 1 1 6 1'1	1 3 5'3
„ subbuteo	1 14 2'9 1 14 3'3					1 1 44 1'3				
„ tinnunculus						1 1 44 1'3	1 1 8 1'5		1 1 6 1'1	
Buteo buteo		1 11 1'0					1 1 8 1'5			
Accipiter gentilis		1 11 1'0							1 1 6 1'1	
Columba oenas		1 11 1'0 1 11 1'1				1 1 44 1'3				
„ palumbus						1 1 44 1'3				
Streptopelia turtur	5 68 14'7 5 68 16'7	7 76 7'4 7 76 7'9	2 2 1 2 267 4'3	1 1 1 1 53 1'8						
Perdix perdix			4 4 5 5 5 667 10'9	4 2 3 4 4 4 210 7'9	1 3 2 3 2 2 3 341 11'1	5 3 5 220 6'7	5 3 5 220 12'8	3 3 18 1'7	1 2 2 13 2'3	
Sylvia sp.		1 11 1'0			1 1 114 3'7				1 1 6 1'1	
Sp.		2 22 2'4 2 22 2'3				3 3 132 4'0	3 3 132 7'7	1 1 8 1'5	1 1 8 1'8	1 1 6 1'7
Number in pairs MM	34 469 30 414	95 1031 85 965	37 30 29 26 46 6143	16 23 31 26 36 24 27 56 2948	15 15 9 10 9 8 27 3076	64 44 73 3300 38 21 39 1716	57 60 68 504 51 53 56 411	155 76 174 1034 62 65 75 448	67 73 88 546 55 50 60 342	19 40 17 34
Number of species	17 14	32 26	17 12 16 11 22	9 10 9 10 15 12 12 24	12 10 7 5 7 5 16	23 12 25 13 8 13	14 19 21 11 12 12	15 18 21 11 12 13	23 24 30 13 11 13	9 7

Figure 6.

Figure 7.

Figure 8.

Figure 9.

EXPLANATIONS OF FIGURES 6.—9.

Figure 6. — One type of open woodland from station 2. In the hollow of the *Acer campestre* in the foreground the *stock-dove* nested. Otherwise the part of the area to be seen here is the nesting territory of the *chaffinch, starling* and the *great titmouse,* and the clearing in the background of the *tree pipit.* (Photo: FELFÖLDY.)

Figure 7. Scrubby pasture from station 2. In the *rose* and *hawthorn* thickets in the foreground *nightingales, whitethroats, yellow buntings* nested. The background of rocky-grassy hilltops is the nesting territory of the *wheatear* and the *sandpipit.* (Photo: L. FELFÖLDY.)

Figure 8. The more open type of scrubby pasture. In the middle distance badly gnawed and trampled *wild rose* and *hawthorn* bushes; in the foreground *Festucetum pseudovinae* clearing with *Ononis spinosa.* Nesting place of the *Finnnet* and the *stonechat.* (Photo: L. FELFÖLDY.)

Figure 9. A more enclosed part of scrubby pasture, from the standpoint of bird ecology a transition to the shrubbery *Querceto-cotinetum.* In the background *oaks,* in the foreground thickets of *wild rose* and *hawthorn.* Breeding territory of *chaffinch, yellow bunting, white-throat, common warbler* and *red-backed shrike.* (Photo: L. FELFÖLDY.) All potographs made November 13th, 1946.