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DOKTORAL (Ph.D) THESIS

HABITAT SELECTION OF THE PHEASANT SPECIES IN AGRICULTURAL HABITATS IN THE TRANS-TISZA REGION

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I. HISTORY OF INVESTIGATION

In our domestic small game management the pheasant, field hare and water-game species have great importance, while saving the in season, but endangered partridge is our wild game management moral obligation. Although quail is not hunted for more than 50 years for now, in the last few decades it's domestic nesting stock appreciably increased and this aroused the interest of the wild biology and wild game management. The pheasant, quail and partridge mainly prefer the field habitats, therefore the changes carried out in the agricultural environment increasingly affect these species.

Partridge (Perdix perdix L.) in the 1920's was the most significant wild small bird in our country. But it's stock throughout the decades rapidly decreased. In the middle of the 1970's the natural breeding stock was estimated up to 800 thousand. This number in the early 1980's decreased to 170 thousand, and soon in the early 1990's it decreased to 44 thousand.

From 1990 the changes that took place in the agriculture, to which as a result of it the plant inhibitor usage compared to the 1984's decreased with 70 % (FARAGO, 1997), resulted in the samll degree growth of estimated partridge individual number. And although the expansion did not happen in the expected scale, the further decrease stopped.

In autumn 1992 the National Partridge Protection Program main objective has been accepted, which main goal was to ensure the species overcame an extreme scale of stock decrease such reservtions, where working together with the farmers and cultivators and also the authorized hunters, and carry out a model worth habitat management model, firstly on those regions, where we can find a large number of natural stock. The DATE Agricultural Zoological and Wildbiological Department joined this program, in which the habitat choosing investigaton methods were born.

The **pheasant** (Phasianus colchicus L.) at present has great role in our domestic small game management. Descending after the natural stock cover, from the 60's the increased hunting needs were completed by releasing artificially brought up birds. The domestic pheasant management after the earlier success, is at present on a downhill. The artifical pheasant upbringing besides it's excessive use, the protection and nurturing of natural breeding stock fell into the background and it's consequences present itself nowadays.

The emissive places, hunting forests, feeders, and watering holes, connected to the artificial breeding, affected the natural breeding stock and our whole pheasant management favourably. The estimated natural breeding stock data from the mid 1970's, which anyway indicated 2,5 million breeding stock reflected that picture.

But from the end of the 1970's the wild game management reports have indicated a stong and continuous decrease in the natural breeding stock. Int he

mean time the artificial breeding came to a more intesve period and in 1989 the released number of pheasants nearly reached the one and a half million, but the coverage data by this time has shown some decrease. This contradiction has been felt by the famers too, but for lack of reliable and exact data they couldn't redress the problems.

The most important question was how to utilize the artificial pheasants, to which measure the pre- and after nurturing quality was seen. The connecting exact data for lack of suitable technical methods at first were not at disposal. Later on it was proved by means of SZENDREI (1992), that only 15-25 % of the issued birds were useful and many emigrated. The main factor for natural pheasant stock decrease is the artificial nurturing technical unorderliness and the following weak efficiency could be mentioned (SZENDREI 1994).

As a consequence of all these processes the investigation on natural pheasant stock and habitat development fell back. Because it is still our most important wild small game bird, every study, based on the species reaction to it's habitat change are necessary.

The **quail** (Coturnix coturnix L.) in the last century was a common hunted bird, which was underlayed by the existing cover data (in 1907 217 600 individuals) (FARAGO 1997). Later on in the 1910-1920's it's individual number has greatly decreased, which the scientist explained by the partridge's stock increase and the two bird's competiton for food and habitat. The stock decreas for the quail in the latter decades continued, but in the mean time in the early 1950's it was still a common bird. Thereafter the continuous and major change int he habitat, the decrease of insects and seed-seed, affected unfavourably on the quail's nesting and nurturing period. But than the excessive number of hunting and catching in south-europe during the migration period, had a greater effect on the specie's european stock (GLÓSER, 1942). In 1954 the domsetic wild game management utilization defunct, and since then from 1971 the specie's is protected. There was an absence in reliable stock measuring data in the past decades, but farmers and ornithological observation reports indicated a stock raise on quial. In many countries in Western and South Europe it's hunting utilization contiunes. The closest place to our country where it's hunted is the Voivod. In our midst there are no exact comparable observation data, which in the first place derives from the specie's features – especially it's strongly habit of hiding.

II. THE OBJECTIVES OF INVESTIGATION

Nowdays more and more areas engage in the field habitat development program, which affect the living space of domestic pheasant living in agricultural environment. It is necessary to recognize these species' habitat usage and preference relations between these management conditions, to which knowledge these ambitions can become more effective.

It was a main point in choosing the sample grounds in the domestic pheasant's habitat usage and preference analysis, that all three species would be found there, and comparable considering the habitat structure, and finally the specialized staff would be suitable for the precise work neede for the shooting. Relying upon these findings we have asigned sample grounds in two trans-Tiszanian county in four wild game management unit grounds on which we have done the habitat supply and usage measuring with the same method.

We have examined in course of the investigation:

- The habitat supply dinamics of the sample grounds
- The partridge, quail and pheasant habitat choosing on sample grounds
- The spring and autumn stock density by all three species during the investigational period
- The relation between habitat supply ratio and pheasant individual density
- The connection between winter grain ratio and quail spring stock density
- Relation between medick region ratio and pheasant stock density
- The connection between winter „set on foot" maize region ratio and partridge and pheasant next year spring stock density

The method of data inclusion made it possible to check the habitat choosing dinamics for all three species. During this we were trying to find answeres, that how does the annual boundary structure changing effect the pheasant's, living in an agricultural environment, seasonal habitat change.

III. METHOD OF INVESTIGATION

The connection for the pheasant, partridge and quail to it's environment, that is to say the resulting of extrapopular factors on population is the habitat choice. The continuous observation processing on sample ground makes it possible to verify the annual habitat choosing cycle by each species.

For defining the breed habitat preference several index have been worked out. Among these the IVLEV-index (electivity index) (IVLEV 1961), and it's improved version the JACOBS-index (preference index) (JACOBS 1974) are the most accepted in wild biological research. For my research the IVLEV-index was more suitable, because this is suitable primarily for observation based databases. The JACOBS-index is used for evaluating data obtained from radiotelemetry (BIRKAN et al, 1992).

I have examined the domestic pheasant (pheasant, quail, partridge) habitat usage and preference between 1998-2002 within the scope of investigational programs ont he four trans-Tiszanian wild game management unit ground. These are:

Bátorliget (Szabolcs-Szatmár-Bereg county)	1998-2002
Biharkeresztes (Hajdú-Bihar county)	1998-2002
Hajdúböszörmény (Hajdú-Bihar county)	1998-2002
Vámospércs (Hajdú-Bihar county)	1998-2002

On wild management unit ground field habitat nearly 1000-1000 sample ground was signed out. The exact expansion of the examined region are determined of the plot size. We registered each time we entered monthly on the same route to the region, that on which habitat did the examined species' individuals and covey at the moment of investigation stay. These data have been summarized monthly, hereby we could verify the pheasant, partridge and quail habitat usage. The rout we entered the region was randomly choosed, by map.

We determined the habitat supply of the five sample grounds in a monthly detail by registering the occured changes in habitats during shooting. This collection of data has assured us, that for the examined period the habitat supply and usage data and, at the same time both habitat's dinamics, stood at our disposal on a monthly basis. I managed to calculate monthly, thanks to these data, the habitat types on all four sample regions with IVLEV-index in the following was:

$$Iv = (N_2-N_1)/(N_2+N_1)$$

Where

Iv : IVLEV –kind of preference index, the value spreads from -1 to +1
N_1 – the given species percental habitat usage
N_2 – the given habitat percental supply

In order to easily compare I have categorized the most important habitat types in terms of supply and usage and I have treated the similar structured and preferred habitats together. In compliance with it I have used the following seven habitat categories:

Maize (grain maize, silo, maize)
Winter crop (winter wheat, winter barley, rye)
Spring crop (spring barley, oat)
Lucern
Field, grazing ground
Stubble (corn, maize, pea etc.)
Tree and bush belts
Unpaved road, grass road, side of ditch

We desired to get answeres for the using of indexes on the basis not only for divergent habitat choosing, but also for habitat preference dinamics. I compared the received data with the already known domestic data (FARAGÓ and BUDAY 1998, FALUDI, 1999, PAPP, 1999). This processing method gives us the opportunity to compare the pheasant's habitat usage and preference.

I have adopted on the sample ground in case of the pheasant and partridge a continuous and full stock investigation mehtod. I have invited for this work beyond the professional hunters of the sampled ground some university students too. We based in case of the partridge and pheasant mostly on visual observations, which were completed with acoustic data, especially in reproductive period.

During the development of quail stock measuring methods, we had to face problems mainly of the species features. The most important above all, is that it follows an extremly hiding course of life, therefore inspecting it int he dense plant cultures favored by it is really tough. Experiences have indicated that it rarely flies away from people walking by, rather they run away between the vegetation, or hide. Mostly they can be seen flying away when we pass by in medick or field-grazing grounds by car, or the individuals can be forced to fly away by a sharpe nosed beagle.

Resulting from the listed abouve that the full stock mapping is quiet tough, therefore we chose the measuring based on the acoustic signs applied in

the foreign practice. Although in caseof the quail both gender gives provoking sounds, in case of the egg-layer it is hareder to hear, and it is mainly observable during the reproduction period. That's why I have decided, to use only the roosters' territory sounds for stock measuring.

The quail roosters during their stay almost throughout the whole time let their characteristic territorial voices heard (pity-palatty). The intonation for roosters in twilight, late evening and morning periods are the most intense. At this time all the revirt occupied roosters signal. During the day, especially on a hot summer day they rarely produce sounds. Some scientists say (BLOTZHEIM 1973), that because in the early evening hours (from half past 8 to 11 o'clock) the intonation comes to a stop, therefore we decided, during the quail stock measuring methological work out, to investigate in the morning (dawn) period. This period was suitable for pheasant and partridge observation too.

We used for the pheasant stock measuring the full counting streak method, the entrance to the sample grounds happened the same way on foot, with the usage of beagles. The path in all three sample grounds were 15 km long. The routes on the sample grounds were signed out accidentaly by map. After that the measuring always happened at the same rout. The observing person stoped at every 200 m for a minimum of 2 minutes and on the surveying sheet and on the map he indicated the heard and seen quail roosters, pheasants and partridge individuals.

I have detemined on a monthly basis the density values fro each species on the sample gorunds on the basis of evaluating the data retreived fro the stock measuring. I have done the investigation on regression connections with a binary regression analysis (SVÁB, 1967, 1981). During the search for correlation I have considered the value's significance level too (p=0,005*, p=0,001**). I have examined the connection between habitat supply ratio and stock density data by polinomial trend function.

IV. THE MAIN STATEMENTS OF DISSERTATION

Investigation on habitat supply and choosing

Examining the average of the investigational 5 years it can be laid down as a fact, that the meadow and grazing grounds usage disponent with large habitat supply dominates mainly in the reproductive and nestling nurturing period for the **partridge** (40,2 %), which in the first place can be explained with the habitats peacefulness and rich food supply. PAPP (1999) preformed a series of measuring in Nagyszénás, which had similar large ratio grass land habitat

usage for this period (63,6 %). In mid summer we van observe a habitat usage change by the species, because in august and in september mainly the corn stubble usage, while in autumn, and early winter months maize stubble habitat dominates. FALUDI (1999) has obtained similar results on the basis of his investigation at Abádszalók.

The spring grain (oat) habitat usage can only be shown in the first two moths of summer (11,8 % and 11,2 %). Early in the nesting period a large ratio of medic (35,9 %) and winter crop (20,4 %) usage can be shown. Last may, only a small ratio has been shown, but medick usage ratio has greatly decreased.

Tree and shrub lines usage ratio in spring aspect was relatively low (1,8 %), but in the late autumn and winter months has already shown higher ratios (10,2 %). FARAGO (1998) int he Lajta-project has shown greater forest belt usage ratios in case of partridge, but there were rich undergrowth observable between the tree and bush belts.

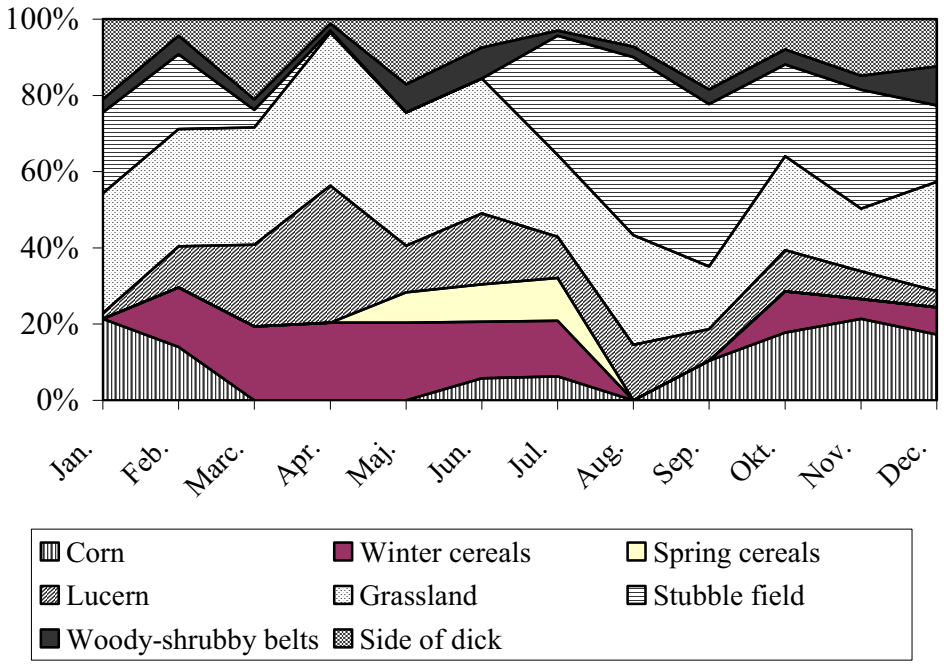


Figure 1.: Habitat usage for partridge on sample ground Biharkeresztes 1998-2002

In an intensive agricultural environment there are less diverse habitat supply for **pheasants**. Therefore they prefer favourable habitats to a higher degree for individuals. BUDAY (1993) completed a series of measuring in the Lajta-project, and there the forest belt usage ratio was above 60 % throughout the year. The habitat usage based on our observations, could never show any habitat with such extent annual preference, but in some months, these data could

be veryfied, that which habitats play key role in the specific period for the pheasant.

In the reproductive period the registered individuals are mainly found in winter grain fileds (22,4 %), fields, grazing grounds (30,4 %) and medick fields (28,7 %) (figure 2.). At the same time in june the tree and bush belt usage increased from 5,2 % up to 12,7 %. For the summer period the number of observed individuals fell back on the field, grazing ground (6,4 %) and medick (2,8 %) areas. At the same time on oat fields we observed more pheasant dame with chikens. Because grain fields were mostly kept untill end of september, this habitat type ,even in early september, has shown the greatest usage ratio in a yearly average (34,8 %). From oktober most of the pheasants were seen on the maize fields and corn stubble (19,6 % and 20,4 %), but they also used the fields and grazing grounds on a larger scale.

The tree and bush belts also gathered pheasants (14,1 %) and on those areas, where these habitats met, a large number of pheasant gathered.

The unharvested corn fields in december and january also became the most used habitats, which were shown in the results of the preformed hunting. (1999: 21 rooster on a 4 hectare field).

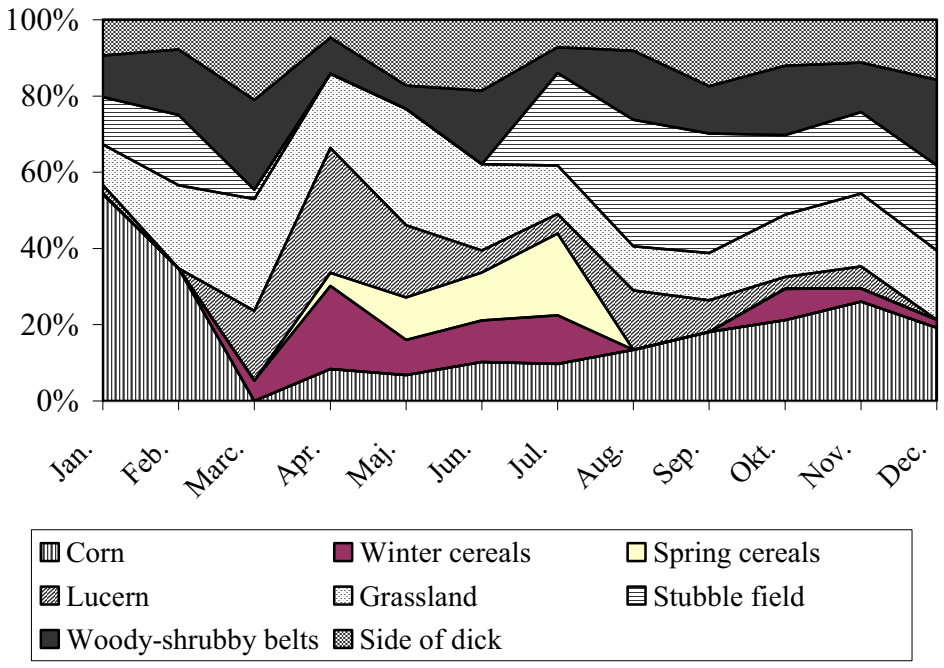


Figure 2.: Habitat usage for pheasant on sample ground Biharkeresztes in 1998-2002

We have measured the **quail**'s habitat usage dinamics annualy and in a five year ratio too. These data have shown, that from the eight main habitat type only six were used during it's stay here. At the time of the spring arrival, it mainly uses the meadows and grazing grounds (30,5 %), but it's almost as common in the autumn grain fields (29,7 %). These two habitat types have

nearly the same average plant hight at this time of the year, and in my opinion this could be the result of the similar usage ratio. Next to this in a single year (2001, 2002) the usage of medick in may was high, which may have been caused by next to the large supply ratio, the appeared favourable plant hight and density till hay-making too.

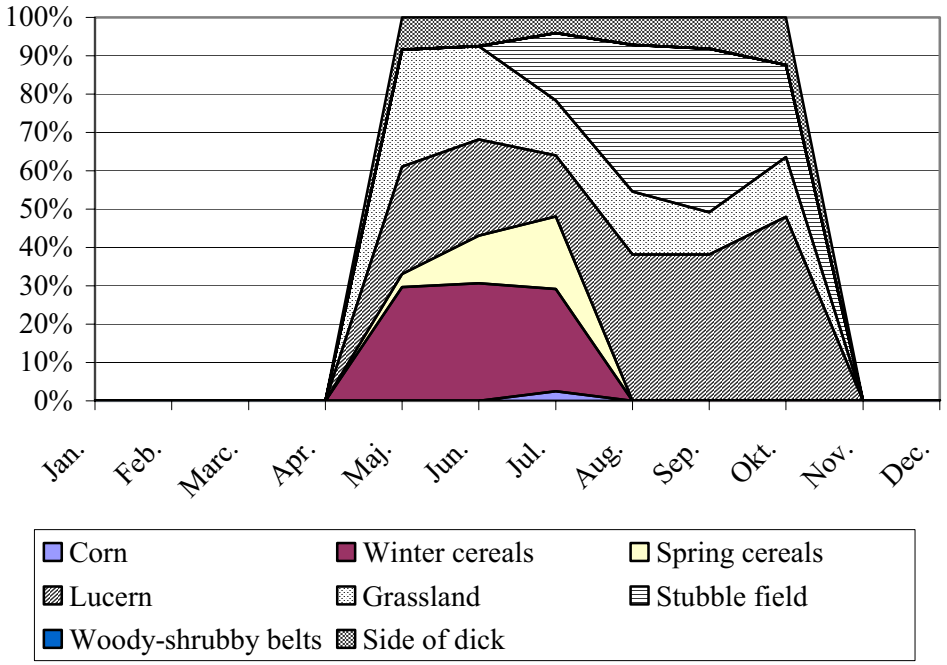


Figure 3.: Habitat usage for quail on sample ground Biharkeresztes in 1998-2002

Untill mid summer (actually until harvesting) the winter crop habitat usage ratio stood firm to a 30 % level, on the other hand the registered quail rooster number decreased on field, grazing ground and medick fields.

The spring crop (oat) has been used by the quail from june, and in july the number of heard and sometimes seen individuals have risen. Actually from the end of the summer the quail stock concentrated on the two habitat types.

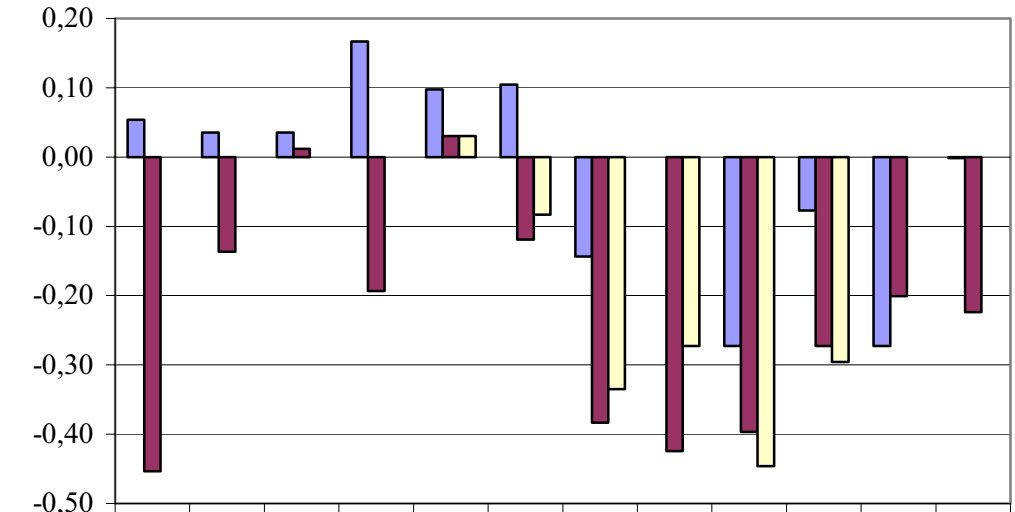
In august the main autumn and spring crop field stubble were the most important habitats (40,9 %), but in migration time the medick usage ratio have risen. By this time we have heard only a few individuals on fields and grazing grounds (10 %), thus this habitat type's autumn usage was not characteristic on sample ground Biharkeresztes (figure 3.).

In case of the partridge the the most balanced values were shown on the sample grund's largest habitat supply giving **field** and **grazing** grounds usage ratio. Because the field and grazing ground ratio during the period under survey didn't change dramatically, therefore it can be laid down as a fact, that throughout the measuring period the supply ratio and usage ratio in case of partridge was in balance (Iv=0,04-0,32). The highest IVLEV values were shown

in spring, which shows that the uncut fields and grazing grounds are the most important habitats for the partridge here, and in terms of the specie's reproduction it deserves highlighted attention (figure 4.).

In case of the pheasant the large supply in field and grazing grounds resulted in that even spring months with large usage ratio habitat preference indicators cross to neagative values only here and there (Iv=0,14).

The large supply ratio on the basis of received data is not in the ratio of those habitat usage in case of the quail. Therefore we have received throughout the whole five year investigation period negative habitat preference values. In spring it showed a small degree of negative preference (Iv=-0,08) ,but in autumn it had a large negative preference (Iv=-0,45).



	Jan.	Feb.	Marc.	Apr.	Maj.	Jun.	Jul.	Aug.	Sep.	Okt.	Nov.	Dec.
Partridge	0,05	0,04	0,04	0,17	0,10	0,10	-0,14	0,00	-0,27	-0,08	-0,27	0,00
Pheasant	-0,45	-0,14	0,01	-0,19	0,03	-0,12	-0,38	-0,42	-0,40	-0,27	-0,20	-0,22
Quail					0,03	-0,08	-0,33	-0,27	-0,45	-0,30		

Figure 4.: Field and grazing ground habitat choosing (IVLEV index) in region Biharkeresztes (1998)

Pheasant stock density dynamics

The stock measuring method on sample regions gave us the opportunity to compare the density value dinamics of the thre species. Relying upon these findings on Biharkeresztes the partridge spring stock density data have shown a small degree of decrease. The quail rooster spring stock density has also shown some decreasing tendency, to which measure somewhat larger than the experienced decrease in case of the partridge. The largest spring density decrease was seen at the pheasant. The density value comparison of all three species show, that by hunting the not utilized species, although decreasing

density values are shown, the measure of it did not make the grade for the pheasant decrease. Because in case of the quail and partridge only the environmental effects cause losses, and only these measurements appear on density data, in case of pheasant, not like by the other two species, the hunting over utilization could have caused the larger density decrease.

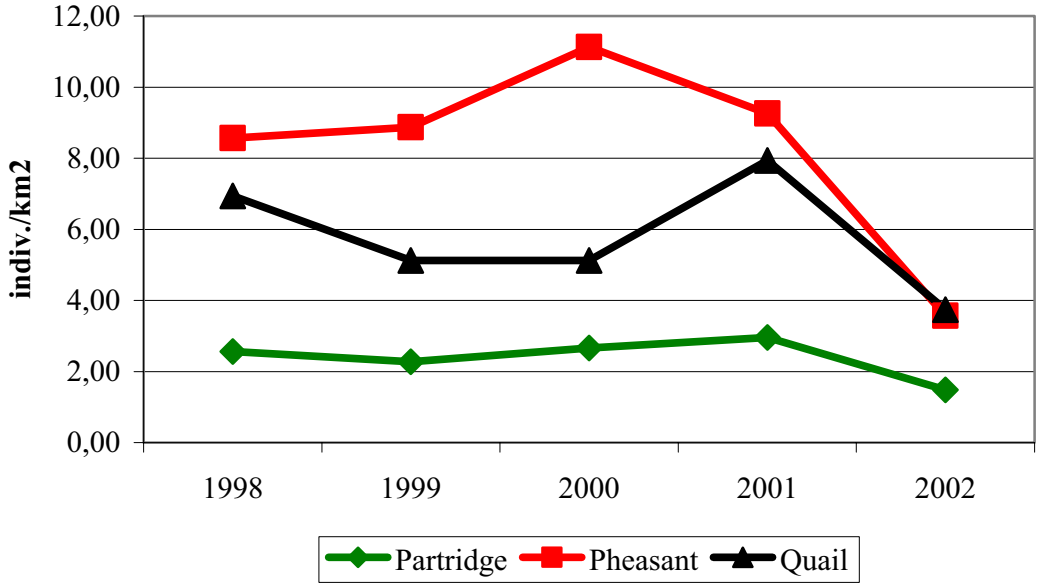


Figure 5.: The spring stock density dinamics at sample region, Biharkeresztes

The survey, done in the first year of investigation, has shown a 2,56 individual/km^2 partridge spring stock density on sample ground. In case of the partridge this density stage was close to the critical stcok density (2individual/km^2)(FARAGO,1986). The populations autumn density increased up to 5,62 individual/km^2, but the 59,6 % next year spring stock density (2,27 individual/km^2) has developed in consequence of winter mortality. In 1999 the autumn stock density was only 4,73 individual/km^2, but the winter loss scale has decreased from last year (45,8 %) and that is why in year 2000 the spring density rose to 2,66 individual/km^2. Unfortunately this years natality rate decreased from last year's, so the autumn stock density has shown 3,84 individual/km^2 during the investigations.

The 23 % winter loss could be a result of the mild winter, thus the population mildly increased, and in spring 2001 the measuring gave a 2,96 individual/km^2 partridge density. This years natality was the highest, because the autumn stcok density increased to 7 individual/km^2.

In year 2001 the winter loss was by far the highest (78,8 %) and for the last year in spring the spring stock density decreased to 1,48 individual/km^2.In

the last year of investigation the sample ground measuerd a quiet low 3,05 individual/km^2 autumn density (figure 6.).

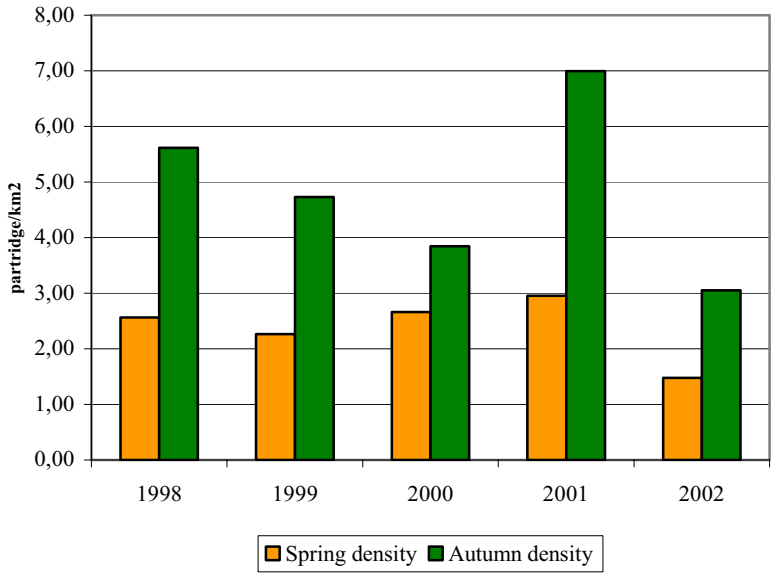


Figure 6.:Partridge's spring and autumn stock density at Biharkeresztes

Study on the relation between habitat ratio and pheasant individual density

The habitat preference studies have shown, that which habitat types are the ones, that pheasants whihc live in agricultural environment during the year choose. Since the habitat type ratio can differ from every habitat, thus we could rightly ask, that has it any effect on pheasant stock extent, or on stock density. The current field habitat pattern is determined by the ownership and applied agricultural technologies. But for wild game management, and within the field habitat develompent, it is an important data, that the different ratio of habitat types show realiton between the individual density of wild species (pheasant).

During habitat preference investigation the pheasant prefered the field and grazing ground regions in compliance with it's supply ratio and the regression analysis on a 5 % probability level showed significant connection between region ratio and spring stock density data (figure 7.). At the same time it can be laid down as a fact, that stock density change could be explainable only 25,5 % with field ratio increase (R^2=0,2551), and ohter environmental factors have determined sping density (e.g. winter loss).

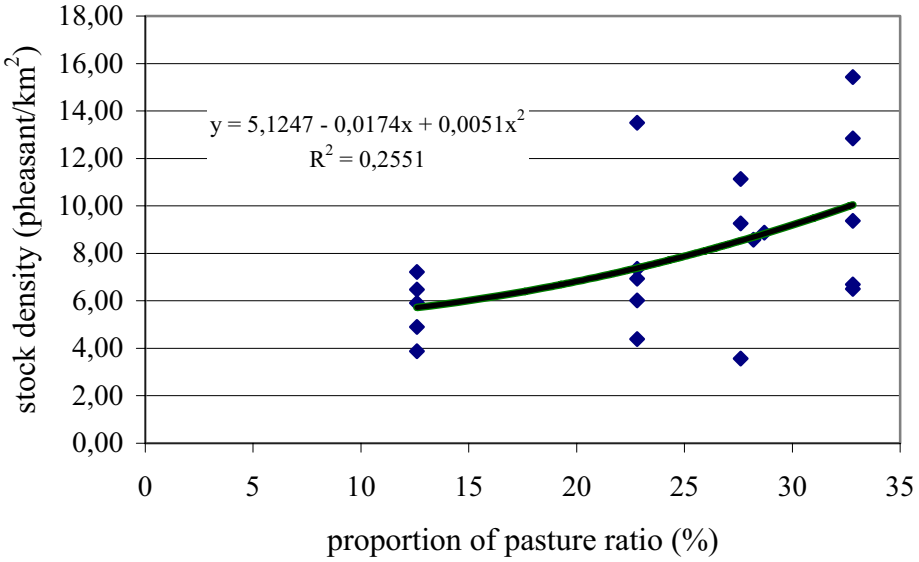


Figure7.: Relation between proportion of pasture and pheasant spring stock density

It appeared in course of habitat choosing investigations, that among domestic pheasants living in agricultural environment, the quail positively prefers autumn grain fields. Therefore that was the only species we have searched for relations between spring stock density and autumn grain supply ratio. During data analysis we have found on 1 % error probability level significant relations between winter wheat field ratio increase and quail spring density (r=0,656).

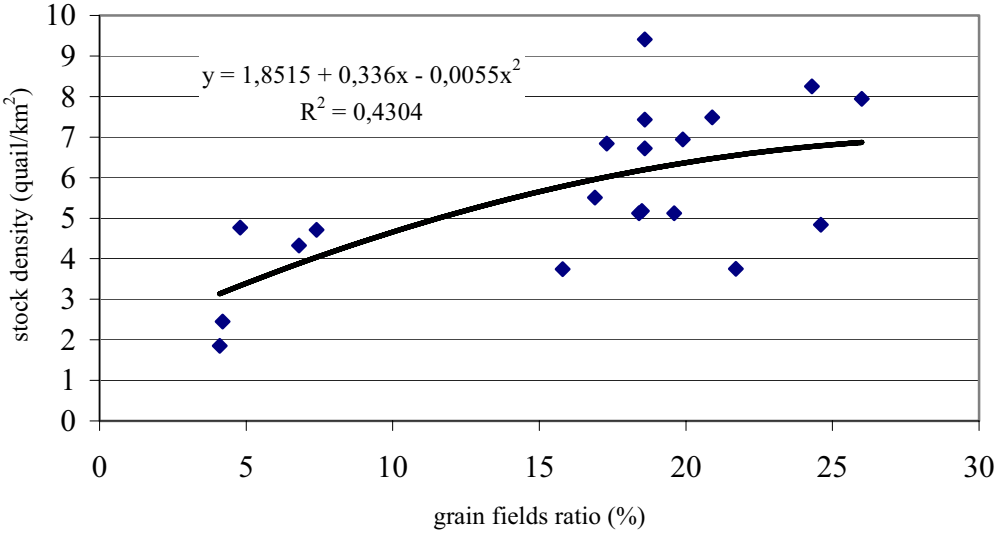


Figure 8.: Relation between winter grain fields ratio and quail spring stock density

Winterly set on foot maize investigation

The collection of data on sample regions justified that pheasants and partridge in late autumn and winter period gladly stayed on spontaneous, or on not harvested maize fields. These fields by means of density gave protection, but especially nutriment for the birds. Because all the preference values on both species were pozitive (Iv>0,5), therefore we searched for relationship between the „standing on foot maize" field ratio and the two species next year spring density.

After analysing the data I have found a quiet strong (P=0,1%) connection between not harvested, in winter period standing on foot maze field ratio and the pheasant spring density. The relation is shown in figure 9. It can be seen, that the connection is mainly linear, on the basis of I have found out that by raising the not harvested maize fields by 1 % the pheasant spring density have risen to an approximately 0,3 individual/km^2. The stock density change could be explained in an approximate 50 % by this element (R^2=0,4894).

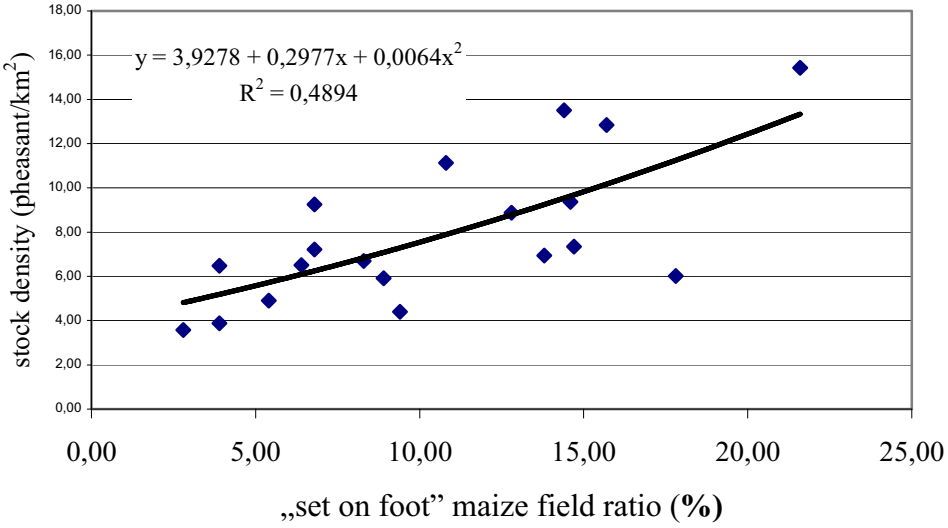


Figure9.: Connection between the „set on foot" maize field ratio and the pheasant next year stock density

I have received the highest correlation value (r=0,866) in case of the partridge, and during the data analysis i have found quiet strict (P=0,1%) relation between the not harvested maize fields and the partridge next year density (10.figure). The relation is actually linear, thus can be told, that by raising the not harvested maize fields by 1 %, the partridge next year stock density have risen to 0,15 individual/km^2 during the study. The stock density change could be interpretable in 75 % by this element (R^2=0,7514).

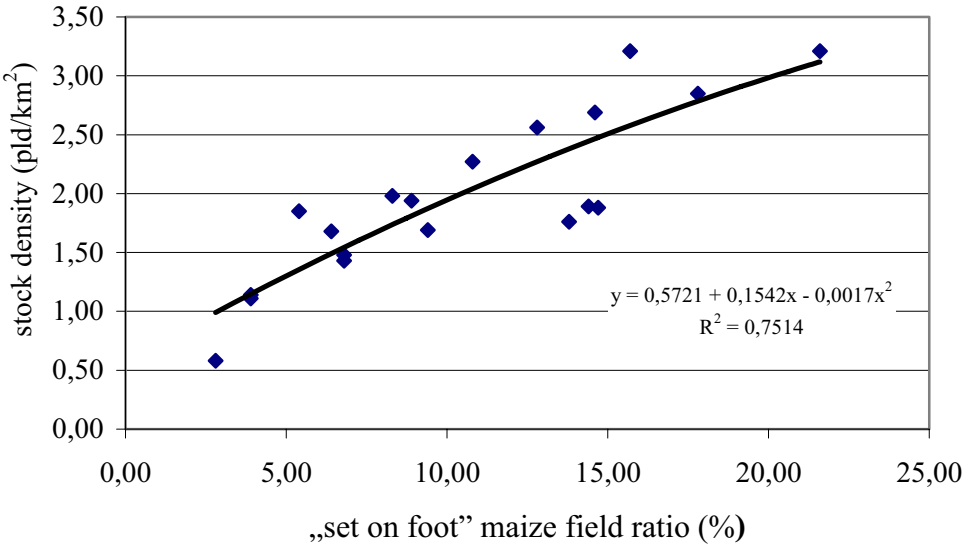


Figure 10.: Connection between the „set on foot" maize field ratio and the partridge next year stock density

V. NEW SCIENTIFIC ACHIEVEMENTS

The preformed habitat preference on the four sample regions have shown, that all three pheasant specie's habitat choosing is determined of the regions structure, it's agricultural usage. At the same time in all three region types (Bihari region, Hajdúság, Dél-Nyírség) each habitat preference relationship – in spite of the different supply –is equal. From the experimental data the following new, respectively modern scientific achievements can be verified:

1. Among the spring grain, pheasant didn't choose spring barley, only corn as a habitat, especially in june and july. At this time again in case of all three species we received high preference values.
2. Investigation has clearly validated, that the maize for the quail during it's whole stay here was a negatively preferred habitat.
3. The preference for the partridge and pheasant for the maize habitat is twofold. The spring and summer periods had explicitly negative preferences, but the late autumn and winter periods had pozitive preferences.
4. I have found out, that there is a really strong (P=0,1%) relation between the not harvested set on foot winter maize region ratio and pheasant's next year spring density. Therefore I propose that during the habitat

development works the desinged cultivated crop shold get highlighted attention.

5. I have verified a significant connection between the not harvested set on foot winter maize region ratio and partridge's next year spring stock density too. Thus the connection between the large field maize sown area and partridge is still negative. By leaving some hectare maize on habitats, prove to raise the partridge's winter survival chances, hereby the next year stock.
6. I have found that the autumn grain types are the most impotant habitats for qail. The standing autun grain, and its stubble also were srongly preferred habitats during the investigation on all four sample regions.
7. During the habitat preference investigations, I have found out, that for quail before the autumn migration the most important habitat was the medick. Beside the strong preference, we have numerically registered the most birds here. That is why preserving these habitats at the same time may result in the quail successful, premigration congregate.
8. I have found out, that among the stubble, especially the grain stubble for the quail, maize stubble for the pheasant and partridge are preferred habitats in late summer and autumn periods. At the end of winter the extant stubble were rarely used by the pheasant and partridge. They prefer the still standing, but pereviously hand broke fields.
9. The habitat area pattern, the field extent for the quail was not so determined like in case of the pheasant and especially the partridge. Quail could be found both inside and ont he edge of great autumn grain fields, but pheasant and partridge mainly preferred linear structured habitats for most time during the year. That is why the two bird species emphasized more the tree and shrub lines as well as the road and side of ditch habitat choosing.

VI. THE PRACTICAL UTILITY OF CONSEQUENCES

The preservation of nature and wild game management habitat development is often puzzled in that single drawn species regarding to cohorts should use the artifical and natural habitetscreated for them. The results aquired from our study have shown single cash growing role at field habitats in csase of the examined species, thus in course of the development works such boundary structures can be established, which equally promote the successful reproductive period and the winterly survival chances.

On further investigationI gave proof, that close structured forest belts and bush stripes are accepted habitats for only the pheasants. Thus for the sake of the partridge stock enlargement the agriculturist has to establish open structured,

abundantundergrowth bush and forest belts. We have come to a conclusion during our study, that cultivated and „left on foot” maize in winter had great role in the survival chances of the pheasant and partridge and so in the next annual spring stock enlargement.

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