

**BirdLife International/BP/Fauna & Flora International
CONSERVATION PROGRAMME**

PROJECT TITLE:

CHAGRA'2000

Ukrainian project of conservation and studying chalk grasslands

FINAL REPORT

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KHARKIV, 2001

Summary

Chalk grasslands of North-eastern and Eastern Ukraine with numerous endangered and rare plant & bird species were in the spotlight of the project CHAGRA'2000, Ukrainian project of conservation and studying chalk grasslands. The level of rarity of plant species and their ecological preferences were under primary consideration together with trying to identify main conservation needs and to raise public concern for the habitats. The project expeditions were started in May, 2000 after receiving primary support and recognition from BirdLife International/BP/Fauna & Flora International Conservation Programme and British Ornithologists' Union (Small Research Grant Scheme).

Special investigations in more than 20 sites in 8 river valleys enabled to clarify the conservation status and the level of vulnerability of 13 plant species listed in 1997 IUCN Red List of Threatened Plants. As a result some changes in IUCN status of several chalk plant species are suggested. We recommend to refer the following species as endangered mainly due to small extent of occurrence (highly fragmented range) or suspected population reduction: *Pinus sylvestris* var. *cretacea*, *Silene cretacea*, *Daphne sophia*. The following species should be referred as vulnerable: *Schivereckia podolica*, *Syrenia talijevii*, *Genista tanaitica*, *Hedysarum ucrainicum*, *Linaria cretacea*, *Scrophularia cretacea*, *Elytrigia stipifolius*. We recommend to treat *Androsace koso-poljanskii*, *Hyssopus cretaceus* and *Artemisia hololeuca* as rare species and *Festuca cretacea* as the species with indeterminate status. For the first time reliable quantitative information on abundance and habitat requirements of these species was gathered when assessing plant community structure along slope profiles.

One of the focuses of ornithological investigations was Tawny Pipit ecology and role it plays in bird communities of chalk grasslands. The results of this case study show both the dependence of Tawny Pipit abundance on habitat features distinctive for virgin chalk slope habitats and the tolerance to impact factors considered in the analysis. Despite discouraging results of searches of such rare birds of prey as Lesser Kestrel and Pallid Harrier, promising success was achieved under the activity of studying vulnerable Eagle Owl. More than 35 breeding pairs were found in Lugansk and Donetsk regions and main factors of threat for the species were identified.

Conservation education was recognised as high-priority activity in attempts of changing the situation with protection of chalk grasslands. Several excursions with schoolboys and students aimed at familiarising with common and rare chalk grassland plant & bird species were organised under the project activity. A leaflet focusing on most endangered species of chalk grasslands was prepared and circulated among local conservationists and teachers in village schools being in close vicinity to chalk grassland sites. These education activities indicate that local teachers and schoolboys are in instant need of special identification guide for Ukrainian chalk plants. The future conservation actions for chalk grasslands may be grounded on the activities of local school enthusiasts.

As main factors of threat for the habitat (afforestation and over-grazing) and principal habitat requirements of chalk plant species were identified, a basis for target-oriented protection is formed. Necessary conditions were created for starting the process of organising a regional national park on the territory occupied by chalk grasslands in Dvourechnaya district, Kharkiv region.

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Introduction

Among other ecosystems of the North-eastern and Eastern Ukraine (mainly, Middle Russian Plain region) **chalk grasslands** constitute very distinct and isolated communities which occupy relatively small areas along elevated right banks of rivers of Don and Miuss basins. Some small sites of chalk grasslands were found also along banks of rivers of Dnieper basin in Sumy region. Chalk grasslands are home for a brilliant gathering of endemic plant species which has formed in these conditions since tertiary times.

Plant communities of chalk grasslands are formed of several distinct species groups of different origin. The origin of most interesting assemblages enriched by endemic species should be dated back to late Tertiary. The most intriguing and ancient group is so-called *Hyssopus* assemblage. It includes species extremely well adapted to the conditions of chalk substratum (e.g. *Hyssopus cretaceus*, *Scrophularia cretacea*, *Linaria cretacea*, *Silene cretacea*). Many of them are related to the species of Mediterranean flora. Another group is formed by the species of thinned pine forests which formerly existed on chalk slopes of river valleys. Chalk variety of Scots pine (*Pinus sylvestris* L. var. *cretacea*) dominated in such forests. This group probably being of the same age as *Hyssopus* assemblage includes some exceptionally interesting and rare endemics as e.g. *Daphne sophia*. Another association of chalk plant species is of more recent origin. It comprises species of peri-glacial hill steppe landscapes of Quaternary time. Many species of this group originated from mountainous flora of Central Europe and Caucasus (e.g. *Androsace koso-poljanskii*, *Schivereckia podolica*). The region of Middle Russian Plain provided continuous favourable conditions for plants when climate seriously worsened in Quaternary. Many plant species survived glacial period just in chalk grassland habitats. Several successive invasions in Quaternary shaped the structure of plant communities of chalk outcrops. As a result, some groups of plants which are different by the time of entering into chalk plant communities can be discerned.

In general, last glaciation have had no or quite moderate destructive impact on plant communities of the territory. This resulted in high share of endemics or relicts in local flora. Most species are endemics of Don basin or even Seversky Donets (main tributary of Don river) basin. Chalk grasslands of North-eastern & Eastern Ukraine should be treated as a centre of endemism (Tallis, 1991) where the distributions of several unrelated endemic populations coincide. Chalk grasslands of North-eastern and Eastern Ukraine should be also considered as paleoreugia because of more recent time of origin of landscapes in surrounding matrix (Nekola, 1999).

J.S. Pate and S.D. Hopper (1994) stressed that the most obvious cases of restricted distributions and rarity come from species inhabiting unusual landforms of limited area. This is exactly the same we found for Don basin endemics since most of them are characteristic for chalk outcrops. The majority of these endemic species depends on specific soil conditions. Outcrops of cretaceous sediments of ancient elevated terraces in river valleys (Sobolev, 1936) provide these species by necessary habitats.

The plant communities of chalk grasslands are unique since in many cases rare, relict or endemic species such as *Artemisia hololeuca* or *Androsace koso-poljanskii* can be dominants of the vegetation cover. Moreover, chalk grasslands are the only undisturbed steppe-like habitats of North-eastern & Eastern Ukraine. Characteristic steppe plants such as *Stipa* species often form vegetation cover of the upper parts of chalk hills (Ermolenko et al., 1981).

19 plant species of Ukrainian chalk grassland habitats are listed in 1997 IUCN Red List of Threatened Plants (Walter, Gillet, 1998) but almost a half of them (9 species) is referred in this record as having indeterminate status. Chalk grassland sites are home for such rare endemic plant species or varieties with restricted range as:

Species	Status according to 1997 IUCN Red List of Threatened Plants (Walter, Gillett, 1998)
<i>Pinus cretacea</i> Kalen. (<i>Pinus sylvestris</i> L. var <i>cretacea</i>)	Indeterminate, endemic, relict
<i>Silene cretacea</i> Fisch. ex Spreng.	Indeterminate, endemic of Seversky Donets basin
<i>Schivereckia mutabilis</i> Alexejenko (<i>Schivereckia podolica</i> (Besser) Andrz.)	Indeterminate, endemic of Seversky Donets basin
<i>Syrenia talijevii</i> Klokov	Vulnerable
<i>Androsace koso-poljanskii</i> Ovcz. (<i>Androsace villosa</i> L.)	Indeterminate, endemic of Kharkiv region
<i>Daphne sophia</i> Kalen.	Indeterminate, tertiary relict
<i>Astragalus dasyanthus</i> Pall.	Rare
<i>Astragalus zingeri</i> Korsh.	Vulnerable
<i>Genista tanaitica</i> P.Smirn.	Indeterminate
<i>Hedysarum cretaceum</i> Fisch. ex DC.	Rare
<i>Hedysarum ucrainicum</i> B. Kaschm.	Rare
<i>Onobrychis radiata</i> (Desf.) Bieb.	Rare
<i>Linaria cretacea</i> Fisch. ex Spreng	Vulnerable, endemic of Seversky Donets basin
<i>Scrophularia cretacea</i> Fisch. ex Spreng.	Indeterminate, endemic of Volga and Don basin
<i>Hyssopus cretaceus</i> Dubjan. (<i>Hyssopus officinalis</i> L.)	Endangered, endemic
<i>Artemisia hololeuca</i> Bieb. ex Besser	Vulnerable, endemic of Seversky Donets basin
<i>Serratula tanaitica</i> P. Smirn.	Indeterminate
<i>Elytrigia (Elymus) stipifolius</i> (Czern. ex Nevski) Melderis	Indeterminate
<i>Stipa dasyphylla</i> (Lindem.) Trautv.	Rare

Many other plant species not listed in IUCN compendium are also quite rare or declining. These species often are considered as true species by Ukrainian botanists (see, for example, Prokudin, 1987) but synonymised by authors of Flora Europaea list (Tutin et al., 1964-80). Undoubtedly, very scarce or even no information on the level of commonness or rarity of chalk plant species is known for compilers of IUCN Red list of Threatened Plants. The absence of relevant data on these species' abundance complicates estimation of global status of chalk steppe sites of North-eastern & Eastern Ukraine as compared to similar grassland habitats in Palearctic.

Despite some interest shown by Ukrainian botanists in 1950-70s in studies of chalk grasslands no or very scarce current information has been gathered on status, abundance and level of vulnerability of rare plant species up to now. However, 37 chalk plant species were included in Ukrainian Red list according to general considerations (Red Data., 1996). Thus, thorough studies were needed to clarify the conservation status and to estimate the level of threat for these species.

Chalk grassland ecosystems of North-eastern and Eastern Ukraine support several rare and vulnerable bird species with poorly known status (see Tucker, Heath, 1994). Lesser Kestrel, Pallid Harrier, Booted Eagle, Short-toed Eagle, Eagle Owl are those birds of prey and owls which either use these habitats as hunting grounds or as breeding sites (Vetrov, 1993; V. Vetrov & V. Kinda personal communication). Lesser Kestrel and Pallid Harrier are among the least known threatened raptors of Ukraine for which long-term decline in numbers and considerable reduction of the breeding range were reported. It's important to note that the only well-known colony of Lesser Kestrel (4-5 pairs) in Eastern Ukraine was found in chalk ravine in Seversky Donets river valley near Krivaya Luka, Donetsk region (Vetrov, 1993). Pallid Harrier was formerly reported as the species which used chalk grasslands as both breeding and hunting grounds (Somov, 1897). For both species new searches of breeding colonies or breeding pairs are evidently needed as even the current status in Ukraine is only hypothetically known.

Eagle Owl gives another example of the species which is highly depended on the state of chalk grassland habitats in Eastern Ukraine. 1999 field season surveys in Lugansk region organised by Lugansk branch of Ukrainian Union for Bird Conservation showed that steppe ravines with chalk grassland habitats supported viable population of the steppe subspecies of Eagle Owl, *Bubo bubo interpositus Rothsch. et Hart.* (V.V. Vetrov, personal communication). This initial study points to the necessity of more thorough studies of Eagle Owl distribution and numbers and identification of possible factors of threat for the species.

Among more abundant and wide-spread species Tawny Pipit being vulnerable at European level (Tucker, Heath, 1994) is probably the most characteristic passerine bird for Ukrainian chalk grasslands. According to 1997 preliminary studies Tawny Pipit is the species for which the virginity of the habitat is crucial. But very little was known on relations between habitat parameters & disturbance level and numbers of the species. Special studies on Tawny Pipit were considered as being essential for the assessment of the overall vulnerability of chalk grassland birds.

Despite the conservation importance from a global scale, chalk grassland ecosystems of North-eastern & Eastern Ukraine are being protected at a lesser degree as compared to many other ecosystems of the region. Protected areas already created to conserve chalk grasslands constitute only 0,017% of the territory of the region. Scientific grounds for the protection are poor. When creating the protected areas in 1970s, main attention was paid to the searches of sites supporting rare plant species, whereas no relevant information was gathered on animal species (e.g. birds or insects) distribution and numbers. A number of endangered and rare species are not covered by the existing protected areas. The protection is restricted to prohibition of land use changes only. No other special measures have been applied. As a result, the protection is rather formal. Other gaps in crucial knowledge for chalk grassland protection are absence of relevant information on relationships between habitat or topographic diversity of chalk grassland sites and their species diversity and absence of reliable data on the impact of unfavourable factors (such as over-grazing, pine planting, chalk quarrying and others) on the state of the habitats. Such information is notably needed for planning conservation measures.

Moreover, general public takes no obvious support or interest in saving chalk grasslands. Such situation requires considerable and lasting efforts to be changed. Numerous gaps in our knowledge on chalk grassland ecosystems motivate to start special investigations aimed at understanding priorities for their conservation.

The idea on planning the expedition to chalk grassland sites of Eastern Ukraine with wide spatial coverage was originated from preliminary expedition trips of 1995-1997 in Kupyansk and Dvourechnaya districts, Kharkiv region organised by Tatiana Atemasova and Mikhail Banik within the Important Bird Areas (IBA) program of BirdLife International. In 1999 attraction of young botanists to the problem resulted in assembling a team of students and post-graduates and in developing a project CHAGRA'2000.

The project received official recognition and approval from Kharkiv board of Ukrainian Ministry of Ecology and Natural Resources, North-Eastern branch of Ukrainian Ornithological Society, Kharkiv branch of Ukrainian Union for Bird Conservation and Kharkiv branch of Ukrainian Botanical Society. The project started in May, 2000 after receiving the support by BP Amoco/BirdLife International/Fauna & Flora International Conservation Programme and BOU small ornithological grants programme.

Personnel

Tatiana Ateasova, 37 years old, ornithologist, scientific worker at Kharkiv National University, has great experience in field zoological investigations. Role in project: project leader, co-ordinator of conservation programme, responsible for post-project conservation activity, leader of first field crew.

Yuri Gamulya, 30 year old, post-graduate at Kharkiv National University, botanist, has an experience in field botanical investigations. Prize-winner of International Science Soros Foundation (1997). Role in project: responsible for botanical investigations in first expedition crew.

Mikhail Banik, 27 years old, ornithologist, research worker at Ukrainian Forestry Research Institute, greatly experienced in line transect counts (full distance measuring) of birds in open habitats. Participant of project «Adji lake ecosystem - conservation for the future» (1998) supported by BP Conservation Programme. Role in project: co-ordinator of scientific programme, leader of second expedition crew, responsible for ornithological work in expeditions and for the assessment of different factors' impact on chalk grassland ecosystems.

Ivan Mironenko, 40 year old, teacher of biology, working at local school at Volchansky Chutora village, one of chosen key sites of the project, has an experience in field ornithological investigations and ecological education. Role in project: co-ordinator of education programme, responsible for education activities in first expedition crew.

Galina Gouz, 30 year old, botanist, working in Lugansk region, has an experience in studies of rare plant species ecology and grazing impact on grassland ecosystems, in 1993-1998 worked in nature reserves «Galichya Gora» and «Les na Vorskle». Role in project: responsible for botanical investigations in second expedition crew.

Anton Vlashchenko, 18 years old, ornithologist, student of Kharkiv National University, experienced in field investigations. Chairman of Druzhina (Team) for Nature Conservation of Kharkiv National University. Role in project: observer (bird counts, searches for rare bird species).

Yulia Kuznetsova, 18 years old, botanist, student of Kharkiv National University, has an experience in field investigations. Member of Druzhina (Team) for Nature Conservation of Kharkiv National University. Role in project: botanist (plant communities studies).

Yulia Taglina, 21 years old, botanist, student of Kharkiv National University, has an experience in field investigations and ecological education. Member of Druzhina (Team) for Nature Conservation of Kharkiv National University. Role in project: responsible for education activities in second expedition crew.

Alexander Sukhina, 17 years old, botanist, student of Chuguev Forestry College, native of Rubezhnoe town, Lugansk region, close to one of chosen sites, has an experience in field investigations. Participant of project «Clean banks for Severski Donets river» (1999) supported by Royal Netherlands Embassy in Ukraine. Role in project: botanist (plant communities studies).

Alexander Volontsevich, 20 years old, ornithologist, student of Kharkiv National University, has an experience in field investigations. Role in project: observer (bird counts).

Fieldwork methodology

The general design of the survey of chalk grassland sites is developed to represent adequately all main river valleys with chalk outcrops within North-eastern and Eastern Ukraine (mainly, Don basin). Within certain river valley sampling is based upon random choice (Cohran, 1977). The number of sites to be sampled was identified according to proportional representation of chalk grassland habitats in each river valley ensuring that the number of sampling quadrates is sufficient for the proper assessment of plant communities' structure (Mirkin, Rosenberg, 1978).

The following methods were used when implementing project working plan:

Vegetation studies

Main method of the assessment of chalk plant species composition and abundance was profile sampling. Average number of sampling quadrates on profile at certain site was 35 to 40. The area of each quadrate is 1 sq. m. At each site sampling quadrates were regularly sampled along slope profiles to represent adequately different topographic positions (see below). The number of profiles were identified according to the required number of sampling quadrates at the site. At each profile the first sampling point was selected at random and the subsequent points (quadrates) at fixed intervals (usually, every third quadrate was sampled). At each sampling quadrate plant species composition and abundance were estimated by recording species cover using modified Braun-Blanquet rating (Poore, 1955):

Scale	Cover range
r	<1%
f	<2.5%
+	2.5-5%
1	5-15%
2	15-25%
3	25-50%
4	50-75%
5	75-100%

Habitat assessment includes both general information that describes a site (profile) on the whole and quadrate specific information. General site information is based on the following parameters (main profile parameters are marked by bold font): **geographical co-ordinates (latitude, longitude)**, slope type (straight, concave, convex, or mixed), **slope inclination** (accurate to 5°), substratum type (chernozem, chernozem with chalk crumb, chalk fragments), vegetation stratification (are there any strata or no), mean height of each stratum (to 2,5 cm), cover percent (to 5%), grass to herb ratio, erosion level (two parameters: relative number of erosion elements, relative extension of erosion elements), grazing regime (5 classes), **chalk quarrying impact** (yes or no), **afforestation impact** (yes or no). Quadrate specific information comprises the following parameters: **topographic position at slope profile** (top and upper slopes, mid-slope and lower slopes), **slope aspect**, **slope inclination**, **substratum type**, **cover percent**, **mean height of vegetation cover**, **grazing regime**. This information is used to identify habitat preferences of some plant species and to outline the factors which determine the structure and composition of plant communities.

Additional route studies were used to get more comprehensive data on species composition and to find some non-numerous or patchily distributed species. These complementary studies of chalk species composition were accomplished in close vicinity to sampling profiles. Besides, some descriptions of plant communities of chalk grasslands were made on route studies in sites where no profile descriptions were completed due to the lack of time. The sites marked on the map (App. I, Fig. 1) are those where profile and route studies were organised.

Special searches of rare and scarcely distributed plant species (first of all, *Linaria cretacea* and *Silene cretacea*) were organised at certain sites where suitable habitats were found. Sometimes the searches are successful but rather patchily distribution of many species seriously hampered the fieldwork. In all cases when *Linaria cretacea* was found the site was carefully described noting first of all the total area of the site, the species abundance, and also habitat parameters (slope position, detailed relief information, substratum description, slope inclination, general vegetation cover) and the composition of associated plant species.

Bird surveys

Tawny Pipit

Studies of Tawny Pipit distribution and numbers and the species role in bird communities of chalk grasslands was accomplished by using transect counts. Transect count was chosen as a working method as it is especially suitable in open habitats (Bibby et al., 1992).

Transect routes of known length (usually about 2-2,5 km) were established in 24 sites along chalk slopes within 7 river valleys. On these routes the count method of full-distance measuring was used. The method was originally developed by Hayne (Hayne, 1949) and lately modified by Yu.S. Ravkin (Ravkin, 1967). It is extremely useful for counting birds in open habitats. All birds occurred within selected habitat type are counted regardless of the distance. Flying birds are counted also and then included in calculation using Yapp method (Yapp, 1956). The following assumption was made when calculating population densities: singing males are considered as pairs for those species regarded as probably breeding. Population densities for certain species were calculated using separate recount by the distances of detection. 6 classes of distances of detection were used: 0-25 m, 25-50 m, 50-100 m, 100-250 m, over 250 m. To calculate population density we used the following formula:

$$D_i = \frac{\sum_{j=1}^m k_j n_{ij}}{L},$$

where D_i - population density of a certain species i , in ind./sq.km, n_{ij} - the number of individuals of i species counted in a j -class of distances, L - the total length of transect, k_j - constant coefficient depending on the width of a given interval of distances of detection.

Three main estimates of Tawny Pipit abundance were calculated for each site: population density (ind./sq. km), occurrence (ind./km) and share in bird community structure (% of the overall bird population density). For each site main habitat parameters and impact factors were identified. Habitat parameters include slope profile type, slope profile part, aspect, slope inclination, substratum type, stratification of the vegetation cover, mean height of the vegetation cover, mean height of each vegetation stratum, vegetation cover and grass to herb ratio. Also river and geographical position of the site were taken as additional parameters. Impacting factors comprise erosion level (two parameters), grazing impact level, chalk quarrying level, pine planting.

Additional information on the habitat preferences of the species was obtained by the analysis of habitat parameters of Tawny Pipit breeding territories. The total of 36 territories were assessed by the above-mentioned habitat parameters and grazing load level.

The data were carefully processed and screened before implementing main analysis methods. Some sites were excluded from the analysis because of the very small size of transect routes or due to rather variable habitat conditions. The following methods were used for the analysis of the data: estimation of non-parametric correlation (Spearman R, Kendall tau), multiple regression method, Kruskal-Wallis test by ranks, analysis of variance, multivariate analysis of variance (taking all three estimates of Tawny Pipit abundance as depending variables).

Birds of prey and owls

Special searches were undertaken at as wider coverage of the territory of chalk grasslands as possible to ascertain the population state of rare birds of prey and owls. As a rule all great chalk ravines were carefully inspected in order to find adult birds, nests or prey remains, pellets or other indicators of birds' presence. The spatial scope of these searches is wider comparing with the studies of plant communities and Tawny Pipit ecology. All main river valleys with chalk outcrops were inspected in Kharkiv (Volchaya, Oskol, Seversky Donets rivers) and Lugansk (Krasnaya, Aydar, Evsug, Kavsug, Luganchik, Teplaya, Derkul, Kamyshnaya, Seversky Donets rivers) regions. Each time when some signs of birds' presence were found (Eagle Owl) all observations were aimed at ascertaining the status of registered birds (single birds or pairs, any signs of breeding, distraction behaviour and so on). All precaution measures were taken to minimise possible negative effect on breeding birds. Nest sites were described and some aspects of breeding biology were registered by cautious inspection of nests. Prey remains were carefully analysed. All breeding territories are mapped to provide a basis for future monitoring of the population numbers. In some cases the data were gathered by questioning local people especially herdsmen and hunters. The latter enabled to trace the history of several pairs on certain territories. Special attention was paid to identifying the factors of negative impact on Eagle Owl population. Questioning provided a majority of the data on such factors.

Conservation education

The following methods and actions were used to achieve the objectives of the project in field of environmental education and spreading information on chalk grasslands:

- meetings with local teachers and amateurs with an aim to clarify the role of chalk grasslands
- organising excursions for local schoolboys in chalk grassland habitats
- organising excursions for students to familiarise them with chalk grassland plants and animals
- educational meetings with students of Kharkiv National University and Kharkiv Pedagogical University aimed at integration of the project results in the programs of environmental education
- organising meetings for familiarising regional scientific community with main results of the project (Kharkiv National University)
- preparing, publishing and distributing a leaflet with basic information on rare and threatened chalk plants and animals among local teachers and local conservationists
- publishing press releases and papers in regional newspapers

Fieldwork results

Plant surveys

General results

Plant surveys within CHAGRA'2000 expeditions covered main sites with chalk grasslands in Ukraine. The total of 20 sample profiles were established and additionally 22 transect routes were used in the same or some other sites to gather supplementary data on rare species distribution and

chalk plant communities' structure (see the map of all sites; App. I, Fig.1). The following sites were visited within the project activities: Zarutsky village, Seym river basin, Sumy region (profile and transect route), Grunivka village, Psyol river valley, Sumy region (transect route), Malaya Volchaya village, Volchaya river valley, Kharkiv region (profile and transect route), Budarki village, Volchaya river valley, Kharkiv region (profile and transect route), Topoli village, Oskol river valley (profile and transect route), Krasnoye village, Oskol river valley, Kharkiv region (profile and transect route), Novomlynsk village, Oskol river valley (profile and transect route), Dvourechnaya town, northern point, Oskol river valley, Kharkiv region (transect route), Dvourechnaya town, southern point, Oskol river valley, Kharkiv region (transect route), Kalinovo village, Oskol river valley, Kharkiv region (profile and transect route), Lysogorka village, Seversky Donets river valley, Kharkiv region (profile and transect route), Protopopovka village, Seversky Donets river valley, Kharkiv region (transect route), Kamenka village, Seversky Donets basin, Kharkiv region (profile), Bogorodichnoe village, Seversky Donets valley, Donetsk region (profile), Tatyankovka village, Seversky Donets valley, Donetsk region (profile), Sidorovo village, Seversky Donets valley, Donetsk region (profile), Serebryanka village, Seversky Donets valley, Donetsk region (profile and transect route), Grigorovka village, Seversky Donets valley, Donetsk region (transect route), Preobrazhennoe village, Kobylka river, Krasnaya river basin, Lugansk region (profile and transect route), Chervonopopovka, Krasnaya river valley, Lugansk region (profile and transect route), Sharovka village, Aydar river valley, Lugansk region (profile and transect route), Khvorostyanoe village, Aydar river valley, Lugansk region (transect route), Zakhotoe village, Aydar river valley, Lugansk region (profile and transect route), Petrenkovo village, Aydar river valley, Lugansk region (profile and transect route), Karpovo-Nadezhdinka village, northern point, Krynka river, Miuss river basin, Donetsk region (profile and transect route), Karpovo-Nadezhdinka village, southern point, Krynka river, Miuss river basin, Donetsk region (profile and transect route).

The overall data on the richness of chalk plant communities in investigated sites can be reviewed on the maps (App. I, Fig.2-A,B). The first map represents the total species richness at each site (the combined list of species derived from both profile studies and route studies). The second map gives a picture of species richness at each site based on the data from sample profiles only.

The results of large scale survey of Ukrainian chalk grassland communities can be briefly summarised as follows: for the first time reliable information was gathered on the abundance and ecological preferences of chalk grassland plants both common and rare with wide spatial coverage (the whole territory of North-eastern and Eastern Ukraine). The results can be used for clarifying the current conservation status of rare chalk plant species as well as to organise species specific protection measures.

The most complete ecological information was gathered on the following rare species included in 1997 IUCN Red List of Threatened Plants: *Androsace koso-poljanskii*, *Genista tanaitica*, *Linaria cretacea*, *Scrophularia cretacea*, *Hyssopus cretaceus*, *Artemisia hololeuca*. This general ecological information along with more detailed data on the relations of species abundance with particular habitat parameters can be used for searches of new locations of the species as well as for developing species-oriented protection measures. Below the detailed information on the distribution, abundance and habitat preferences of chalk plant species listed in IUCN Red List of Threatened Plants is given according to the data gathered within CHAGRA'2000 activities:

Silene cretacea

This species should be considered as one of the rarest and most threatened of chalk plant endemics of Eastern Ukraine. In spite of very careful and intensive searches it was found only in one site (Zakhotoe village, Aydar river, Lugansk region; App. I, Fig. 3-A). *Silene cretacea* was registered on 4 of 40 quadrates on profile (10% occurrence) situated in bench position (inclination 0°) on mid-slope. Just this bench is used by local people to drive livestock from upper slopes to Aydar river flood-plain meadows. Therefore, grazing impact was estimated as being extremely

heavy (rating 5). Mean species cover ranged from r to f (mean value 0,8%). *Silene cretacea* individuals grew well distanced one from another and about 50% of them were in state of good vitality with flowers. General vegetation cover was extremely low due to the above-mentioned over-grazing. It varied from 5 to 20% (mean value (11,3%), so as only at one of the quadrates where *Silene cretacea* was found a threshold of 5% for single species was taken (by *Artemisia hololeuca*). Mean vegetation height ranged from 2,5 to 5 cm (mean value 4,4 cm).

Schivereckia podolica

Schivereckia podolica is an extremely rare species with highly fragmented distribution. It was found in only one site of all profiles and routes investigated (Serebryanka village, Seversky Donets valley, Donetsk region, App. I, Fig. 3-B). It was registered on one quadrate of 38 sample quadrates on the profile (2,6%) in lower slope part. Slope aspect was 10°. Slope inclination amounted to 40°. Grazing regime was estimated as 2. Cover range estimate for this species was 2,5 to 5%. General vegetation cover amounted to 55%. Mean vegetation height was 12,5 cm. Only one species, *Genista tinctoria*, was comparatively abundant on the quadrate.

Additional data gathered in the vicinity to the sample profile showed that *Schivereckia podolica* was confined very strictly to lower slope parts with mainly northern aspect. The main substratum was represented by firm chalk with thin chernozem layer. Often quite large chalk fragments up to 20 cm in diameter were found in such sites. Vegetation cover was comparatively well developed. Several individuals were found flowering in July (although spring blooming is reported in available literature; Alexeyenko, 1946) but flowers lacking peduncles were attached in centres of rosettes. In some parts of the area where *Schivereckia podolica* was found evident signs of damaging plants through intensive grazing were registered.

Syrenia talijevii

Syrenia talijevii is a rare endemic species with heavily fragmented range. It was registered on 2 sample profiles in Kharkiv and Donetsk regions. Mean weighted occurrence of the species was 7,4%. The species cover ranged from r to f ratings and averaged to 0,92%. *Syrenia talijevii* occurred mainly on the quadrates where general vegetation cover was comparatively high and ranged from 55 to 90% (mean cover amounted 75%). Among dominants of the vegetation cover main accompanying species were *Onosma tanaitica* (44,4% of sample quadrates with *Syrenia talijevii* registered), *Thymus calcareus* (33,3%), *Carex humilis* (33,3%), *Gypsophila altissima* (22,2%) and *Festuca valesiaca* (22,2%). Vegetation height was about 12,5 cm. All but one findings of the species were confined to mid-slope positions with inclination ranged from 0° to 40° (mean value 8,3°). Substratum types were chalk and chalk with thin chernozem layer. Grazing impact ratings were 1 to 2.

Androsace koso-polijanskii

Androsace koso-polijanskii is a typical species of undisturbed chalk grasslands in northern parts of the investigated region. The species is often a dominant of vegetation cover but always together with some other species. It was found on 6 sample profiles in Kharkiv region within Volchaya and Oskol river valleys being completely absent on chalk slopes in eastern and southern regions (Donetsk and Lugansk regions). The mean vegetation cover on these sites varied greatly from 5 to 100% but the species clearly preferred the slopes with high vegetation cover (see Fig.?.; mean value 68,%; median value 75%). The mean vegetation height ranged from 5 to 40 cm (mean and median values were very close; 17,9 and 17,5 cm, accordingly). *Androsace koso-polijanskii* is confined mainly to gentle slopes (sites with inclination angle 0° to 10° comprised 50% of the quadrates where the species was recorded). The range of inclination variation is wide (0° to 45°; mean value 16,4°; median value 12,5°). The species preferred mid-slope positions (92,7% of the quadrates) but rarely grew also in lower third of the slope. The very indicative is the distribution by grazing ratings (see Fig.?) as 80,9% of the quadrates were on the sites without any signs of disturbance (range 1 – 4; median value 1). The mean weighted species occurrence was

comparatively high – 29,8%. The abundance of *Androsace koso-polijanskii* often indicated an important role it plays in chalk plant communities' structure (the species cover exceeded 5% on 36,8% of the quadrates). The range of abundance ratings was wide (r to 4; mean value 7,7%; median value 1,75%). The list of accompanying dominant species is long (41 species) but the most usual satellite species was *Carex humilis* (47,1%). The following species or species groups were also quite common: *Salvia nutans* (14,7%), *Bromopsis riparia* (11,8%), *Thymus calcareus* (36,8%), *Stipa* species (30,9%), *Gypsophila altissima* (14,7%), *Onosma tanaitica* (13,2%).

The analysis of possible relations between *Androsace koso-polijanskii* abundance and some habitat parameters revealed the only clear relationship with general vegetation cover (Spearman R = 0,35; p < 0,004; Kendall T = 0,26; p < 0,002). Some weak relations were found also with mean vegetation height (Kendall T = 0,22; p < 0,05).

Genista tanaitica

Genista tanaitica is one of the characteristic but not numerous chalk plant species. It was registered on 7 sample profiles and on 1 transect route in Kharkiv, Lugansk and Donetsk regions. The mean vegetation cover on these sites was medium to comparatively high. It varied in very wide range from 5 to 100% (mean and median values were quite similar; 57,8% and 55%, accordingly). The mean height of vegetation cover on the quadrates where the species was recorded ranged from 2,5 to 50 cm (mean value 15,4 cm; median value 12,5 cm). The very indicative distribution was revealed for slope inclination (see Fig.?). *Genista tanaitica* obviously preferred gentle slopes (range 0° - 40°; mean value 11,9°, median value 10°). Clear preference was also detected for slope position (92% of the quadrates were in mid-slope positions). The majority of the quadrates where *Genista tanaitica* was recorded were undisturbed by grazing (76,6%). The mean weighted occurrence of the species was comparatively high – 37,0%. The abundance varied slightly from r to 1 and was mainly very low (mean value 1,5%, median value 1,75%). The cover of the species was less than 2,5% on 88,5% of the sample quadrates. The list of accompanying dominant species was very long but the most frequent were *Stipa* species (34,5% of the quadrates) and *Thymus* species (33,3%). Other important satellites were *Salvia nutans* (11,5%), *Gypsophila altissima* (11,5%), *Artemisa hololeuca* (20,7%) and *Carex humilis* (23,0%).

No sound conclusions can be drawn about the relations between *Genista tanaitica* abundance and allowed habitat parameters. Weak correlation was found only for the species abundance and slope inclination (Spearman R = -0,28; p < 0,01; Kendall T = -0,24; p < 0,002). The highest abundance was found for the slopes with gentle inclination. Some relations were found also with such parameter as general vegetation cover.

Hedysarum ucrainicum

Hedysarum ucrainicum is one of the typical chalk plant endemics with extremely local and fragmented range confined to some sites in Lugansk region, Ukraine and in Voronezh region, Ruusia. The species was found only at one transect route near Sharovka village, Aydar river, Lugansk region. The majority of *Hedysarum ucrainicum* individuals observed at this site on 4.08.2000 already finished blossoming. The species grew mainly on low chalk hills of unusual profile structure with gentle inclination, mainly in lower third of the slope. The substratum was pure chalk chiefly along wash-out gullies. *Hedysarum ucrainicum* often dominated here in vegetation cover, so, that at one place the cover of the species occupied an area of about 1000 m². Main accompanying species occurred with *Hedysarum ucrainicum* were *Artemisia hololeuca*, *Hyssopus cretaceus* and *Artemisia salsoloides*. This site is situated in outskirts of Sharovka village so that village dump (where in addition to usual waste some fertilisers were thrown out) is in the immediate vicinity to the plots where the species grew. It should be mentioned also that the site is under the threat of gradual afforestation, as another slopes of the same hills are already partly afforested by *Pinus sylvestris*. The site is certainly unique for the protection of this poorly studied and exceptionally rare, near threatened species in Ukraine. Besides, the site is very important as here several other species of IUCN red list are grown such as *Hyssopus cretaceus*, *Artemisia*

hololeuca, *Linaria cretacea* and *Genista tanaitica*. *Hedysarum cretaceum* (only one individual!) was found also about 5 km lower along Aydar river valley near Tanyushevka village on gentle slope (about 10°) with accompanying abundant *Matthiola fragrans*, *Artemisia hololeuca* and more sparse *Thymus calcareus*, *Astragalus albicaulis*, *Genista tanaitica*, *Hyssopus cretaceus* and *Scrophularia cretacea*.

Linaria cretacea

Linaria cretacea Fisch. ex Spreng. is an exceptionally rare species within the investigated region. It was found only on two sample profiles (Fig.), one in Kharkiv region (Kalinovo village, Oskol river), another one in Lugansk region (Zakhotnoe village, Aydar river). Additionally, the species was found in two route studies (Dvourechnaya village, Oskol river; Sharovka village, Aydar river). Individuals of *Linaria cretacea* were found only on 6 quadrates on above-mentioned sample profiles. Therefore, some complementary information was gathered, whenever possible, on the ecology of *Linaria cretacea* groups. Mean weighted occurrence of the species calculated for two profiles was 7,7%. All quadrates were situated on mid-slope parts. Mean inclination was 6,7°. Mean vegetation cover amounted to 17,5%. Mean vegetation height totalled 5,8 cm. Mean *Linaria cretacea* cover was 1, 13% on the quadrates where the species was registered. Grazing regime varied from 2 to 5, thus, the species can be found even in the conditions of very intensive grazing impact. *Linaria cretacea* was found on the quadrates where either no plant species dominated in the general cover (more than 5% of the cover), or such dominants were *Artemisia hololeuca*, *Thymus dimorphus* and *Thymus calcareus*.

The total of 29 groups of *Linaria cretacea* was analysed to get additional data on habitat preferences of the species. The area occupied by scarce groups of *Linaria cretacea* ranged from 0,1 to 30 m² while mean area was 8,2 m². Mean weighted density in such groups amounted to 39 individuals/ m². Mean vegetation cover on the sites where *Linaria cretacea* groups were found was 15,9%. The overall distribution of the sites by this parameter can be seen at Fig. The prevalence of sites with small values of general vegetation cover is clearly visible. Another distribution on the same Fig. is for slope inclination within the sites. Slopes with gentle inclination (10-15°) are the most favourable habitats of the species. *Linaria cretacea* apparently grow on comparatively plain sites between gullies where continuous wash-out of fine-grained chalk material took place. Chalk fragments are mainly less than 1 cm in diameter (most of all, 0,7 to 0,8 cm). Other preferred habitats include slopes of well-expressed gullies or small ravines and bottoms of gullies. The following species are very characteristic being associated with *Linaria cretacea* groups: *Asperula tephrocarpa* (50% of described sites), *Pimpinella titanophila* (46,2%), *Odontites lutea* (42,3%), *Gypsophila altissima* (30,8%), *Diplotaxis* sp. (26,9%) and *Scabeosa ochroleuca* (26,9%). These species are not only abundant in the above-described habitat conditions but also in the state of high vitality. Some other species can occur even more frequently but the individuals of the species are usually found in suppressed condition: *Hyssopus cretaceus* (65,4%), *Matthiola fragrans* (57,7%), *Artemisia hololeuca* (46,2%), *Scrophularia cretacea* (26,9%), *Thymus calcareus* (26,9%).

Scrophularia cretacea

Scrophularia cretacea is a less common satellite of more widely distributed *Hyssopus cretaceus*. This interesting and rare endemic species was registered on 5 sample profiles in Kharkiv and Lugansk regions (Fig.?). It was found on sample quadrates where mean vegetation cover ranged between 5 and 60% (mean value 26,3%, median value 20%). Such characteristics are very close to the same in *Hyssopus cretaceus* showing even more pronounced tendency of the species to grow on the sites with very scarce cover on pure chalk substratum. The mean vegetation height on the quadrates where *Scrophularia cretacea* was registered varied from 2,5 to 20 cm being generally low (mean 8,6 cm; median value 7,5 cm). The species grew on the sites with high amplitude of inclination values (from 0° to 40°; mean 11,3°; median value 10°) but it preferred more gentle slopes as compared to *Hyssopus cretaceus*. The latter can be an indirect result of evidently higher

tolerance of *Scrophularia cretacea* to grazing impact, the factor acting mainly in gentle slope conditions. The distribution of the quadrates with *Scrophularia cretacea* by grazing ratings is at some extent even (see Fig.?). Grazing impact was assessed as varying from 1 to 5 with median value 3 (!). All sites where the species was registered were in mid-slope positions. The mean weighted occurrence of *Scrophularia cretacea* on sample profiles was 18,9%. The species abundance was mainly very low (from r to 1; mean value 3,3%; median value 1,75%; see also Fig.?). It's noteworthy to state that very often there are no dominant species accompanying *Scrophularia cretacea* (41,2% of the quadrates). The most usual dominants were *Thymus* species (44,1%), as in the case of *Hyssopus cretaceus*, and *Artemisia hololeuca* (17,7%).

Very few significant conclusions can be made about the habitat preferences of *Scrophularia cretacea* based on the gathered data of sample quadrate descriptions. The only significant or near significant correlation coefficients were found for mean vegetation height and the species abundance (Spearman R = 0,33; p < 0,06; Kendall T = 0,27; p < 0,03), probably, being a reflection of better state of plants in conditions of lesser grazing impact.

Hyssopus cretaceus

Hyssopus cretaceus is a rather characteristic species of chalk slopes especially on chalk scree and taluses where continuous movement of coarse chalk fragments is the main habitat factor. It was registered on 11 sample profiles and on some additional sample transects in Sumy, Kharkiv, Donetsk and Lugansk regions (see Fig.?). Vegetation cover on the quadrates where *Hyssopus cretaceus* was registered ranged from 5 to 85%, with mean value 32,3% and median value 30%. Clear confidence to the sites with generally low vegetation cover can be seen on Fig.?. Mean vegetation height on these sites ranged from 2,5 to 40 cm (mean value 8,9 cm; median value 7,5 cm). The species more often was recorded on the sites where mean vegetation height was comparatively low (5-7,5 cm). The observed distribution by inclination angle over the sites was very significant (see Fig.?). 24,3% of the quadrates where *Hyssopus cretaceus* was recorded were on extremely steep slopes with 45° inclination! Mean inclination was 26,2°, while median value amounted to 25°. All registrations of *Hyssopus cretaceus* were made in mid-slope positions. Grazing impact on these quadrates was rated 1 to 5 with clear prevalence of undisturbed sites. Mean weighted occurrence of the species on sample profiles was 17,5%. The abundance of the species ranged from r to 2 (mean value 4,2%; median value 1,75%). It should be noted that the registrations are almost evenly distributed among abundance ratings showing that the species can be as often dominant in vegetation cover as very scarce. The most common accompanying species among dominants of the vegetation cover (more than 5%) were *Thymus* species (*Thymus calcareus* at 32,9% of the sample quadrates on which *Hyssopus cretaceus* was registered, *Thymus dimorphus* – 11,4%). The very usual accompanying species were also *Artemisia hololeuca* (34,3%) and *Pimpinella titanophila* (12,9%). It's important to note that often *Hyssopus cretaceus* was recorded on the quadrates where no plant species can be considered as dominants (24,3%).

Attempts to reveal important habitat preferences of *Hyssopus cretaceus* indicated most of all certain dependence of the species abundance on grazing impact. Calculated non-parametric correlation coefficients between grazing impact and *Hyssopus cretaceus* abundance were highly significant (Spearman R = -0,40; p < 0,002; Kendall T = -0,34; p < 0,0001). In other words, the heavier is the load of trampling, the lower is the species abundance. The influence of the same factor was revealed also by non-parametric analogue of the analysis of variance (Kruskal-Wallis test, H = 11,37; p < 0,02). Significant correlation coefficients were found also between mean vegetation height and *Hyssopus cretaceus* abundance (Spearman R = 0,25; p < 0,04; Kendall T = 0,21; p < 0,012). Some relations were also revealed between slope inclination and the species abundance (Kendall T = 0,16; p < 0,05).

Artemisia hololeuca

Artemisia hololeuca is without doubt the most numerous and one of the most widely distributed (except *Hyssopus cretaceus*) species among chalk plant endemics. It is a very unusual species

with poorly known systematic position. *Artemisia hololeuca* was found on 8 sample profiles in Kharkiv, Donetsk and Lugansk regions (the total number of sample quadrates where the species was registered was 169). It is a characteristic member of a group of western chalk plant endemics with the range mostly concentrated within Seversky Donets valley but with one isolate in southern parts of Donetsk region, in Krynka river valley.

The mean vegetation cover on the quadrates where *Artemisia hololeuca* was recorded varied in an exceptionally wide range from 5 to 100% (mean and median values very close; 49,7% and 50%, accordingly). The species is among main dominants of vegetation cover on firm chalk substratum, thus, it often represented considerable part of the general vegetation cover. The mean vegetation height on these sites ranged from 2,5 to 35 cm (mean value 9,2 cm; median value 7,5 cm) with clear peak for 5 – 7,5 cm. The distribution of the quadrates by inclination angle is very indicative (Fig. ?) showing apparent tendency to grow in a range of 5-10° (mean value 16,7°; median value 10°). The same clear preference was pronounced also in slope position. The overwhelming majority of quadrates with *Artemisia hololeuca* were situated in mid-slope positions (95,9%). The species is probably very sensitive to grazing impact that reflected in characteristic distribution of quadrates by grazing ratings (see Fig. ?; range 1 to 5, but median value 1). 67,5% of the quadrates where the species was recorded were on the sites with no grazing impact. The mean weighted occurrence of *Artemisia hololeuca* on the sample profiles amounted to 58,5%. As it was mentioned above, the species is apparently dominant in vegetation cover. Abundance ratings varied from 1 to 4 (mean and median values very close; 9,4 and 10%, accordingly). The distribution by abundance estimates can be seen on Fig. ? The list of accompanying dominant species is comparatively long (45 species!) with extremely apparent prevalence of *Thymus* species (59,8% of quadrates). Also very usual were the following accompanying dominants: *Onosma tanaitica* (10,1%), *Pimpinella titanophila* (11,2%), *Scabeosa ochroleuca* (11,2%) and *Carex humilis* (10,1%).

Weak correlation was found between *Artemisia hololeuca* abundance and such parameters as mean vegetation cover (Spearman $R = 0,22$; $p < 0,005$; Kendall $T = 0,17$; $p < 0,001$) and inclination angle (Spearman $R = 0,15$; $p < 0,046$; Kendall $T = 0,12$; $p < 0,017$). Kruskal-Wallis test revealed no significant relations with involved parameters (mean vegetation height, grazing impact and slope position except above-mentioned).

Elytrigia stipifolius

Elytrigia stipifolius is one of the very patchily distributed species with clear confidence to the sites with thin to middle chernozem layer on chalk substratum. It was registered only on 3 sample profiles in Donetsk region (the southernmost parts of the investigated region) and Lugansk region. The species is apparently confined to upper or lower slopes with high general vegetation cover where it usually takes dominant positions. The mean vegetation cover on such sites ranged from 60 to 100% (mean value 85,6%; median value 90%). The mean vegetation height was usually very high (5 to 45 cm; mean value 24,8 cm; median value 22,5 cm). The slope inclination varied in limited boundaries (0° to 20°; mean value 8,8°; median value 5°). 66,7% of the quadrates were situated either in upper or in lower slope positions where chernozem layer is well apparent (see Fig. ?). The grazing impact on the sites where *Elytrigia stipifolius* was registered is usually very low (1 to 2). The mean weighted occurrence of the species on sample profiles amounted to 22,4%. The species is chiefly dominant (see Fig. ?), thus the abundance is usually very high (1 to 5; mean value 29,0%; median value 10%). The majority of accompanying dominant species is formed of characteristic plants of upper slope positions: *Artemisia salsoloides* (37,5%), *Jurinea stochaedifolia* (20,8%), *Teucrium polium* (20,8%), *Onosma tanaitica* (33,3%), *Thymus calcareus* (41,7%), *Pimpinella titanophila* (25%), *Linum ucrainicum* (16,7%), *Amygdalus nana* (16,7%) and *Stipa capillata* (16,7%).

The analysis of the relations between *Elytrigia stipifolius* abundance and considered habitat parameters allowed to state about some clear tendencies. The very reliable relations were found

between general vegetation cover and the species abundance (but one should be reminded that the species often plays a significant role in the development of the cover). The non-parametric correlation was comparatively high (Spearman $R = 0,61$; $p < 0,002$; Kendall $T = 0,47$; $p < 0,001$). The same tendency was revealed by applying Kruskal-Wallis test ($H = 15,21$; $p < 0,03$). The strong relations found for mean vegetation height and species abundance seemed to be apparently tied to the above-mentioned dependence on the development of general cover (Spearman $R = 0,73$; $p < 0,00005$; Kendall $T = 0,59$; $p < 0,00005$). The application of multiple regression analysis (mean vegetation cover, mean vegetation height, inclination angle, slope position and grazing impact taken as independent variables) showed also significant dependence on mean vegetation height and on grazing level (about 89% of the variance of *Elytrigia stipifolius* abundance explained by the factors involved in analysis; $F = 9,66$).

Festuca cretacea

Festuca cretacea is one of the poorly known chalk plant endemics with a fragmented range and very low abundance. It was registered on 4 sample profiles in Kharkiv, Lugansk and Donetsk regions (the total of 15 quadrates). The mean vegetation cover on these sites varied from 20 to 80% (mean value 51,3%). The mean vegetation height was 7,5 to 17,5 cm (mean value 11,0 cm). The species can be found both in mid-slope and in lower slope positions. The slope inclination varied from 10° to 50° (mean value 33,3°), so it can grow in the conditions of very steep slopes. The grazing impact on the sites where *Festuca cretacea* was recorded ranged from 1 to 4 (mostly 2). The mean weighted occurrence of the species amounted to 10,2%. The species abundance wasn't high but in some it can reach 10% or more (r to 2; mean value 4,4%). Three species can be considered as primary accompanying dominant species: *Thymus calcareus* (46,7%), *Asperula tephrocarpa* (46,7%) and *Artemisia hololeuca* (26,7%).

Bird surveys

General bird surveys were usually undertaken in those sites where intensive vegetation studies are accomplished. This enables to use habitat information in attempts to estimate the relations between bird numbers and habitat features. Some data on the composition of bird communities of chalk grasslands are gathered along with information on vertical distribution of the birds on slope profile. Searches of raptors and Eagle Owl were organised on more broad territories including some minor river valleys and chalk ravines in Lugansk region.

Tawny Pipit (Anthus campestris) in chalk grassland habitats: factors impacting distribution and numbers

Tawny Pipit (*Anthus campestris*) deserves special attention of both professional ornithologists and conservationists being a vulnerable bird species in European part of the range with pronounced decline in numbers reported for many regions of Europe (Tucker, Heath, 1994). Thus, it's important to obtain reliable estimates of the relations of Tawny Pipit abundance with main habitat features and impact factors. In North-eastern Ukraine the species uses two main breeding habitats: chalk slopes and sand dunes in river valleys. Ornithological part of the CHAGRA'2000 project (Ukrainian project of conservation and studying chalk grasslands) is organised to estimate the relations between Tawny Pipit abundance and habitat parameters & disturbance factors.

For the purposes of this study transect counts of Tawny Pipit and other birds were made in May-July 2000 in 24 sites within 7 river valleys in North-eastern and Eastern Ukraine (Sumy, Kharkiv, Lugansk and Donetsk regions). Three main estimates of Tawny Pipit abundance were calculated for each site: population density (ind./sq. km), occurrence (ind./km) and share in bird community structure (% of the overall bird population density). For each site main habitat parameters and impact factors were identified. Habitat parameters include slope profile type, slope profile part, aspect, slope percent, substratum type, stratification of the vegetation cover, mean height of the vegetation cover, mean height of each vegetation stratum, vegetation cover and grass to herb ratio. Also river and geographical position of the site were taken as additional parameters. Impacting

factors comprise erosion level (two parameters), grazing impact level, chalk quarrying level, pine planting. Moreover, estimates of Tree Pipit (*Anthus trivialis*) abundance were taken as complementary variables. Additionally, 36 territories of Tawny Pipit were assessed by the above-mentioned habitat parameters and grazing load level.

The data on habitat parameters and impact load were carefully processed and screened before implementing main analysis methods. Some sites were excluded from the analysis because of the very small size of transect routes or due to rather variable habitat conditions. Estimation of non-parametric correlation (Spearman R, Kendall tau) was applied as an initial analysis method. In Table 1 main results of this initial step in data analysis are given (only those correlation coefficients where p-level is less than 0,05). The data reveal clear and reliable relations between any estimates of Tawny Pipit abundance and mean height of vegetation cover. The taller is the vegetation, the lesser is Tawny Pipit numbers. The same is true for the relations between Tawny Pipit abundance and mean height of the 1st vegetation stratum which usually strongly correlates with mean height of the vegetation. Tawny Pipit abundance correlates also with the part of slope profile as the species shows slight tendency to breed in middle parts of the slope and to avoid upper parts where the vegetation cover is generally taller, with higher grass to herb ratio. It's interesting also to note some level of negative correlation between Tawny Pipit abundance and the numbers of the other pipit species, Tree Pipit which uses far more broader spectrum of habitats. Both species are characteristic for chalk grassland habitats in Ukraine and the mentioned relations can be attributed to some difference in habitat preferences rather than to the result of interspecific competition.

This initial analysis was used for identifying the parameters for more stronger analysis methods which comprise multiple regression method, one-factor and multi-factor analysis of variance, multivariate analysis of variance (taking all three estimates of Tawny Pipit abundance as depending variables). The general preconditions for using these methods are the type of variables (nominal, ordinal or interval) involved, the problem of data normality and the level of correlation identified in initial analysis.

All multiple regression models used for the analysis of Tawny Pipit habitat requirements show most of all the significance of mean vegetation height in predicting Tawny Pipit abundance. The only significant beta coefficients were derived just for this habitat parameter ranging from -0,33 to -0,46. The best results were got in multiple regression models when considering slope profile part, mean height of vegetation cover, grass to herb ratio and Tree Pipit density as independent variables ($R^2 = 0,336$). In all cases involved factors explain no more than about 25% of the variance of Tawny Pipit abundance estimates in applied multiple regression approach.

Applying the technique of the analysis of variance (anova) resulted in finding less apparent but also significant relations between estimates of Tawny Pipit abundance and habitat parameters. In one-factor anova models significant results were obtained for not only mean height as grouping factor but also for vegetation cover ($p < 0,05$; $F = 3,01$, $F = 3,40$, accordingly; taking Tawny Pipit density as dependent variable). The two-factor anova models produce significant results for only two mentioned habitat parameters (Tawny Pipit density and occurrence were used as dependent variables).

Multivariate analysis of variance was accomplished taking all calculated estimates of Tawny Pipit abundance as dependent variables. This method showed the only significant result for vegetation cover as grouping variable (Wilk's lambda = 0,419; $p < 0,05$). The results reflect the effect of this indicator more sharply if Tawny Pipit share has been excluded (this parameter is related with overall bird community structure concealing direct habitat effects).

Table1. Correlation (Spearman R, Kendall tau) between estimates of Tawny Pipit abundance and different factors (habitat parameters and estimates of Tree Pipit abundance)¹.

Factors (habitat parameters and estimates of Tree Pipit abundance)	Estimates of Tawny Pipit abundance					
	Tawny Pipit density		Tawny Pipit share in bird community structure		Tawny Pipit occurrence	
	Spearman R	Kendall tau	Spearman R	Kendall tau	Spearman R	Kendall tau
Slope profile part	<i>-0,342</i>	<i>-0,275</i>	-	<i>-0,270</i>	-	-
Mean height of the vegetation cover	-0,578	-0,469	-0,532	-0,430	-0,458	-0,366
Mean height of the 1 st vegetation stratum	-0,473	-0,370	<i>-0,385</i>	-0,311	-	<i>-0,262</i>
Tree Pipit density	-	<i>-0,234</i>	-	-	-	-
Tree Pipit share in bird community structure	<i>-0,338</i>	<i>-0,262</i>	-	-	-	-

Assessment of Tawny Pipit breeding territories give us additional information that can help to unravel the relations between estimates of Tawny Pipit numbers and habitat parameters & impacting factors. The principal parameters involved in this investigation are the same as in transect counts.

The results of this study showed that some corrections may be added to the pattern revealed in described investigations. First of all, this touches such parameters as substratum type and stratification of the vegetation cover. The distribution by substratum type was obviously shifted in so manner that the territories with chalk substratum without any soil layer prevailed (57,1%). At the same time, the territories with apparent soil layer comprise only 11,5% of the total investigated. The shift in distribution by the stratification of the vegetation cover points to the tendency for Tawny Pipit to occupy sites without any stratification (77,1%).

Other results of the inspection of Tawny Pipit territories allow to supplement the outcomes of the described investigations at higher level. For instance, we can conclude that Tawny Pipit prefers sites with mean vegetation height ranging from 12,5 to 20 cm (such sites comprised together 57,2% of the assessed territories). The situation is not so clear for such parameter as vegetation cover. The territories are comparatively evenly distributed by vegetation cover groups with maximum for 80% cover (20,0%). The tendency to occupy territories in middle slope positions can be illustrated by the results for such parameters as slope profile part and slope percent. The territories situated at middle and middle to upper slope positions amount to 74,3% of the investigated. The distribution by percent slope simply indicates the prevalence of values characteristic for middle slope positions. The distribution by grazing load probably reflects general rarity of sites with severe load. Notably even distribution by classes indicating no, less or medium grazing load (34,3, 34,3 and 22,9%, accordingly) demonstrated certain tolerance to this factor impact.

¹ Coefficients with p-level below 0,01 are highlighted by bold font while those with p-level below 0,05 were printed in italics.

Searches of Lesser Kestrel and Pallid Harrier

Unfortunately, the results of our searches of the most rare and endangered species such as Lesser Kestrel and Pallid Harrier can be reported as nearly dead failure. The only known colony of Lesser Kestrel on chalk steeps of Seversky Donets river in Donetsk region has disappeared. Lesser Kestrel wasn't recorded during our expeditions. It should be noted also that there were only single records of Common Kestrel in the investigated region. Common Kestrel were registered only in 3 of 28 sites specially surveyed during expedition searches of rare raptors. This confirms clear overall decline tendency for the species numbers in Northern and North-eastern Ukraine reported by regional ornithologists for the last decade. Common Kestrel also use chalk steeps as breeding habitat (records of pairs which breed in such conditions are known for Lugansk region only). The species uses niches in chalk steeps as sites for building nests. No clear cause of the prolonged decline for both species is evident. The results of the surveys convince that Lesser Kestrel is especially rare or even extinct in the observed region.

Despite there were no records of birds which can be identified as Pallid Harriers one finding of the expedition can be considered as indication of the presence of this extremely rare harrier species in investigated region. 23.07.2000 an egg was found on a hillock on chalk slope of northern aspect in close vicinity to the geo-botanical profile near Karpovo-Nadezhdinka, Donetsk region (the southernmost site surveyed by the expedition team). This egg belonged to some harrier species without doubt. It was lily-white with the following dimensions: 43,4 x 35,9. It should be noted that this egg evidently wasn't of Marsh Harrier (*Circus aeruginosus*) (too small) or of Montagu's Harrier (*Circus pygargus*) (too large), both the most common harrier species in North-eastern and Eastern Ukraine (see species specific egg dimensions in Makatsch, 1974). It's almost completely impossible that this egg can be of Hen Harrier (*Circus cyaneus*), the species with breeding range situated far more northerly. Thus, we supposed that the egg belongs to Pallid Harrier most probably. In any case, this is the only indication for this species presence obtained from the expedition searches.

Nevertheless, the expedition searches of raptors gained some records of rare species. Chalk slopes are used as feeding territories by such species as European Honey-buzzard (*Pernis apivorus*), Black Kite (*Milvus migrans*), White-tailed Eagle (*Haliaeetus albicilla*), Short-toyed Eagle (*Circaetus gallicus*), Marsh Harrier, Montagu's Harrier, Northern Goshawk (*Accipiter gentilis*), Eurasian Sparrowhawk (*Accipiter nisus*), Common Buzzard (*Buteo buteo*), Booted Eagle (*Hieraaetus pennatus*), Common Kestrel and Hobby (*Falco subbuteo*). All these species were recorded during our expedition time. Four species were most abundant: Marsh Harrier (recorded in 11 of 28 sites), Montagu's Harrier (10 sites), Common Buzzard (19 sites) and Booted Eagle (11 sites). The latter is surprising and encouraging as Booted Eagle is the species of European Conservation Concern (Cat 3, rare). The species breed in small deciduous forests on elevated slopes of river valleys or in more vast forests in river floodplains. In both type of forests the main tree species is oak. Booted Eagles constantly use chalk grassland sites as hunting grounds, thus they depend on the virgin state of these sites in appreciable extent. Montagu's Harrier is another raptor species which being mainly a meadow breeder depends on hunting sites in forest-less areas along elevated river banks. In Eastern and North-eastern Ukraine many of such sites are represented by chalk grasslands. Montagu's Harrier is also listed as deserving conservation concern in Europe (Cat 4) but is considered as stable.

Another species of European Conservation Concern recorded at the time of CHAGRA'2000 surveys were European Honey-buzzard (4 sites), Black Kite (5 sites), White-tailed Eagle (1 site) and Short-toyed Eagle (2 sites). The most interesting were registrations of two probably breeding pairs of Short-toyed Eagle both in Lugansk region (Aydar and Evsug river valleys). This species is highly secretive in breeding period and very rare in the surveyed region. Short-toyed Eagle actively used chalk grassland sites as hunting grounds. White-tailed Eagle was recorded only once within CHAGRA'2000 scope in Kharkiv region not far from Seversky Donets river valley where

great forest “Izhyumska Luka” is situated. The breeding of White-tailed Eagle in this forest has been known for about 10 years.

Eagle Owl inventory

The notably fruitful results were achieved in studying vulnerable Eagle Owl. Viable population of the species was found in the eastern part of the observed region. The total of 38 breeding pairs or territorial birds were registered including some findings of territories where the birds obviously nested in previous season but were killed in last winter or disappeared for an unknown reason (2 territories). The majority of Eagle Owl population is concentrated in Lugansk region (37 pairs). One pair was found in Donetsk region not far from the border with Lugansk region, thus, representing the same population. The species shows clear trend in geographical distribution. The number of Eagle Owl is evidently higher in eastern parts of the region while decreasing gradually towards western direction. This trend can be shown by the distribution of breeding pairs by river valleys. In the list given below the inspected rivers, most of which are the tributaries of Seversky Donets river are arranged downstream of the latter river, in eastern direction (the biggest rivers were indicated by bold type): **Oskol** river (no records), **Krasnaya** river (1 pair), **Aydar** river (5 pairs), Evsug river (3 pairs), Kovsug river (2 pairs), Luganchik river (2 pairs), Teplaya river (1 pair), **Derkul** river (13 pairs), **Kamyshnaya** river (6 pairs). The other breeding pairs were registered within Seversky Donets river valley. This distribution is caused most probably by habitat availability. In western parts of the region characteristic great forked chalk ravines are absent. Such sites are the most suitable for the breeding of Eagle Owl as all territorial pairs registered during our surveys were found in these sites.

The diet of the species was studied by inspecting the remains of prey found near the nests. The results were generalised by species only not by the numbers of taken animals as in many cases it was difficult to identify the latter. The list of the prey species is given in Table 2. The total number of inspected territories for identifying diet composition was 22. The diet is surprisingly various ranging from small rodents and birds (e.g. larks) to considerably large prey as hares or mallards. Some prey species evidently are more favourite e.g. among birds Grey Partridge (*Perdix perdix*) and Common Quail (*Coturnix coturnix*) and among mammals East European hedgehog (*Erinaceus concolor*).

At the majority of breeding territories nests with eggs, nestlings or fledglings were found. Some data on the time of breeding, behaviour and breeding success were gathered for the whole population. Hatching occurs in the mid of April mainly between 5th and 15th April. In day time when the female incubates, the male as a rule takes a permanent post usually within 100 m upward along the ravine. The mean clutch size was 2,91 (n=23, including a pair in which 2 clutches were found, one was deserted). Clutches with 3 eggs were most frequent (13 of 23; 56,5%), while clutches with 2, 4 and even 5 eggs comprised 34,8%, 4,4% and 4,4%, accordingly. The mean egg dimensions were the following (n = 15): 58,21 x 47,24 (maximum - 63,5 x 48,9 and 60,3 x 49,5, minimum - 52,0 x 43,6). The overall hatching success was assessed in 18 pairs. It amounted to 80,4% (41 nestlings hatched from 51 eggs). The causes of hatching failures were the following: no development of embryo (9 cases, 90% of all failures, 17,7% of all eggs), embryo death (1 case, 10% of failures, 2,0% of eggs). The overall breeding success was estimated by the ratio of the number of fledglings to the number of laid eggs in 12 pairs. It totalled 64,1% (25 birds fledged from 39 eggs). The majority of nestlings fledged and lost the nest to the end of May – early June. Fledglings kept together in a group usually slightly downward of the nest location along the ravine (within 100 m of the nest). Sometimes they trampled tracks in dense bush vegetation formed by *Caragana frutex*.

Main factors of threat for the population were identified by analysing the data of questioning local residents from adjacent villages, local hunters and herdsmen. The gathered information comprises not only the data of 2000 season but also those of 2 preceding seasons but all are for the sites surveyed during project expedition in 2000. Killing adult birds in winter during hunting on hares

is the most serious factor that leads to pair collapse. The breeding of Eagle Owl at the territories where such incidents were reported often has ceased for 1-2 seasons until the formation of a new pair. Hunting impact was reported with more or less reliable evidences for 7 breeding territories of 38 surveyed (18,4%). For 2 more territories the death of one bird in a pair was assumed but there were no data on the causes. Among mentioned 7 accidents of losses because of hunting 2 cases resulted in complete disappearance of birds from the territory. The pair wasn't formed in time for breeding in 2 of 7 above-mentioned cases (only one bird was registered at the territory). Late pair formation was surmised as a possible cause of unsuccessful breeding of one more pair. At last, 2 pairs on the territories previously suffered from hunting bred in 2000 season but in one pair the breeding was most probably unsuccessful.

Another negative factor that impacts the breeding success of Eagle Owl population is grazing. In 2 cases (5,3% of the surveyed part of the population) the tracks of cows were found in immediate vicinity to the nests. In one of these cases nestling fell out of the nest probably as a result of flushing the female by cows. In one more case (2,6%) the gathered questionnaire data evidenced that the nest was taken by herdsman in 1999 season.

Steppe fires was an additional harmful factor for Eagle Owl population state. The results of the questioning revealed one case (2,6%) when Eagle Owl nestling died as a result of steppe fire.

Chance factors also can effect the breeding success. In one case (2,6%) two eggs rolled out of the nest and fell into the marmot burrow in front of which the nest was built (the results of questioning of local residents; this accident occurred in 1999).

Table 2. The diet composition of Eagle Owl in North-eastern and Eastern Ukraine (the favourite prey species or species groups are highlighted by bold type).

Prey species	Number of territories where the remains were found
Mammals	17
Erinaceus europaeus	7
Lepus europaeus	1
Marmota bobak	2
Cricetulus migratorius	4
Arvicola terrestris	1
Ondatra zibethicus	1
Allactaga major	1
Mustela erminea	1
Birds	19
Anas platyrhynchos	5
Anas querquedula	3
Buteo buteo	1
Perdix perdix	15
Coturnix coturnix	8
Rallus aquaticus	1
Vanellus vanellus	1

Prey species	Number of territories where the remains were found
Strigiformes Including	9
Asio flammeus	2
Asio otus	1
Alauda arvensis	2
Oenanthe oenanthe	1
Corvidae Including	10
Corvus frugilegus	5
Corvus cornix	1
Pica pica	3

Factors of threat

Preliminary analysis of those unfavourable factors impacted chalk grassland ecosystems showed that afforestation should be considered as main destructive factor. Planting pine stands includes terracing chalk slopes as an initial operation that completely destroys native vegetation cover. Otherwise, the majority of chalk plants both rare and common entirely disappears after closure of forest tree crowns. The afforestation may be justified only if an endemic form of Scots pine *Pinus sylvestris* var. *cretacea* will be planted ensuring that no important locations of rare chalk plants are disturbed. But to the date traditional practice is to plant common form of Scots pine.

The problem of afforestation of chalk grasslands becomes more serious in recent time since special efforts are planned by Ukrainian State Forestry Committee to create stands on waste lands. Therefore, a lot of elucidative work is necessary to prevent precipitate measures and to identify which sites are extremely significant as habitats of threatened species.

The second unfavourable factor which should be noted is grazing. At some sites it seriously disturbs the structure of chalk grassland communities especially at top and upper slopes. The majority of typical chalk plants is inedible for livestock but these plants suffer greatly from trampling. Some rare plant species are especially vulnerable to the impact of this factor (such as *Artemisia hololeuca*) while other are much more persistent (e.g. *Silene cretacea*).

Direct human impact is a serious cause of threat for certain rare plant or bird species. For example, culling flowering *Paeonia tenuifolia* is the main factor of reducing this species abundance. The same situation is characteristic for such bird species as Eagle Owl. Direct human impact (nest destruction, killing adult birds during traditional winter hunting on hares) is the only factor of threat for the species nowadays.

Human disturbance often resulted in steppe fires which additionally affect the state of chalk grasslands. Fire impact is more pronounced in upper slope parts. Generally, fires are more destructive for animal populations especially for rare species (e.g. destruction of Eagle Owl nests and so on) comparing to plant communities.

Chalk quarrying should be regulated at several sites where it can impact the state of rare plant populations. However, it's a factor of minor importance as compared to the above-mentioned.

Erosion is a factor of mainly natural origin. It rarely threaten chalk grasslands because, as a rule, the majority of chalk plant species are well-adapted to erosion processes.

Discussion

Rare plant species status, abundance and ecological preferences

General pattern of distribution and diversity of chalk plant communities is mainly formed by an insular effect. This is reflected in apparent uniqueness of certain river valleys (and even certain outcrops). The uniqueness is expressed either in strong confidence of some species to certain river valleys (as e.g. *Hedysarum ucrainicum* to Aydar river valley, *Erysimum krynkense* to Krynka river valley and so on), or in evidently higher abundance of some species in certain river basin as compared to other river valleys (e.g. *Scutellaria alpina* in Krasnaya river basin, *Syrenia talijevii* in Seversky Donets valley, *Linaria cretacea* in Aydar river valley). Such clear differences in the structure of plant communities of chalk grasslands in certain river valleys can be explained as a result of historical causes. Another distinctive feature in the structure of plant communities is the higher species richness in the middle reaches of certain river (mainly tributaries of Seversky Donets river) that can be partly seen on the maps (Fig.?). This feature can be probably explained as a result of more ancient origin of chalk outcrops in the middle reaches as compared to the source or the lower reaches. In this case the middle reaches were colonised earlier that resulted in higher species richness. One should mentioned also that some peculiarities of rare species abundance can be explained as a reflection of their distribution. Some species which seem to be of more eastern origin can become more abundant in eastern direction towards the centre of the range (e.g. vulnerable and threatened *Linaria cretacea*, *Silene cretacea*, or more numerous *Artemisia salsoloides*). Below the data on distribution, abundance and habitat preferences of rare and threatened species are discussed mainly to draw some conclusions about the current status of these species, the factors of threat and necessary protective measures:

Silene cretacea is evidently one of the rarest chalk plant endemics. Searches of the species in Kharkiv region under CHAGRA'2000 project activities failed even in the sites from which it was reported in XX century. The only site in Lugansk region where the species was found is unique without doubt, at least within Ukrainian part of the species range. It should be noted that at the same site some other threatened and rare species were registered including *Hyssopus cretaceus*, *Artemisia hololeuca*, *Scrophularia cretacea*, *Syrenia talijevii* and *Linaria cretacea*. *Silene cretacea* was found growing in the conditions of very heavy grazing impact. All signs registered can be considered as evidences of the tolerance of the species to the influence of such destructive factor. Other chalk plant endemics are tolerant to this factor in much lesser extent (*Hyssopus cretaceus*, *Scrophularia cretacea*) while some of them are probably extremely sensitive (*Linaria cretacea*, *Artemisia hololeuca*). All individuals of *Silene cretacea* were found on the sites with very low general vegetation cover (the result of trampling) where negative consequences of competition with other species are mainly reduced. Probably, *Silene cretacea* is more tolerant to grazing than to the competitive influence of other chalk plant species. Another interesting remark is that the species was registered in bench position on mid-slope where the inclination is minimum. It's possible that such habitats are characteristic for *Silene cretacea*. Nevertheless, it should be noted that the above-mentioned considerations are grounded on very scarce data from only one site, so, should be regarded with certain level of deliberation.

According to the above-mentioned data and considerations we recommend to change the current status of the species in IUCN Red list from indeterminate to endangered mainly according to such criterion as very limited area of occupancy. Further investigations are needed to search possible sites where *Silene cretacea* grow and to identify the factors of threat.

Schivereckia podolica is a very rare species with main range concentrated outside the investigated area in more northern regions of Central Russia. This is probably the main reason for the species rarity in Eastern Ukraine. The same considerations are acceptable to explain the species confidence to the slopes of northern aspect. The site where *Schivereckia podolica* was found in Eastern Ukraine (Serebryanka village, Donetsk region) is, therefore, unique for this species

protection. Serious protective measures should be taken to ensure that the habitats of the species will not be disturbed in the future by grazing impact, the main factor of threat for this small population of *Schivereckia podolica*. The analysis of gathered and literature data convinced to recommend the changes of the species status in IUCN Red list from indeterminate to vulnerable taking into consideration most of all severely fragmented range of the species in Ukraine and Russia.

Syrenia talijevii is one of the poorly known chalk plant species. It is quite scarce and scattered even within the sites where it was registered. Range pattern of *Syrenia talijevii* clearly shows the signs of heavy fragmentation. Our findings can be regarded as some indication of concentration of the species populations chiefly in southern parts of the investigated region in Seversky Donets valley within Donetsk region mainly. Unfortunately, no considerations were proposed for the factors of threat for this species mainly due to very little information gathered to the date. We recommend to refer the species as vulnerable in IUCN Red list (it's the current status of the species) until new data will be gathered. We also recommend to list *Syrenia talijevii* in Ukrainian Red Data Book with the same status it is referred in 1997 IUCN Red List of Threatened Plants.

Androsace koso-polijanskii should be treated as one of the dominants in chalk plant communities in northern parts of the investigated region. The species is confined mainly to the mid-slope positions and to the sites with high vegetation cover. On such sites usually chernozem soil is developed and pure chalk substratum is very rare. The latter preference of *Androsace koso-polijanskii* can be indirectly confirmed by the analysis of the list of accompanying species including such important species (relict of peri-glacial steppe vegetation) as *Carex humilis*. The species was recorded mainly on undisturbed sites probably showing very low tolerance to any unfavourable factors as afforestation and grazing impact. Special investigations will elucidate some unclear habitat requirements of the species. Now we recommend to change the species status in IUCN Red list from indeterminate to rare (or lower risk, least concern; LR, lc) taking into consideration comparatively high abundance.

Genista tanaitica is one of comparatively widely distributed but less abundant chalk plant species. The species habitat requirements remained not completely clear but certain confidence to the slopes with gentle inclination of about 10° was apparent. This preference can be formulated also as a tendency to grow on substratum where already chernozem soil was formed. The latter is confirmed by the composition of accompanying dominant species among which such typical steppe species as *Salvia nutans* and *Stipa* species were registered. Our data showed probably low tolerance of the species to the impact of trampling by livestock. Besides, such factor of threat as afforestation remained dangerous for *Genista tanaitica* as for the overwhelming majority of chalk plant endemics. The status of the species in IUCN Red list can be changed from indeterminate to vulnerable taking into account overall low abundance and severely fragmented range.

Hedysarum ucrainicum is a very interesting chalk plant endemic with probably extremely small range (based on CHAGRA'2000 expedition data and some literature data). It is confined to Aydar river basin in Ukraine. Also very few locations are known for more northern regions in Russia. The only location found within our investigations is under threat from several unfavourable factors including direct impact of local village dump and possible afforestation of the site. Special protection measures (protection campaign) are needed to prevent the loss of this small population. The changes in the status of the species in IUCN Red list are necessary (from rare to vulnerable) along with special searches of unknown locations. It's very probably that the status of the species should be even changed to endangered.

Linaria cretacea is one of the very patchily distributed and quite not numerous species among chalk plant endemics. It is especially scarce in western parts of the investigated region (Kharkiv region) being completely absent on comparatively newly formed chalk outcrops in Sumy region. It also wasn't found in Seversky Donets valley in Kharkiv and Donetsk regions and in southernmost sites in Donetsk region. Our findings can be considered as evidences of gradual

increase of *Linaria cretacea* abundance towards eastern direction in valleys of Seversky Donets tributaries. Such increase can be interpreted as an indication of proximity to the species centre of origin, and as a reflection of higher habitat diversity within eastern sites that provides *Linaria cretacea* with suitable habitats.

All data on ecological preferences gathered within CHAGRA'2000 project indicate that the species is highly specialised to growing in conditions of continuous wash-out of fine-grained chalk material. It tolerates the impact of chalk fragments up to 1 cm in diameter, but probably slope inclination plays prominent role in the species distribution as a factor which determines the velocity of chalk particles' movement. *Linaria cretacea* clearly isn't adapted to the impact of coarse-grained chalk particles as compared to *Hyssopus cretaceus*, *Scrophularia cretacea*, *Artemisia salsoloides*. Therefore, it is confined mainly to mid-parts of gentle slopes with average inclination of about 10°. On the other hand, *Linaria cretacea* avoids outcrops of firm chalk substratum where no or very little wash-out of chalk particles takes place. In all cases, *Linaria cretacea* groups were found on the sites which are related to gullies and scours formed by running water. It is possible that *Linaria cretacea* is the only species among most ancient chalk plant endemics with such habitat adaptations. A few species are confined to the same habitat (*Asperula tephrocarpa*, *Pimpinella titanophila*, *Odontites lutea*, *Gypsophila altissima*, *Diploxys cretacea*). They are probably of more recent origin.

Range fragmentation and specific habitat requirements are considered as main factors of *Linaria cretacea* rarity and vulnerability. Habitats which are suitable for the species occupy comparatively small areas as usually slope inclination is more than 15-20°. The species specific habitat requirements are evidently very rarely met as the majority of gentle slopes are usually covered by other species or even partly terraced and transformed. All sites where the species grows should be protected and monitored for habitat changes. We recommend to keep the current status of the species in IUCN Red list (vulnerable) unchanged until new data will be gathered.

Scrophularia cretacea can be considered as less widely distributed and generally rare satellite of *Hyssopus cretaceus*. This species preferred the same habitats, steep slopes with continuous movement of coarse chalk fragments but usually the slopes of less inclination as compared to *Hyssopus cretaceus*. It is also confined to the sites with sparse vegetation cover but in contrast to *Hyssopus cretaceus* it very rarely dominates in chalk plant communities. Probably, it is sensitive to the competitive influence of other chalk plant species. At the same time, *Scrophularia cretacea* is much more tolerant to such factor as grazing impact as compared to *Hyssopus cretaceus*. The data on habitat preferences of the species should be ascertained in the future to estimate whether some factors of threat were missed in our studies. Now we recommend to change the current status of the species in IUCN Red list from indeterminate to vulnerable taking into account high fragmentation of the range and overall low abundance of *Scrophularia cretacea*.

Hyssopus cretaceus is possibly the most widely distributed species among typical chalk plant endemics. It was absent only in southernmost chalk outcrops in Krynka river basin in Donetsk region and in northernmost sites in Szym river basin, Sumy region. Very interesting finding of CHAGRA'2000 expeditions was discovery of *Hyssopus cretaceus* on chalk outcrops in Psyol river, Sumy region (near Grunovka village). Now this site is the westernmost known point of the species range, the location distanced at about 100-150 km of the main area of the species distribution.

The wide distribution of *Hyssopus cretaceus* can be partly explained as a consequence of specific habitat preferences of the species. It inhabited the sites with very distinct habitat conditions which are unfavourable for the majority of other chalk plant species. Usually in these sites the vegetation cover is very sparse, rarely exceeding 20-30%. The sites are situated on steep slopes with inclination angle usually more than 20° - 25° and with continuous movement of coarse chalk fragments as a result of erosion and wash-out. The root system of *Hyssopus cretaceus* is well-adapted just for the resistance to continuous pressure of the above-mentioned factors (Semyonova-

Tyan-Shanskaya, 1954). Such sites are well expressed at almost all chalk outcrops providing excellent conditions for *Hyssopus cretaceus* distribution. In such sites (where only a few species can exist) it dominates in the vegetation cover. In other sites where habitat conditions are essentially different (more firm chalk substratum, lesser inclination angle) other species can successfully compete with *Hyssopus cretaceus*. Besides, in such sites grazing often becomes an important additional factor. *Hyssopus cretaceus* is very sensitive to the impact of trampling (damage of stem and roots) as was shown by the analysis of our data. As a result, in the above-mentioned sites it is found usually in small numbers and in suppressed condition. The latter considerations explain characteristic even distribution by species abundance estimates registered in our investigations.

In general, it can be concluded that *Hyssopus cretaceus* is the species without any risk of extinction in the nearest future. Grazing impact is certainly the factor, which leads to some reduction in numbers and affects the state of some populations. However, there is no serious threat for the species from this factor impact on steep slopes, the main species habitat. Another important factor of threat can be afforestation of chalk outcrops and preceding terracing of slopes. Nevertheless, steep slopes where *Hyssopus cretaceus* is the most abundant are at lesser risk of transformation comparing to slopes with gentle inclination. As a result of our investigations we can recommend to change the current status of the species in IUCN Red list from endangered to rare (or lower risk, least concern; LR, lc).

Artemisia hololeuca should be considered as one of the most safe chalk plant endemics. The species is widely distributed within Seversky Donets basin with one isolated location in southern part of Donetsk region (Miuss river basin). The species is apparent dominant of chalk plant communities which occupied the outcrops of firm chalk substratum mainly in transition zone from upper to mid-slope positions (but mostly confined to the latter). The constant satellite of the species is co-dominant *Thymus calcareus* which formed together with *Artemisia hololeuca* characteristic associations. *Artemisia hololeuca* seems to be sensitive to grazing impact (although no evident relations with the species abundance was found) as it is clearly visible on the distribution of the sample quadrates. In our judgement the most important factor of threat for the species is afforestation of chalk slopes leading to complete destruction of typical chalk plant communities. Grazing should be considered as the factor of lesser importance taking into account the species wide distribution and capacity to grow in conditions of steep slopes where grazing is usually limited. The results of our studies can be considered as a base for the changes of species status in IUCN Red list from vulnerable to rare (or lower risk, least concern; LR, lc).

Elytrigia stipifolius is one of the lesser known species with extremely fragmented range. It is a typical species of undisturbed grasslands formed on chalk substratum. The species usually dominated in the vegetation cover. Habitat requirements of the species are clear: it is confined to upper or lower slope positions where vegetation cover is closed and mean vegetation height is high. The main problem of the species protection can be very heavily fragmented range as *Elytrigia stipifolius* is absent in many sites where the habitat conditions are quite suitable for its well-being. Taking into account these circumstances we recommend to change the status of the species in IUCN Red list from indeterminate to vulnerable.

Festuca cretacea is a representative of the large group of neglected chalk plant species which are not listed in IUCN Red list of threatened plants. Here we recommend to record this species with indeterminate status in the list based on our data on low abundance and extremely fragmented range.

Our expeditions provide some indirect information that together with existing literature data can be a base for sound considerations about current status of such plants as *Pinus sylvestris* var. *cretacea* and *Daphne sophia*. We consider these species as being near extinction and recommend to change their status in IUCN Red list from indeterminate to endangered. It's very likely that the status of *Daphne sophia* should be changed even to critically endangered as among 14 known

locations in Byelgorod region, Russia and Kharkiv region, Ukraine only 6 probably can support small populations of the species to the date. Our expeditions in the sites known as species locations in Kharkiv region failed to find it. It isn't unlikely that the species completely disappeared in Ukrainian part of the range. Therefore, special searches, investigations and very carefully developed protective measures are needed to reduce the risk of extinction for the mentioned species in the nearest future both in Ukraine and in Russia.

Tawny Pipit (*Anthus campestris*) in chalk grassland habitats

Tawny Pipit being in the focus of the project bird surveys is one of the characteristic species of bird communities of chalk grasslands though it's numbers rarely exceed the level permitting to consider the species as dominant. 22,1% was the highest value for Tawny Pipit share in bird community structure recorded in our study but usually it amounts to 2-4%. The mean population density totals 17,7 ind./sq. km or 0,9 pair/10ha that is two times higher than the values reported for sand dune habitats in the Netherlands (Neuschulz, 1997). Very similar value for population density (14 ind./ sq. km) is known for Tawny Pipit population in stony steppe habitats in Rostov region, Russia (Belik, 1996), the region situated to the south-east of the investigated territory. It should be noted that chalk grassland habitat is one of two main habitats of the species in Ukraine. The second one is sand dunes.

Main results of the study showed that Tawny Pipit abundance tolerates negative impact of such factors as over-grazing, erosion, chalk quarrying and pine planting (at early stages). Grazing has no significant impact on Tawny Pipit numbers but the design of the study was unable to reveal the effect of the very high level of grazing impact (the number of sites with such load was too small). In any case Tawny Pipit numbers remain insensitive to low or medium grazing. No significant effect was found also between chalk quarrying presence and Tawny Pipit numbers. The same regards to the relations with pine plantations presence but one should noted the surveyed sites represent pine stands at minimal percent of stocking. No significant geographical trend in distribution of Tawny Pipit numbers was found.

The analysis of the gathered data revealed that Tawny Pipit abundance is related mainly with two habitat parameters: mean height of vegetation and vegetation cover. The lesser are the values of these parameters, the higher is Tawny Pipit abundance. Mean height of vegetation plays the paramount role in all regression models producing the only significant beta-coefficients. Vegetation cover significance was revealed by the analysis of variance yielding the only significant result for multivariate case. The latter probably indicates the increasing role of the Tawny Pipit population in bird communities of the chalk slopes with scarce vegetation cover.

Analysis of the parameters of Tawny Pipit breeding territories revealed additional traits in habitat preferences being in close agreement with pronounced tendency to breed on sites with low mean height of vegetation and low vegetation cover. Namely, Tawny Pipits territories were located on the sites with solely chalk substratum (57,1% of the territories) and without any vegetation stratification (77,1%).

Some observations on Tawny Pipit biology supplements the overview of habitat requirements of the species. We suppose that regular morning feed flights can influence the distribution of the species. The temperature on chalk slopes is too low in early morning, thus Tawny Pipits are constrained to feed on sunlit meadows of the river valley at this time. Therefore, the combination of both slope and open plain sites is often crucial for normal breeding of the species in the investigated area.

Special interest deserves the relations between Tawny Pipit and Tree Pipit abundance as certain level of negative correlation was found for these parameters. No direct evidences of the interspecific competition were gathered but some effects of interaction were revealed e.g. by multiple regression models. It's interesting to note that Tawny Pipits maintain considerably large territories as compared with Tree Pipit. Our estimate for Tawny Pipit territories size is 6-7 ha.

This is in certain agreement with available literature data. For instance, in Germany Tawny Pipits hold territories with average size about 3 ha (Kruger, 1980). At the same time, Tree Pipit territories usually are nearly 10 times smaller. Such cardinal difference in space requirements and considerable overlap in territories are significant constraints for the hypothesis that the species compete for the territories in any way. The mentioned relations are much more likely the reflection of differences in habitat choice.

Lesser Kestrel, Pallid Harrier and other raptor species

Special searches of Lesser Kestrel and Pallid Harrier showed that both species but especially the first one should be considered as almost completely disappeared in North-eastern and Eastern Ukraine. Of course, the region where the project expedition was carried out is too large and it isn't fully covered by our surveys. Small colonies of Lesser Kestrel can be missed. But despite all such considerations the decline is evident as for example the only known colony in Donetsk region ceased to exist. The causes of this decline remain unknown but it took a long period of time as it can be realised from the consultations with regional specialists on raptors. It isn't inconceivable that the decline of Lesser Kestrel can be explained by similar reasons as for the case of Common Kestrel but the factors involved still are beyond our understanding.

The finding of an egg which is very probably of Pallid Harrier at one site in southern part of Donetsk region should be considered as pointing for more thorough searches of the species in southern and south-eastern parts of Ukraine. This is the region which is closer to the species strongholds in neighbouring parts of Russia (e.g. Rostov-na-Donu region) than any other in Ukraine. The role of chalk grasslands as habitats for this species unfortunately remained uncertain.

Accessory results of the searches of most rare and threatened birds of prey showed that chalk grasslands constitute very important habitat for less rare but also being under threat raptors. The cases of Booted Eagle, Montagu's Harrier and Short-toyed Eagle are the striking instances for such relations. All these species breed in other habitats but use chalk grasslands intensively. Booted Eagle uses these open sites not only as hunting territories but also as sites for characteristic demonstrative flights (observations at one site in Volchaya river valley). It should be noted that the species is one of the most abundant raptors in the investigated habitats holding third position after Common Buzzard and Marsh Harrier. In turn, Montagu's Harrier relies on chalk grassland sites as permanent hunting grounds. The impression appeared during the project studies was that the abundance of Montagu's Harrier is lesser in those river valleys (e.g. Seversky Donets river) where elevated right banks of rivers are covered by extensive forests. The species reaches the highest numbers in north-eastern parts of the surveyed region (e.g. Volchaya and Oskol rivers) in comparatively small to medium river valleys with large areas occupied by chalk grasslands. Short-toyed Eagle also uses chalk grasslands for hunting on its usual prey, snakes and lizards. This species is the most rare and interesting among all others recorded during our surveys.

Eagle Owl

The results of our expeditions show clearly that Eagle Owl meets quite favourable conditions for breeding in chalk grassland habitats in North-eastern Ukraine. Extended and greatly forked chalk ravines are the favourite habitats. These ravines usually empty great river valleys and have a lot of branches with numerous cliffs and steep slopes. The latter provides a wide range of niches and other sites suitable for nest building. Local people use the ravines very little, mainly for grazing in their upper parts. Thus, the owls are usually only slightly being disturbed by human interference during breeding season. Nevertheless, there are other kinds of threat in winter time.

Questioning local residents, local hunters and herdsman convinces in high level of residency of Eagle Owl. The birds keep the same territories for many years. For one territory it's known that birds occupy it since mid 1980s. Such sedentary habit is a source of vulnerability for Eagle Owl in winter period when hunting pressure becomes an important locally acting factor. Hunting seems

to be the only serious factor that threatens the population state of the species in North-eastern Ukraine. Hunters shoot owls in winter time during hunting on hares which usually takes place on the territories occupied by Eagle Owls pairs. This factor probably affects about 20% of the Eagle Owl population annually. Shooting adult birds leads to delaying or even ceasing breeding because of late pair formation. Delayed terms of breeding resulted in unsuccessful breeding attempts (2 known cases). Some widowed birds obviously fail to form new pair and consequently remain lone for one more season. Among 7 registered occasions of certain impact of hunting factor only once the new pair established soon after killing one of partners bred then successfully.

The cases of killing Eagle Owls are completely the result of low level of awareness of local people. A bias against Eagle Owls still prevailed among local hunters. Although the species is listed in the Ukrainian Red Data Book, no special and non-formal measures for the species protection have been undertaken to the time. Evidently, the measures for raising the awareness of local people should be applied to diminish the negative impact on Eagle Owl population in North-eastern Ukraine.

The role of grazing as an additional factor of threat for Eagle Owl population is less clear and requires special investigations. In any case the importance of this factor is far lesser as compared to hunting impact. The ways for counteracting this factor should be principally the same as for the mitigation of hunting impact.

Dependence of Eagle Owl on great ravine systems seems to be a restrictive factor for spreading the species in western and north-western directions. Relief conditions change in these directions in so manner that the occurrence of great and forked ravines (the favourite habitats of the species) in river valleys gradually falls. 50% of breeding territories of Eagle Owl were found in easternmost river valleys (Derkul and Kamyshnaya rivers) within the investigated area (these rivers are situated at the Ukrainian-Russian border). Studied population of Eagle Owl belonged to the steppe subspecies *interpositus* for which the northern border of the range is reported as being coincided with 50° latitude (Pukinsky, 1993). Our data suggest that the range border in North-eastern Ukraine is rather longitudinal. Besides, in our opinion the border of the subspecies range is shaped by habitat distribution factor.

Characteristic shift for Grey Partridge and Common Quail in Eagle Owl's diet is noteworthy. This finding is in good agreement with the data gathered in other parts of Eagle Owl's range e.g. in Germany or Moldova (Marz, 1958; Pukinsky, 1993). One can be supposed that these species are comparatively effortless prey for Eagle Owl as compared to other bird species.

Data on clutch size gathered within CHAGRA'2000 project are in good agreement with already reported for Europe (mean clutch size - 2,6; n = 481; Mikkola, 1983). Breeding success is comparatively high (2,1 fledglings per pair) being within the limits known for European parts of Russia (1,4 –2,5; Pukinsky, 1993). The general impression gained as a result of studying Eagle Owls in North-eastern Ukraine is that the population is viable and self-sustaining but the efforts should be made for raising the awareness of local people to minimise negative effects on the owls and mainly to avoid the risk of shooting adult birds.

Conservation education & public awareness

Despite the uniqueness and importance of chalk grasslands very little has been done up to now to attract the attention of general public to the necessity of conservation of these ecosystems. CHAGRA'2000 project activities were planned in so manner to change the situation and to draw the interest of local people and students of regional colleges & universities to the problems of chalk grassland conservation.

The education activity was concentrated mainly on the work with two target groups: teachers in local schools and students of colleges and universities in Kharkiv and Lugansk regions. Several meetings with local teachers and amateurs reveal that one of the largest gaps in education is an

absence of relevant guides which can be used for identification of rare plant species. As a rule, even non-numerous general guides on Ukrainian plants were inaccessible for local teachers and schoolboys. The situation is complicated since no comprehensive guides on chalk plants exist in Ukrainian language.

One of the steps towards the change of the described situation was publishing a leaflet with photos and concise information on rare and characteristic chalk plants & animals. The leaflet is designed for conservation education purposes. It is designated mainly to familiarise local teachers and schoolboys with mysterious and threatened endemic plants of chalk grasslands and the factors of threat for these habitats. The leaflet can be used in preparation of excursions for local schoolboys to involve them in studying native habitats and to train in practical identification of rare plant species. Another objective was to attract an attention of local and regional conservationists to the importance of chalk grassland ecosystems. Photos taken in the project field expeditions were used for designing the leaflet. It was prepared in two languages, Ukrainian and English, for local and international dissemination of the project information, accordingly. The leaflets along with special letter of inquiry on the demands in additional information and help were distributed in local schools and local & regional stations of young naturalists in the regions where chalk grasslands are spread. We covered Volchansk, Kupyansk and Dvourechnaya districts of Kharkiv region and the majority of the territory of Lugansk region through this action.

Many school teachers (and children also) replied on this project dissemination action. All replies were very positive some of them being noteworthy for substantial pieces of new information on findings of rare chalk plant species (e.g. *Linaria cretacea* and *Silene cretacea*). Some teachers showed an apparent concern on the level of habitat and species protection within small protected areas (“zakazniks”) in chalk grassland habitats. They mention uncontrolled grazing on these territories and, most of all, very low level of awareness of the importance of chalk grasslands in local population. As it became evident from the replies on our letters the level of threat for the habitats is very different in different locations. Some sites were comparatively undisturbed in recent times due to general harsh economic situation in the regions.

In some local schools associations of schoolboys were already established aimed at ecological work in native area. Surprisingly, many of them are familiar with the adjacent protected areas. Schoolboys together with their teachers participate in special work on investigation (excursion field work) and conservation of chalk grasslands. In Dvourechnaya town schoolboys formed a team of young naturalists. They organise special work to clear the territory of the nearest “zakaznik” of rubbish and even carry out awareness actions for local people. Moreover, they are rather well familiarised with native flora and fauna. Such associations are able to co-operate with the project team in field investigation and conservation work. This is not only an ability but an enthusiastic willingness most of all!

The same is true for regional stations of young naturalists. Our educational campaign revealed a great extent of involvement in investigation work (organisation of expeditions to the protected areas) of young people from Kupyansk regional station of young naturalists. The work was organised together with enthusiastic teachers from local schools in Kupyansk. The reply obtained from this station of young naturalists justified the need of local environmentalists involved in ecological education in guides for identification of chalk plant species or in some help of specialists in botany in fieldwork organisation. In other replies a need in a manual on rare and threatened species of chalk grasslands with photos or drawings of good quality is stressed too. The majority of replies accentuates the usability of the leaflet in education process stressing that it partly fills a considerable gap in coverage of conservation issues for chalk grassland habitats.

Surprisingly, the action to advertise the project activities and to spread information on main project findings among local teachers and in district stations of young naturalists resulted also in rather unexpected response. We received a letter from Belovodsk regional museum (Lugansk region) in which great interest in CHAGRA’2000 activity was expressed. Museum workers asked

us for more information about the project e.g. project report or some photos. These are really good news, as we have seen keen interest inspired not directly by our appeal but as an echo of our educational campaign in local schools. We have prepared a synopsis of our field findings along with general information on ecology of rare plant species, copies of some important journal papers on the subject, leaflets and our best photos of habitats, plants and animals to supply the museum exhibition. Now we are informed that all these are arranged in Belovodsk museum display. The museum workers are extremely grateful for this contribution to the exhibition and are ready to co-operate with project participants in future to strengthen conservation actions for chalk grassland habitats at regional level.

Project team efforts were streamlined also towards raising awareness of chalk grassland importance and interest in conservation activity in students of regional colleges and universities. For these purposes special meetings with presentation of main preliminary results of the project were organised in Kharkiv National University and Kharkiv Pedagogical University. In summer time several excursions were organised with students of Kharkiv National University and Rubezhnoe college (Lugansk region) aimed at familiarising with endemic & rare plant and bird species. As a result, many students not only became aware of the principal characters and ecological peculiarities of chalk plant & bird species, but also have got to know the methods of transect counts of birds and geo-botanical studies of plant communities. Another objective of the actions in Kharkiv National University and Kharkiv Pedagogical University was to show how the results of the project can be used by lecturers in the programs of environmental education. Many lecturers expressed keen interest in CHAGRA'2000 actions and asked for photos of rare plant & bird species to be used in education process.

Main results of the CHAGRA'2000 project were reported also at several scientific and environmental meetings with an aim of disseminating new data on chalk grassland communities and explaining our view of the possible ways of conservation these ecosystems. The presentations were organised within the programmes of meetings of Regional Working Group on the Birds of Seversky Donets basin and Kharkiv branch of Ukrainian Union for Bird Conservation (BirdLife International partner in Ukraine). Some results of the project were presented also at international conference "The structure and functional role of the animal population in natural and transformed ecosystems" that was held in Dniepropetrovsk, Ukraine in September, 2001. General information on the birds of chalk grasslands was presented also as a contribution to the forthcoming 23rd International Ornithological Congress to be held in Beijing, China on August 11-17, 2002.

Some efforts were made for disseminating the results of the project and information on the state of unique chalk grassland habitats in regional press. A paper devoted to the issues of conservation of chalk grasslands was published in two district newspapers in Kharkiv region and in one district newspaper in Lugansk region. In the paper main chalk plant species and general features of their ecology are reported with special emphasis on the necessity of the protection of chalk grassland habitats.

Main results of the project in conservation sphere were formulated and presented to regional offices of the Ukrainian Ministry of Ecology and Natural Resources as well as to regional administration authorities. This resulted in starting the organisation of a national park on the territory occupied by chalk grasslands in Dvourechnaya district, Kharkiv region. The scientific background for the creation of this new regional protected area was developed based mainly on the data gathered in field expeditions of CHAGRA'2000 project. Now the agreement was made with Dvourechnaya district authorities to provide funds from district budget directly assigned for the organisation of regional national park in chalk grassland sites.

Logistics and administration notes

The following recommendations were formulated based on the experience of CHAGRA'2000 project:

- if any geo-botanical studies are planned considerable time should be allotted for accomplishment of this work as it's especially time-consuming in steppe communities with high species richness
- the natural periodicity in main phases of life cycles of plant species should be necessarily taken into account when planning expedition activity
- if you are in a position to spend some time for identification plants in nature do it as it's much more difficult to fulfil this work in a laboratory
- great experience of local teachers of biology is invaluable in searches of new sites where rare plant species survive
- questioning local people often help to find new breeding territories of large raptors or owls and to identify some factors of threat

Photography

A lot of time was spent and great efforts were concentrated for taking photos of rare and characteristic chalk plant species. We considered this work as crucial for supporting and supplying all future steps in conservation education activity. The majority of chalk plant species are purely known not only in local population but also in scientific community. That is why it's so important to have as more pictures of these species as possible to attract the attention of specialists, amateurs and wider public.

Conclusions

Plant surveys within the project activity enabled to obtain reliable information on the status, distribution, abundance and habitat preferences of 11 species listed in 1997 IUCN Red List of Threatened Plants. Substituted data drawn from the special field searches and questioning local teachers & conservationists are considered as an indication of the status of two more species: *Pinus sylvestris* L. var *cretacea*, *Daphne sophia*.

The data obtained as a result of CHAGRA'2000 investigations enable us to recommend changes in IUCN status assignments for some chalk plant species. We recommend to refer the following species as endangered mainly due to small extent of occurrence (highly fragmented range) or suspected population reduction: *Pinus sylvestris* var. *cretacea*, *Silene cretacea*, *Daphne sophia*. The following species should be referred as vulnerable: *Schivereckia podolica*, *Genista tanaitica*, *Hedysarum ucrainicum*, *Scrophularia cretacea*, *Elytrigia stipifolius*. *Androsace koso-poljanskii*, *Artemisia hololeuca* and *Hyssopus cretaceus* should be treated as rare species. For such species as *Syrenia talijevii*, *Astragalus dasyanthus*, *Astragalus zingeri*, *Hedysarum cretaceum*, *Onobrychis radiata*, *Linaria cretacea*, *Serratula tanaitica* and *Stipa dasyphylla* no status changes are needed. We recommend also to include such species as *Festuca cretacea* (indeterminate) in IUCN Red List of Threatened Plants based on our data on its abundance and distribution. The species is referred in Ukrainian Red Data Book. We also recommend to list *Syrenia talijevii* in Ukrainian Red Data Book with the same status it is referred in 1997 IUCN Red List of Threatened Plants.

The overall conclusion on the level of vulnerability of rare and threatened chalk plant species was that the nature of distribution pattern is the crucial factor. Some species have rather patchy pattern of distribution. They are absent on extensive territories with suitable habitats but are concentrated in a few sites. Such sites should be in the focus of conservation efforts for chalk grassland protection. The list of the species with extremely fragmented range includes *Silene cretacea*, *Schivereckia podolica*, *Hedysarum ucrainicum*, *Elytrigia stipifolius*. Such species as *Syrenia talijevii*, *Festuca cretacea* and *Linaria cretacea* also have patchy distribution but it is less

fragmented. *Androsace koso-poljanskii*, *Genista tanaitica*, *Scrophularia cretacea*, *Hyssopus cretaceus* and *Artemisia hololeuca* are less vulnerable from this point of view.

A huge amount of information on the distribution, abundance and habitat preferences of other chalk plant species was gathered within the project activities and compiled into the database. Ecological data obtained in geo-botanical studies in chalk grasslands can be used to describe habitat requirements of rare and threatened species and the level to which they tolerate the impact of unfavourable factors.

Hyssopus cretaceus is a species with the widest distribution among other rare plants within the studied region. It inhabits steep slopes with continuous movement of chalk crumbs along hillside. In such conditions *Hyssopus cretaceus* usually dominates in vegetation cover. Afforestation is the main factor of threat for this species habitats as well as for the majority of the species discussed below.

Scrophularia cretacea is a species with fairly similar habitat requirements as *Hyssopus cretaceus*. It can be considered as a constant companion of the latter. However, it has more fragmented range and is usually sparse and rare.

Genista tanaitica is a widely distributed but not-numerous species of steep slopes of chalk hills with low tolerance to the impact of unfavourable factors as grazing impact and afforestation.

Syrenia talijevii is notable for its highly spotted and lesser known range in Eastern Ukraine. The species was found in few sites with coarsely fragmented chalk substratum and comparatively high general vegetation cover.

Artemisia hololeuca often serves as a dominant in vegetation cover on steady and firm chalk substratum with minimum movement of chalk crumbs. This species is highly dependent on the virgin state of the habitats and is especially vulnerable to over-grazing.

Linaria cretacea is a very rare but characteristic species of gentle slopes with continuous wash-out and movement of fine-grained chalk material. Patchy distribution of the species is the primary factor of the extinction. The abundance of *Linaria cretacea* evidently becomes higher in eastern direction (in Lugansk region).

Hedysarum ucrainicum serves as an example of locally abundant species which sometimes forms pure cover. However, it was found by our expedition in only one site presumably the same from which it was described by B.F. Kashmensky in the beginning of XX century. Thus, we considered the species as being extremely vulnerable to any disturbance of the habitat.

Silene cretacea is an extremely rare species found only in one site within the studied region. The tolerance to over-grazing was noted but extremely fragmented range opens it to the risk of extinction in the nearest future.

Some other species listed in 1997 IUCN Red List of Threatened Plants are more related to the mixed substratum with thin layer of true chernozem soil. *Androsace koso-poljanskii* is one of the dominants of vegetation cover mainly in western and northern sites within the investigated region. *Schivereckia podolica* was found in only one site with clear relation on the slopes of northern aspect. This species evidently has very fragmented range and deserves special conservation efforts. *Elytrigia stipifolius* is known from only few sites where it is sometimes abundant mainly in upper slope parts.

Evidently, such species as *Silene cretacea*, *Daphne sophia*, *Astragalus dasyanthus*, *Astragalus zingeri*, *Hedysarum cretaceum*, *Hedysarum ucrainicum*, *Onobrychis radiata*, *Serratula tanaitica*, *Elytrigia stipifolius* among species listed in IUCN Red list require additional studies and careful searches. It's particularly significant for such species as *Silene cretacea* and *Daphne sophia* being reported as declining and endangered for considerable periods of time and for such species as *Hedysarum ucrainicum* with extremely small range.

The results of the case study on Tawny Pipit ecology show both the dependence of the species abundance on habitat features distinctive for virgin chalk slope habitats (low mean height of vegetation and low vegetation cover) and the tolerance to impact factors considered in the analysis (grazing, erosion, chalk quarrying and pine planting at early stages). The results can be used to predict the level of Tawny Pipit abundance.

Searches of Lesser Kestrel and Pallid Harrier were mainly unsuccessful indicating that the species suffer severe decline in numbers in the region covered by project expeditions. It's very likely that Lesser Kestrel ceased to breed in North-eastern and Eastern Ukraine. Pallid Harrier can be very rare or occasional breeder in south-eastern parts of the investigated area, in Donetsk region. Chalk grassland habitats provide excellent hunting grounds for such rare species with European Conservation Concern status as Short-toyed Eagle, Montagu's Harrier and Booted Eagle. These species can be partly depended on undisturbed state of chalk grasslands.

Eagle Owl, another vulnerable bird species being in the focus of the CHAGRA'2000 project was found in the eastern part of the surveyed region mainly along great tributaries of Seversky Donets river. The abundance of Eagle Owl decreased towards western direction following gradual disappearance of great forked chalk ravines, the favourite habitat of the species. The population of Eagle Owl can be considered as viable but some negative factors reduce the breeding success. As killing adult birds during winter hunting on hares is the most powerful of these factors probably affecting 20% of the population annually, special education actions should be taken to enlighten local hunters and to change the situation.

The implementation of the project CHAGRA'2000 enabled to assess the most strong factors affecting the state of chalk grassland habitats as a whole and the state of populations of certain rare and threatened plant species. The main factor of threat for chalk grassland habitats and species is afforestation of chalk slopes by Scots pine (*Pinus sylvestris*). Afforestation completely destroys habitat structure and results in extinction of many characteristic chalk plant species. Another adverse factors of lesser importance are over-grazing, chalk quarrying and steppe fires.

Education activities within the CHAGRA'2000 project scope revealed a high level of concern and involvement in the issues of chalk grassland studies in local schools and local & regional stations of young naturalists in North-eastern and Eastern Ukraine. At the same time, local teachers obviously lack suitable guides or manuals for plant identification with good images of chalk plant species. This gap is especially pronounced as just chalk grassland plants is the group for which no special illustrated guides existed neither in Ukrainian, nor in Russian languages. The gap was only slightly covered by distribution of the special leaflet with chalk plants' photos prepared by the project team. Searches of new sites with threatened chalk plants can be essentially facilitated if local teachers and young naturalists will take part in the process. To make it possible real actions are needed for perfection of identification skills of these people. Undoubtedly, further steps in changing the situation are necessary.

Education campaign along with scientific findings of the project resulted in growing interest not only among local teachers and conservationists but in regional authorities and in Kharkiv regional board of Ukrainian Ministry of Ecology and Natural Resources. Therefore, the project CHAGRA'2000 team was able to initiate some progress in conservation of chalk grassland habitats in Ukraine. The results of the field expeditions of the project were used for preparation of the background for organising a new regional national park in Dvourechnaya district, Kharkiv region. Now the decision was made to organise the park on the territory of Dvourechnaya district (Oskol river valley) with general financial support to be provided by district administration.

Acknowledgements

We are extremely grateful to the project sponsors, BP Amoco, BirdLife International and Fauna & Flora International who supported our investigations by giving an award of the BP Conservation

Programme and providing us with necessary advisory books and guides. Our especial thanks for Katharine Gotto, former manager of BP Conservation Programme who helped expedition team during initial stages of the project and for Marianne Dunn, manager of BP Conservation Programme for her advice and support at project implementation stage.

We are also in debt of gratitude to our sponsors from British Ornithologists' Union who partly financed the project through the programme of Small Research Grants (studying of relations between Tawny Pipit numbers & distribution and habitat characteristics). Steve P. Dudley (BOU) efforts on organising the support of this part of the expedition are especially thankworthy.

We would like to extend our thanks to officers of Ukrainian Union for Bird Conservation (UUBC) for their kindly help during initial stages of the project. We readily express our sincere thanks to the personnel of Kharkiv regional board of Ukrainian Ministry of Ecology and Natural Resources whose consideration and support are of great importance for the project success.

We are especially grateful to Vitaly Vetrov, Head of Lugansk branch of UUBC for his invaluable help in studying Eagle Owl population. Vera V. Tveretina, botanist and senior lecturer from Kharkiv Pedagogical University deserves our special appreciation for her continuous help in plant identification. Alexander Tselishev from Ukrainian Institute of Forestry and Forest Melioration provided serious help and support for the expedition in almost all field expedition activities. We would like to thank also Eugeny Skorobogatov, scientific worker of the Laboratory of Applied Problems of Animal Ecology, Biological department, Kharkiv National University for invaluable support in organising fieldwork activities. Project team is extremely grateful to Dmitry Shabanov from Zoology and Animal Ecology Chair, Kharkiv National University whose enthusiasm and inspiration converted the technical routine of lay-outing project reports in something indeed lively. Enormously important work with digitised images would have failed if processed by the team alone but Alexander Leman from Ukrainian Institute of Forestry and Forest Melioration saved the situation quickly and effectively. We would like to express our sincere thanks to those people who helped the team at all stages of the project implementation: Olga Filatova, Pavel Vlaschenko and Egor Yatsuk.

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