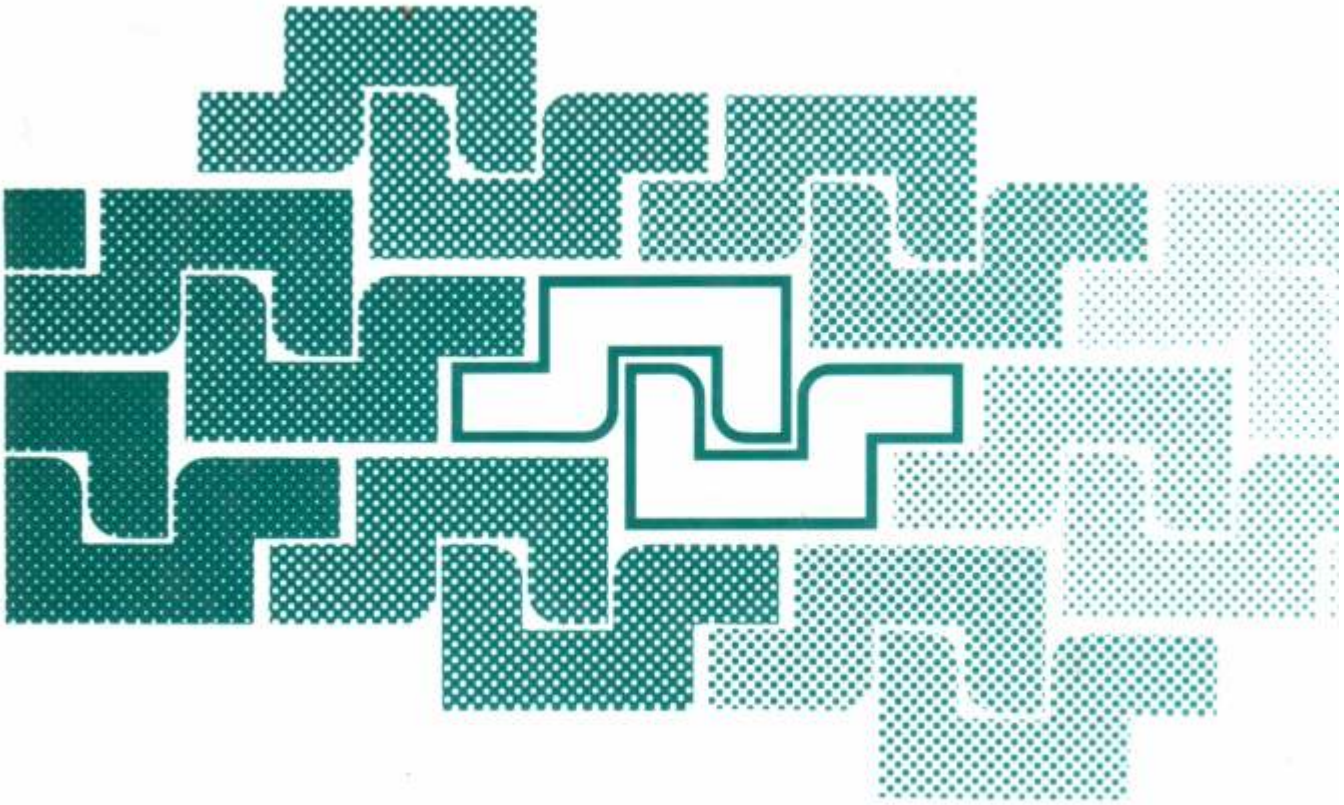

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Integration of Information on the Kraków-Czestochowa Jura for Conservation Purposes: Application of CORINE Methodology

Anna Dyduch-Falniowska[1], Malgorzata Makomaska-Juchiewicz[1], Róża Kaźmierczakowa[1], Joanna Perzanowska[1], Katarzyna Zając[1]

[1] Institute for Nature Conservation, Polish Academy of Sciences, Kraków, Poland

Abstract. The Kraków-Częstochowa Jura constitutes a structural and functional entity and is an area of great natural value. It has been identified as a site of European importance in the CORINE system. The individual character of this area is determined by geological conditions, specifically geomorphology, and particularly karstic phenomena. The specificity of the nature of the Jura lies in the presence of very different type of habitats and associated mountain and boreal-mountain species, as well as southern taxa (Pannonic and Mediterranean). The Jura has preserved its natural richness under many centuries of human pressure. To understand this area fully, and formulate conclusions for conservation of the natural heritage of the Jura, it is necessary to collect and arrange all available information on the nature of the area. In this paper the integration of information is proposed according to CORINE methodology.

Keywords. biodiversity conservation, CORINE, Poland, Kraków-Częstochowa Jura

1 Why Integration, Why the Kraków-Częstochowa Jura?

The Kraków-Czestochowa Jura (Figure 1) is of interest because it has preserved its natural richness under many centuries of human use and pressure. To fully understand this phenomenon and formulate conclusions for conservation of the natural heritage of the Jura, it is necessary to collect and arrange all available information on the nature of the area. Truly interdisciplinary research is lacking on the nature of the Jura. Such research would be useful in preparing a general concept of management of this region, which is compatible with the idea of sustainable development.

Data for this paper are part of the data bank of the CORINE (Coordination of Information on the Environment) biotopes project. It is one of many CORINE programmes undertaken in Europe since the eighties. The Kraków-Czestochowa Jura as a whole corresponds with many aspects of CORINE methodology. It has been identified as a complex-site, which contains 29 individual sites. Each of these also meet CORINE criteria (Figure 1).

From the point of view of physical geography the Kraków-Częstochowa Jura should be treated as a geo-complex. It is a large plateau, rising in the west, with a steep rocky edge sloping to the north-east. This plateau is built of Upper Jurassic limestone. The south-eastern area is formed of Triassic and Paleozoic (Devonian, Carboniferous, and Permian) rock, while the central and eastern parts, are Cretaceous (Czeppe 1972). Specific features of the area include limestone monadnocks rising on the plateau, deeply incised valleys and gorges, and numerous caves. The rich and diversified relief is the result of geological processes working for many millions of years after the formation of base rocks of the contemporary Jura.

The Kraków-Częstochowa Jura distinguishes itself among other regions by its very rich vegetation. The Jura contains about 1300 vascular plant species, i.e. nearly 50% of the vascular plant species noted from Poland, over 400 moss species, and 400 lichen species. Approximately 90 plant communities have been described for the area; with about 50 associations identified beyond question.

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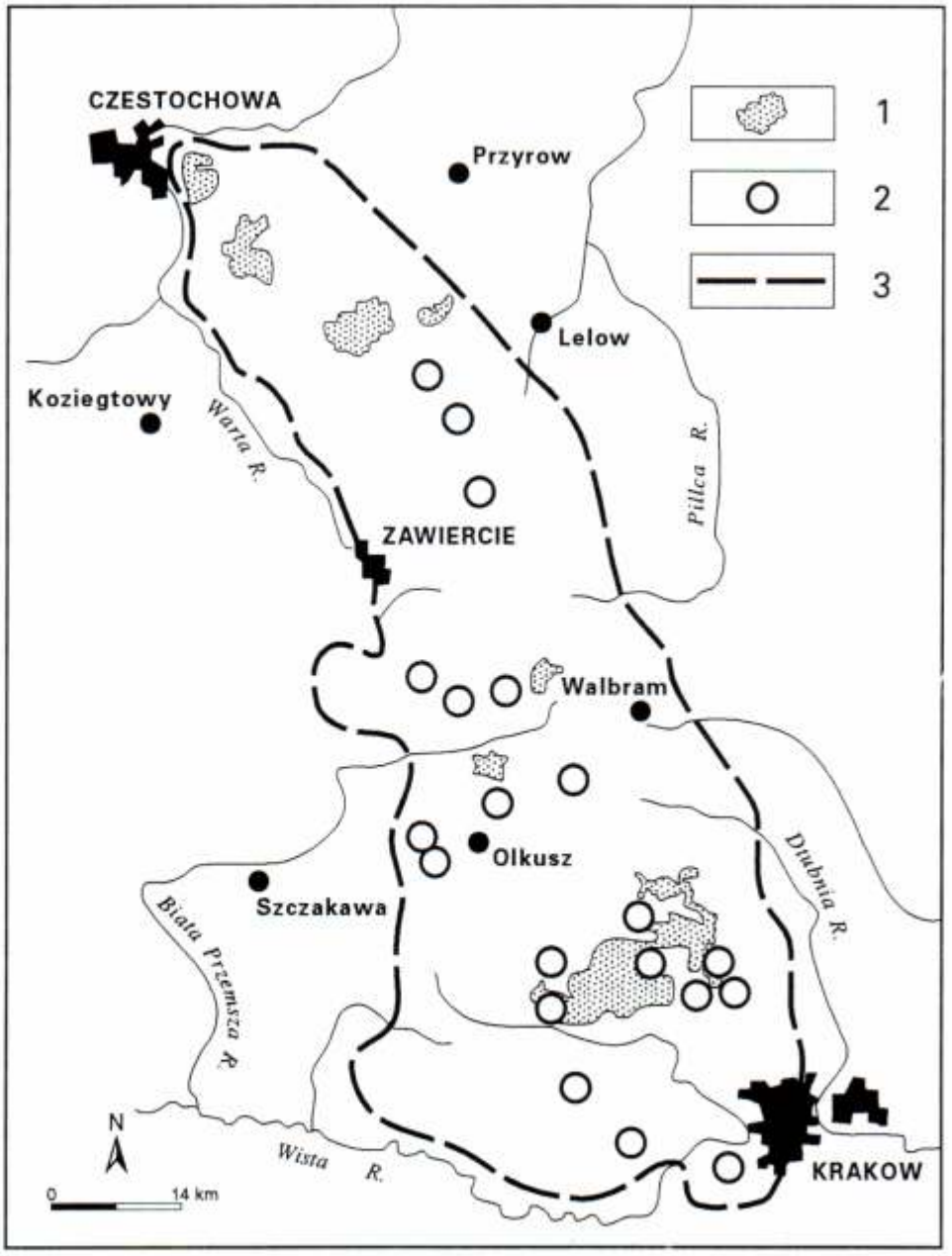
Figure 1. Distribution of CORINE sites in Kraków-Częstochowa Jura. 1 - sites larger than 100 ha, 2- sites smaller than 100 ha, 3- boundary of complex-site.



About 70% of the area is occupied by agrocenoses. Forest communities cover only about 20% of the area. The occurrence of the two types of mountain beech forests is noteworthy. In the southern part of Jura on shady and humid northern slopes of ravines there are extrazonal sites of *Dentario glandulosae-Fagetum*, an association characteristic of the lower montane belt of the Western Carpathians. In the central and southern parts of Jura we found patches of *Dentario enneaphyllidis-Fagetum* typical of the lower montane belt of the Sudety Mountains. Rare in Poland and well-developed in Jura is the mountain sycamore forest with the heart's tongue *Phyllitido-Aceretum*, growing in shady and humid places on rocky debris (Medwecka-Kornaœ 1952; Medwecka-Kornaœ and Kornaś 1963). The sunny southern slopes with rocky substratum are covered with the rare in Poland *association Carici-Fagetum convallarietosum*, a thermophilous beech forest (Michalik 1972). In the past on the plateau there were common mixed pine-oak forests. Most of these forests are greatly changed.

Among non-forest communities, the xerothermic vegetation is particularly noteworthy. It is represented in the Jura by natural and semi-natural grasslands developed on rock, grasslands on sand, and thermophilous scrub with hazel. We should mention here, above all, patches of loose natural grasslands on rocky substratum, belonging to the *Festucetum pallentis* association. This develops in two subassociations: *F. p. neckeretosum* in shady places and *F. p. sempervivetosum* in sunny places. Very rare taxa, such as *Thymus praecox*, or taxa which have relic sites in the Jura, such *as Saxifraga aizoon* of arctic-alpine affinity, are involved in this association. Xerothermic and thermophilous communities cover less than 1% of the area of the Jura. However, species in these communities constitute almost one third of the flora of the region. In valley bottoms are found different semi-natural meadow communities and in places, small fragments of peat bog, rush, spring, and water communities. The spring area of Biala River near Olkusz was once a site of the endemic association, *Cochlearietum polonicae* (Kwiatkowska 1957).

The Kraków-Częstochowa Jura flora is dominated by species widely distributed in Europe. Also numerous are taxa whose localities in the Jura are separated from their major ranges. This concerns, above all, relic localities of mountain species, steppe species, and boreal taxa. Two endemic species occur in the area: *Galium cracoviense* growing on limestone tors and *Cochlearia polonica* growing in cold springs on a few replacement sites in the southern part of the area. Both are placed in the Polish Plant Red Data Book (Zarzycki and Kaźmierczakowa 1993). Among other threatened in Poland plant species, there are about 50 which have stations in the Jura.

The character of the invertebrate fauna of the Kraków-Częstochowa Jura is determined by the presence of xerothermic habitats and post-glacial relics, and by connections with the Carpathians. The occurrence of over half of the species of particular invertebrate groups known from Poland, shows the importance of the Jura for the fauna of the country (Szeptycki and Warchalowska-Śliwa 1992). The most characteristic and valuable components of the Jura fauna are xerothermic elements. Two types of xerothermic invertebrate communities occur in the Jura. One group is connected with natural non-forest habitats, which originated as a result of the particular coincidence of topographic, microclimatic and other factors. Another group inhabits open sites arising from deforestation of the area. These two types of habitats differ from one another in soil fauna (Szeptycki and Warchalowska-Śliwa 1992).

Insect groups unrelated to the soil, such as butterflies, hymenopterans, or orthopterans, do not show this differentiation. In a study of the butterflies of Częstochowa Jura, Skalski (1992 a,b) estimated the proportion of lepidopterofauna species confined to dry habitats at 13%. Species now characteristic of this type of habitat in the Jura are *Lysandra argester (Bgstr.), L. coridon (Poda),* and *Meleageria daphnis*.

One may suppose that xerothermic zoocenoses in the Jura have a very dynamic composition. This can be illustrated by the results of studies on the coleopterofauna of the environs of Ojców. Pawlowski et al. (1994) analyzed this group in two periods: 1854-1914 and 1955-1990. In the first period 30 strictly xerothermic species were found, and in the second one, 50. Only 6 species were common for these two periods, i.e. they were noted in the past and at the present time. The authors

suggest that these intriguing qualitative differences are connected with the migrations of species from several directions, facilitated by human impact on the uplands of southern Poland.

The majority of the regionally most valuable invertebrate species are connected with beech forests. A characteristic phenomenon is the simultaneous occurrence of western or alpine, and sudetic, and Carpathian species, in the Jura (Szeptycki and Warchalowska-Sliwa 1992). Particularly interesting is the occurrence of some high mountain species in the Jura, such as *Orchesella alticola* which is the representative of *Collembola*. These live in extremely cold places, for example cave holes or on fragments of rocks with such a microclimate. The arrival of these species was connected with a periglacial period, or with some other cold and woodless time.

Worthy of notice also are troglobiontic species of invertebrates. The cockchafers: *Choleva lederiana gracilenta, Catops tristis infernus* and a representative of *Collembola - Onychiurus alborufescens* were found in the Pod Sokkia Góra Cave; *Mesochorutes ojcoviensis (Collembola)* is known from the Nietoperzowa Cave; and the mite *Oribella cavitica*, from the caves of Ojców. The spider *Porrhomma moravicum* is the most numerous troglobionte. The sites of troglobiontes in the Jura are mostly of relic character; they are relics of the last interglacial period (Szelerewicz and Górny 1986).

The distribution of numerous species, valuable from the point of view of biodiversity conservation in the Jura, is an effect of the operation of many geobotanical, microclimatic, topographic and historical factors. It reflects the strong fragmentation of habitats, whose influence on the populations of particular species should be thoroughly analyzed if suitable conditions for conservation of the full biodiversity of Jura are to be created.

A characteristic feature of the mammal fauna of Kraków-Częstochowa Jura is the very rich group of insectivore species (83% of the insectivore fauna of Poland). Almost all known Polish species of bats occur here. Among them are three species characteristic of this area: the seriously threatened lesser horsehoe bat *Rhinolophus hipposideros*, the greater horsehoe bat *Rhinolophus ferrumequinum* and the extremely threatened Geoffroy's bat, *Myotis emarginatus*. Outside of the Kraków-Czestochowa Jura only single localities of the lesser horsehoe bat are known. Geoffroy's bat practically does not occur out of the Jura. The fauna of bats in the Jura is not satisfactorily known. The existing data concern, above all, species which are connected with rocky habitat, and winter in caves or in fortifications (Labocha and Wołoszyn 1994; Postawa et al. 1994). The greater horseshoe bat is sporadically known for the area; the last record dates from 1922 in the Wierna Cave at the CORINE site of Parkowe.

Of the mammal species placed in the Polish Red Data Book of Animals (ed. Glowacinski 1992), 9 species occur in the Jura. Among them there are 6 species of bats (*R. hipposideros, Myotis bechsteini, M. emarginatus, Vespertilio murinus, Eptesicus nilssoni* and *Nyctalus leisleri),* the European beaver (*Castor fiber*), the fat *dormouse (Glis glis*), and the otter (*Lutra lutra*). Most of them are rare species (category R).

The breeding avifauna of the Jura is relatively rich (Walaś and Mielczarek 1994). This is related to the exceptional differentiation of the environment. Birds occur which represent forest habitats, open areas (meadows and fields), scrub and mid-field groups of trees. Some birds are confined to water and marshy habitats, and others are linked to limestone tors (monadnocks). To this last group belong such species as *Apus apus*, or *Falco tinnunculus* which occur here in their natural environment. At the present time these species are known, above all, from towns and villages where they nest in walls, a substitute for their natural rocky habitat.

The reptiles of the Polish Jura include six species with three from the CORINE list. The threatened smooth snake, *Coronella austriaca*, is particularly worthy of notice. The species is recorded at Dolina Prądnika and Góra Zborów. Amphibians are represented by 13 species, including eight from the CORINE list, with *Bufo calamita, B. viridis and Hyla arborea*. More thorough research on the herptofauna has been completed in the northern part of Jura, in the Częstochowa Upland (Kowalewski 1992).

Summing up, the Kraków-Częstochowa Jura is a structured and functional entity - an area of great natural value. It should therefore be treated, independently of its administrative divisions, as one natural area with great inner variation.

2 Impacts on natural values of Human Activity in Prehistoric Times and in the Middle Ages

It is in the Kraków-Częstochowa Jura that the oldest traces of human presence in the territory of contemporary Poland have been found. Human groups appeared in this area about 120,000 years ago when a subarctic climate dominated. A little later, in the period of the last interglacial, small isolated groups of Neanderthal people lived in the Kraków Upland. Their subsistence economy was based on hunting (Kruk 1990). The scale of human impact on the nature of the Jura is thought to have been rather insignificant. People hunted for large animals: mammoths; hairy rhinoceros; cave bears. Small groups of hunters often changed hunting grounds, and traces of their presence were obscured by nature. This stage ended about 40,000 B.C. (Kruk 1990).

Homo sapiens appeared in the Jura in the middle phase of the Würm glaciation. Forest tundra was the preferred area of camping and hunting for bears, mammoths, aurochs, European bison and reindeer. Archeological finds dated from this period are found in the caves: Nietoperzowa and Koziarnia (Jerzmanowice culture), Mamutowa in Wierzchowie (Aurignacian culture), and in the open excavation at Spadzista Street in Kraków. These are sites from the Upper Palaeolithic. This stage of human presence in the Jura ended about 10,000 years ago when the climate became more severe and the Upland turned into arctic tundra (Kruk 1990). Also in this period the impacts on natural values of human activity were likely no greater than the capability of biocenoses to regenerate. Yet some archeological finds suggest intensive hunting pressure in the area which may have led to local extirpations. So the question arises why did humans abandon this area. Did they overexploit the populations of large mammals?

At the beginning of the Neolithic (4,500-1,800 years B.C.) the next stage of human settlement in the Jura began. The economy was based on the extraction and distribution of flint. Agriculture began to develop on the Jura plateau. The first limited groups of farmers most probably settled in small deforested areas, forming isolated aggregations, mainly in the neighbourhood of river valleys. Over time human settlements extended over larger and larger areas. A 50 ha settlement from this period was discovered at Olszanica on the right bank of Rudawa River. The settlers built houses mostly of oak logs; for other purposes hornbeam was used. They cultivated wheat in small fields obtained by clearing of forest by fire. But these fields were quickly abandoned.

A radical change in the method of farming took place in the period of 4,100-3,800 B.C. At that time, larger settlements originated, often on loess hills. They were more sparsely distributed, and suggest more extensive farming. At the beginning of the fourth millenium B.C. the pattern of occupation by settlers again changed. The permanently settled zone moved from the margins of valleys to the plateau. In agriculture more extensive methods of plant cultivation were introduced. The role of stock breeding increased (Godlowska et al. 1995). Information on the methods of husbandry in this period would be helpful in studying the possible consequences of these activities on nature. Undoubtedly, it is the first period when human economic activity brought about the differentiation of habitats and the origin of new regional biocenoses.

At the beginning of the Bronze Age (2,300-1,600 B.C.) a network of permanent settlements was formed; agriculture developed in river valleys, with stock and sheep breeding on deforested heights. Traces of this colonization in the Upland are found in Iwanowice, Szyce, Modlnica and other areas. Fields were most probably cultivated by forest-field rotation. Forest was cleared to obtain a place for plant cultivation, but stumps were left. At first, cereals were sown. After a lapse of time fields were abandoned for 15-20 years. The subsequent successional stages of abandoned fields were used as gathering grounds and as a kind of pasture. After about 20 years young forest was cut down, wood

was used as timber, and a cleared area was utilized anew for cultivation purposes (Kadrów 1995). This kind of husbandry probably did not bring persistent negative consequences for the nature of the Jura. Certainly, it contributed to the maintenance of new semi-natural habitats. Conditions were also created for the incoming of species and communities characteristic of open areas.

The Early Bronze Age was followed by the stage of depopulation of the Kraków-Częstochowa Jura. We may suppose that in this period only caves were used as places where groups of people spent nights. Few traces of Lusatia culture have been dated as Bronze and early Iron Age in the southern part of the Jura. This rather long period, from 1,400 B.C. to the arrival of Celts, was characterized by a slower rate of colonization and cultural transformation. The question arises whether the existing earlier open habitats of anthropogenic origin could persist in these conditions. This problem needs further study.

In the 3rd century B.C. Celts appeared in the area of Jura. Traces of their colonization in the La Téne period are concentrated in the southern margins of the Kraków Jura, on both sides of Vistula River. Farther to the north they are relatively scarce (Godłowski 1995). In the La Téne period, i.e. up to the 1st century B.C., the natural consequences of human activity apparently were insignificant. Later on, from the 1st to 5th century A.D. colonization of the Jura intensified. Archeological finds from this period are mainly earthenware, tools and the like. Intense economic activity probably took place throughout the area of Kraków-Częstochowa Jura. At the end of this period intensified use of caves occurred, including some with not very comfortable conditions. Perhaps, they constituted refuges for people during the invasion of the Huns. Archeological finds from this period include different objects of material culture. However, no conclusions on the natural consequences of human activity can be drawn on the basis of this material. The distribution of archeological finds in the Kraków Jura (Godłowski 1995) shows that in this period people chose for settlement, areas that had been inhabited earlier such as river valleys, or adjacent heights. The scale of human impact on the nature of this region was likely rather small in view of the depopulation mentioned earlier.

No traces of early Slavonic occupation have so far been found in the Jura. Traces of two small settlements near Tyniec and three strongholds near Damice, Mników, and Zagorów, have been dated from the tribal period (7th-10th century). It should however, be stressed that the archeological knowledge of this period is not satisfactory. Nevertheless, the opinion seems justified that the Kraków part of Jura was weakly populated in the early Middle Ages and it constituted a base of supplies for main settlement centres (Poleski 1995)

In the late Middle Ages numerous fortifications were raised in the Jura, linking Kraków to Czestochowa. From 1228 when Prince Henry the Bearded built the castle of Skala, through the rest of the epoch of the Piast dynasty to the down-fall of the Polish state at the end of the 17th century, human impact on the nature of the Jura increased systematically. Its scale depended on the needs of castles and fortifications on the Eagle Nests Route. These structures were connected with the development of colonization, industry, and agriculture. A detailed analysis of the changes in nature, which accompanied this development, is not a simple task. Above all, it would be necessary to interpret anew, from the point of view of the nature, the material history of this region. Analyses made by Laberschek (1995) raise a hope that reconstruction of the human-nature relations in the Kraków-Czestochowa Jura will be possible. The later history of human impact on the nature of Jura is the history of mining and metallurgy, accompanied by intense urbanization. Only some parts of Jura have been the subject of historical studies which would enable the reconstruction of human impact on nature. The Prądnik River valley and Olkusz have been studied in this way.

3 Contemporary Threats to the Nature of Jura

The Kraków-Częstochowa Jura is situated among the three large urban-industrial agglomerations of Silesia, Kraków and Częstochowa. There are also numerous villages and small towns, and industrial plants located on the Jura itself. That is why the Jura is greatly affected by human pressure which threatens the existence of many plant and animal species, as well as whole ecosystems. As a result of intense urbanization and the rapid development of systems of roads and power-lines, valuable natural

areas decrease. Similar effects are produced by building more and more popular recreational houses, which are especially dangerous for nature as these houses are usually located in the most attractive natural areas. The presence of human settlements is connected with contamination of the environment. The concentration of SO_2 in the air increases due to burning of sulphur rich coal in household stoves. Water and soil are polluted by sewage from farms and untreated municipal sewage (about 78% of the total amount of sewage). Illegal refuse grounds are numerous and dumping of litter directly into rivers and streams is a very common practice.

Many hundred years of colonization of the Jura have caused considerable deforestation and transformation of much of the area into arable land. For example, in the province of Czestochowa, arable land constitutes 60% of the area. Intensive farming is followed by the increased endangerment of the flora and fauna due to water pollution by fertilizers, insecticides and herbicides rinsed from fields and by dumping of refuse from stock-farms. As a result of drainage, hygrophilous species lose their habitats and are scarce in the Jura in any event. Burning of stubble and grassland destroys the invertebrate fauna. Arable soil is less resistant to water erosion, the results of which were observed during this year's (1996) heavy spring and summer rains.

Through clear-cutting and introduction of coniferous plantations in historical times, forest management has reduced floristic composition and transformed the structure of stands. The dying of coniferous trees, particularly vulnerable to industrial emissions, results in uncovering of the forest floor and changes in the structure of the herb-layer. Typical forest species recede and synanthropic and meadow species encroach. The introduction of foreign species, such as *Pinus nigra, Robinia pseudacaccia,* and *Padus serotina* is common. These changes in forest management favour the synanthropization of vegetation and withdrawal of vulnerable native species.

A characteristic feature of the Kraków-Częstochowa Jura, is the occurrence of solution pits and karst phenomena. They cause the escape of water deep into the ground; as a result of this, the network of surface waters is scarce. The natural water deficit has been increased by the deforestation of large areas, river channelization and drainage. Mining has also caused the lowering of the ground water table and formation of depression sinks. Dense population and developing industry bring an excessive uptake of water. Intake from spring water often leads to irretrievable destruction of these features. As a consequence, the Jura suffers from serious water shortage. Permanent drying of habitats contributes to their transformation and the dying off of hygrophilous species.

Industry located at the outskirts of the Jura is very burdensome for the environment. Large sections of rivers carry waters which cannot be directly used because they are polluted by industrial wastes, municipal sewage, and mine waters that are strongly saline and rich in heavy metals. An analysis of the physical and chemical properties of waters in the province of Czestochowa showed that these waters do not meet any of the prevailing water quality standards. Also *Coli* exceeded the acceptable level. Extractive industries (gravel pits, quarries) locally have caused the complete mechanical destruction of vegetation and the upper horizons of soil. Dumps and refuse grounds produce similar results. Particularly dangerous are long-range emissions. Winds bring large amounts of pollutants. Chemical compounds either directly affect living organisms (causing e.g. chlorosis and necrosis of tree leaves), or they accumulate in soil and water, particularly in deep Jurassic valleys. In conditions of still air and high humidity; their effects are visible for some time.

The input of pollutants in the Kraków-Częstochowa Jura was estimated according to the methodology of the CORINAIR programme (one of the CORINE programmes), separately for a group of eight compounds (SO_X, NO_X, NMVOC, CH_4 , CO, CO_2, N_2O, NH_3), 11 possible sources of emissions were taken account. The method of data processing allowed for determination of the share of a given source in the emission of particular groups of compounds. For example, the main sources of SO_X emissions are heat and power generating plants (48%), processes of combustion in industry (30%) and local domestic heating (14%). The magnitude of emissions has been estimated for particular provinces, so it is difficult to determine the average level of pollution for the Jura, situated as it is in three provinces, and also because of the great local differentiation of emissions (Table 1) (Pazdan 1995).

The picturesque landscape with its interesting tors and diverse flora and fauna make the Jura exceptionally attractive for tourists. However, the rapid development of tourism, especially motorized tourism, brings with it development pressures for the construction of new roads, parking facilities, and picnic places. Participants in group excursions destroy the forest herb-layer, beat new paths, pick up flowering specimens of plants, litter the area with rubbish, make noise, and startle wild animals. Lovers of rock-climbing leave the paths leading to tors trampled to bare rock. They damage rocky crevices and walls. Speleologists damage the dripstone of caves and startle cave-dwelling bats.

Table 1. Emission of selected groups of pollutants for three provinces in 1990 [in Mg].

Group of pollutants	Katowice	Kraków	Czestochowa
SO_x	662 500	150 000	40,600
No_x	262 500	71 250	22 500
NMVOC	90 000	35 000	27 000
CH_4	2500 000	75 000	62 000
CO	1800 000	700 000	260 000
NH_3	1 650	875	1 100

Apart from the transformations of the environment, caused by human activity, we observe other natural changes, undesirable from the point of view of nature conservation. Preservation of semi-natural habitats, such as xerothermic grasslands, so important for biodiversity conservation, requires human interference. It is necessary to apply historic forms of farming, such as moderate grazing and irregular mowing, otherwise, grasslands left to their fate quickly undergo succession towards scrub and forest. Overshadowing causes a decrease in the number of species because light-loving plant and invertebrate species withdraw from the area.

4 Nature Conservation in the Kraków-Czestochowa Jura

Protected areas in the area of Kraków-Częstochowa Jura include one national park (Ojców - 1,592 ha), 25 nature reserves (c. 1,308 ha in total) and 6 landscape parks (Orle Gniazda, Dlubnianski, Dolinki Krakowskie, Tenczyński, Rudniański and Bielańsko-Tyniecki) covering 102,115 ha in total. Other areas in the Jura are a zone of protected landscape. Thus, the whole area of the Jura theoretically has protection, which means that we are sensible to its great natural value. However, the protective regime of landscape parks - to say nothing of the areas of protected landscape - is rather liberal and practically it does not guarantee the protection of landscape values, threatened habitats, or sites of rare plant and animal species. Another national park (Jura NP) is proposed for the northern part of the Jura (Czestochowa province). This park would include, among others, 4 CORINE sites (Skaly Jurajskie near Olsztyn, Sokole Góry, Parkowe and Góry Gorzkowskie). Identification of such sites of European importance in this area is a strong argument for taking it under protection as a national park which is the highest category of protection in Poland. Most of the CORINE sites selected in the Jura are situated in nature reserves or landscape parks.

5 What We Need to Protect the Biodiversity of Jura: The Distribution of Natural Sites, Fragmentation and Patchiness of Habitats, Ecological Barriers and Corridors

The uniqueness of the Kraków-Częstochowa Jura lies in the fact that despite many hundreds of years of human pressure, very rich flora and fauna have survived there. Some biocenoses have preserved their natural character. Others contain valuable natural objects. That is why the Jura is considered as an area of great natural value. As earlier mentioned, our knowledge of the nature of Jura is incomplete and unsystematic, so this knowledge cannot be the basis for a co-ordinated plan of protection for the whole area. There is relatively rich information on the Kraków Jura (Ojców Plateau) but single reports only for the northern part of the area (e.g. Skały Jurajskie near Olsztyn, Sokole Góry). The results of studies concerned with the fragments of Jura are often extrapolated for the whole area. However, spatial planning and rational conservation of the biodiversity of Jura can not be based on such an approach. Many species have very limited ranges in the Jura. An example is *Galium cracoviense*, a species endemic to Poland, so far known only from limestone tors near Olsztyn. Among the cockhafers, there are many species which have their only sites in the environs of Ojców (Pawlowski et al. 1994). Similar examples may be found in other groups of invertebrates. We know that many species of molluscs have insular distribution in the Jura.

Necessary complements to the faunistic and floristic recognition of the Jura should include the most valuable elements of biotopes (species, plant associations, geomorphological forms). They should be considered as the structural-functional elements of systems to which they belong. Hence, it is necessary to integrate information on them so that this integration can be a basis for spatial planning satisfying the needs of biodiversity conservation. A possible approach to this question is the integration of information according to CORINE methodology. This involves different levels of organization of ecosystems and biocenoses. Within the scope of the CORINE biotopes programme, this integration would comprise the distribution of species important from the point of view of European natural heritage conservation. To meet the requirements of nature conservation on the national, or regional scale, the CORINE data bank should be completed, particularly with field autecological observations.

A next step in the work should be the integration of the distribution of CORINE sites with the land cover map. Analysis of the land cover categories, especially those separating CORINE sites, should be undertaken from the point of view of their functions as ecological barriers or corridors. To make the results of the integration useful in spatial planning on the regional or local scale, further field research should be carried out as well. This will enable the precise identification of ecological barriers and corridors within the geocomplex of the Kraków-Częstochowa Jura. CORINE sites constitute so-called biocentres and it is necessary to ensure contact among them. For example, two sites, Dolina Pradnika and Dolinki Podkrakowskie, are separated by a narrow belt of cultivated fields and settlements. In preparing the land use and management plans for this area, provision should be made for a corridor connecting these two sites, so that the plants and animals can move freely between the sites. Faunistic and floristic studies, much more detailed than those made in the Jura up to now, are needed for this work. It is necessary to take into account the ecological requirements of species and entire biocenoses.

It has been already mentioned that preservation of the natural values of the Jura under conditions of many hundred of years of human pressure is an intriguing challenge. To examine the biogeographic and human conditions influencing the present state of the flora and fauna of the Jura, we are planning a historical study of colonization in selected sites of European and national importance, as well as the effects of this colonization on the present shape of biotopes and biocenoses. Conclusions from this study should be useful in nature conservation. They should be helpful in building up proper relations between local communities and protected areas. It is a well known fact that the success of any undertaking in the field of nature conservation is conditioned by the ecological consciousness of communities. The Kraków-Częstochowa Jura seems to be a particularly appropriate area for

comprehensive natural education. That is why it would be advisable to prepare natural and cultural educational or interpretation trails or paths on the basis of selected CORINE sites.

6 References

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