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RESEARCH ARTICLE

Natural conditions in the Carpathian Basin of the middle ages

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Abstract

The analysis of natural conditions is a new field in Hungarian medieval research. This field could only come into existence with the spread of new sources of research, and with the need of drawing the most realistic picture of medieval living conditions with the help of more – previously ignored – data and facts. This field of research may have a special meaning as according to sources of the age, the Carpathian Basin was one of the natural Paradises of Medieval Europe.

Keywords

natural conditions · Carpathian Basin · medieval Hungary · animal husbandry · population data · living conditions · medieval climate · forest destruction of medieval forests

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Many medieval travelogues mention with amazement the natural conditions of our country and the living conditions, which were much better than in most of the other European countries. These sources inform us with a witness' authenticity of the fertile arable lands, mountains covered with woods, of rich wildlife, hiding fabulous treasures in their depth and rivers full of fish. Even the German bishop, *Otto Freising*, who did not mince matters with his antipathy towards Hungarians, could not get away from the experiences he obtained crossing Hungary during the Second Crusade in 1147. The following can be read in his book *Acts of Caesar Friedrich I*, in the chapter describing Hungary and Hungarian traditions:

"This providence, for a long time called Pannonia - since all around it is bordered by woods and mountains with a roomy land of plain in the middle, which plain is ornate of rivers and rich in woods and of various wildlife - is known as such a rich country, due to the fertility of its wonderfully flourishing lands, that it can be seen as God's heaven or the famous Egypt."

And a little later, before anyone could stamp the claim of bias on him, he sighs thus:

" ... it would only be proper to blame the caprice of fortune or to admire the patience of God that he let this marvellous land as prey to these beasts of human, whom I cannot call men." [32] p. 167.

An unknown Dominican monk of maybe French origin with the same enthusiasm gives an account of his experiences of Hungary, obtained at the beginning of 1308. During the geographical and historical introduction of the Middle-European region he wrote the following about Hungary:

"It's lands are proper for grazing and very rich in cereals, wine, meats, gold and silver; and in the abundance of fishes it nearly outshines all countries [...]; it's land is mainly plain, spiced with tiny hills, but here and there it has got high mountains; in the region of Transylvania the mountains of salt are gigantic, people hollow out salt like stone, and transport it to all parts of the country and to all neighbouring countries." [5] p. 134.

Instead of enthusiasm, unambiguous and practical composition is typical of the description written by the Arabic trav-

eller coming from Granada, *Abu-Hámid al-Garnáti*, who rambled through most parts of the civilized world of the age. He spent three years in Hungary between 1150 and 1153, and he concluded his experiences in his work *Clear Report on Some Miracles of the Western Countries* as follows:

1 "Hungary is one of the countries where life is the most easy and best."

[5] p. 72. How much of this reflects the image, described by these sources, on the real conditions of the medieval Carpathian Basin? Do they describe the features only at the given time, or can this image can be extended to the whole period of the Middle Ages? By what means, can the environmental conditions of the time be reconstructed at all, if yes, what method should be chosen for this? Our essay tries to answer these questions.

The exploration of the real environmental conditions in the medieval Carpathian Basin cannot be considered as a simple task at all. All direct sources which could have saved a scholarly description of the land of the age are missing. The rest are the data we can use indirectly to obtain the information we are interested in. Charters referring to the foundation and property of monasteries, records on field areas, records of land donations and heritage matters can glean information on the state of natural conditions of the time. This image is completed with other sources, tax lists, market and customs tariffs and trade contracts referring to farming and trade. From these data we can draw the conclusion on not only the state of environment, but on the changes in it, the modifications made by humans, the yield capability of the land and from this the population. The settlements and graves excavated by archaeologists provide plenty of information, the animal and vegetal remains placed next to the bodies refer to the environmental conditions of the period. Though it is worth mentioning that animal bones placed in graves are much more connected to the world of beliefs than to the actual composition of the wildlife of the time. But these classical methods of historical science and archaeology cannot give enough information to explore the natural conditions precisely. Mostly because they only take a snapshot, their conclusion applies only to the time and place of the source's origin; it cannot be extended to whole periods, greater areas or countries.

This is especially true for the Carpathian Basin, where these sources are available for us just in very small numbers, and rather disorderedly in chronological and geographical terms.

The adoption of new scientific methods has led to a more precise recognition of the natural conditions of the age. For some decades, with the help of entirely new branches of science, an opportunity has presented itself for discovering such kinds of data sources and connections that were inaccessible and even unimaginable for the researchers of previous times. The common starting-point of these new methods is based on turning over the proof-process. In case there are not enough data at our disposal about the natural conditions of the time, we should search for factors related to it – which influence it or on the contrary, are dependent on it – explore these factors, and from the resulting facts we should deduce the state of environmental relations. With reference to this, the analysis of climate, hydrography and natural flora comes to the fore, as factors that have decisive influence on the changes in natural conditions.

First let us start with one of the factors that effect the natural conditions independently of humans – **climate**. In connection with this, it first has to be clarified, what kind of data we possess about the weather of the age.

Unfortunately very little information is accessible directly, since there is no remaining weather forecast of the examined time. Of course notes on weather observation are known from this age, but their data are individual ones, scattered over time and distances and the tendency of changes in weather cannot be determined from only this source. Lists of data especially concentrating on weather, more precisely on changes in weather, from results of systematic observation are known from later periods and then only from the middle of the 17^{th} century. The oldest of these is a note recorded between 1652 and 1658 by *Mauritius Knauer* Benedictine monk [19] p. 10.

Written sources or imaginary representations can be completed, specified or interpreted by data of other origins, which record the weather conditions in different ways. The glaciers of the Alps, the thousand year old ice fields of Greenland have captured the air molecules of the time. The analysis of them gives answers to many questions about the changes in climate. The proportion of the oxygen's isotope No 18, the changes in its location related to other layers has evident connection with Solar activity and the dominant temperature of the period [39] p. 70. The physical and chemical composition of the air-bubbles refers to the air conditions, from it the influence of atmospheric pollution, like volcanic eruptions or increased mine and industrial activity can be shown [30] pp. 58-59. The extension of glaciers, their withdrawal or spreading is also dependent on the climate at the time, in this way they can refer to the possible changes in it [39] p. 77. *Dendrochronology*, the analysis of annual tree rings can also be a good basis for the researchers of climatic changes, as - beside soil conditions considered permanent – the thickness and density of annual rings is mainly determined by weather: by the amount of rain and the temperature [12] p. 4, [9] p. 314.

The remains of plants and animals that once lived in the given area also shed light indirectly on the weather of the examined period. Animal bones, vegetal shreds and pollens are important finds in waste pits, wells or cavities filled up with organic waste and previous cultural layers [38] p. 48. The complex analysis of them can throw light on not only the possible changes in climate but also on the living conditions, cultivations and nutritional habits of the time.

The use of these methods is made much more difficult by the problem of calibration, the exact timing of the sample. For this often other special methods are needed – like radiocarbon time determination – which also hides the possibility of deficiency [9] p. 314.

With the help of the introduced methods the main characteristics of the climate of medieval Carpathian Basin can be concluded as follows:

According to the evidence of chemical analysis of air recovered from the air-inclusions of the Greenlandic thick ice, after the last ice age in our area – just as in other parts of Europe – a balanced climate free from major changes, was dominant [30] p. 58. This period, which was meteorologically peaceful , was followed by a warmer and much drier age at the end of the 8^{th} millennium BC. Resulting from this, between 7000 and 5500 BC, in the lands of Hungary natural grassy fields – similar to today's Alföld – were formed, leaving pollens of such plants behind, which appear only in warm steppe zones today [16] p. 68. At the beginning of the 1^{st} millennium BC the climate turned milder and wetter determining the weather of the whole of Europe for nearly for a thousand years. Many researchers put the flourishing of classical Greek city-states down to this favourable climate [37] p. 25., but the development of woods, covering most parts of the continent in the early Middle Ages, can also be originated from this period.

At the end of the 1^{st} century AD, in the region of the Carpathian Basin a much warmer and drier period set in, which was more or less similar to today's North-Italian climate. This can be supported by the fairly dense annual-ring-structure of the oak-remains from the Roman age, the appearance of Mediterranean plant types (fig, apricot, peach, plum, and pear) as well as with the large number of high, trellis-like vineyards. Also the open inner court of houses, which was widespread all around Pannonia, can only be explained by this climate-optimum [4] p. 6. Data in connection with the lower water level of rivers and lakes also refer to a drier climate. In any other case the present location of fortifications, bridges, graves and house remains from Lake Fertő, all standing under water, would otherwise be hard to interpret [12] pp. 4-5, [38] p. 51.

This dry period, which beside the Carpathian Basin also affected Eastern Europe culminated in the 4^{th} century. As a result the latter region suffered drought and partly depopulated, even the Great Silk Route was closed. According to the hypothesis of several researchers, this unfavourable change in the climate of Inner-Asia led to the great migrations lasting for centuries, as the tribes of nomads living there, due to the drying of their lands, followed their animals and moved gradually west [39] p. 71.

In the 7^{th}-8^{th} centuries the area of the Mediterranean Sea was again ravaged by drought, what forced the inhabitants of Southern Italy and Greece to migrate from the inner areas to the sea coast.

The climatic warming also spread over to the northern parts of Europe. The thick ice of the Arctic withdrew and the sea storms lessened. From the chemical analysis of the air captured in ice, the archival and archaeological materials on barley cultivation in Iceland and North-Norway and the book *Landnámabók* about the early history of Iceland, researchers have come to the conclusion that the temperature of both the air and the sea water of Northern Europe was 3-4 degrees higher from the end of the 8^{th} century to the end of the 12^{th} century than it is today. This favourable weather made the Viking invasion possible, first towards Iceland, then to Greenland and later forming the North American colony of Vinland in addition to the exploration of the North-Sea down to Spitzberges and Novaja Zemlja [39] p. 69.

The warming in the region of the Carpathian Basin was temporarily succeeded by a colder period in the 8^{th} century, and then from the 9^{th} century the climate became warmer again around Europe. This "climatic optimum" was about 1^{o}C higher average temperature than today, but what is more important, it came with heavier rainfall than before [8] pp. 685-686. Since this advantageous weather coincided with the "agricultural revolution", the invention of new cultivation methods and resulting from this a sudden increase in produce, this period can be considered as the golden age of the medieval period.

In Europe this favourable weather lasted until the second half of the 13^{th} century. The deterioration in climate was observed first in Greenland on the turn of the 12^{th}-13^{th} century [39] p. 73, but its influence was perceivable even in the Carpathian Basin at the latest in the first half of the 13^{th} century. The climate became more continental, namely colder and drier [35] p. 53. The most striking sign of this change was the winter of 1241-42, when the Danube was frozen by the severe cold and Tartars could reach Trans-Danubia by getting across this provisory natural bridge. The sea ice spreading down to the south closed the northern trade routes and the storms and floods on the south coast of the Northern Sea frequently caused devastation. According to estimations, tides and high waves in the 13^{th} and 15^{th} century cost more than 500 thousand human lives, and the most devastating tide of historical ages on 1^{st} November 1570 claimed at least 400 thousand victims from France to the German coasts [39] p. 75. [10] p. 49. Contrary to the climate of the Carpathian Basin, which became drier, Western Europe was afflicted by rather cold and rainy weather in the first half of the 14^{th} century. The continuous rain between the period 1313 and 1321 created swamps from country-sized lands, where no ploughing, sowing or harvesting could be carried out. As a result of this throughout the whole region of Western Europe, especially in France and England, there were terrible and devastating famines, which even led to cannibalism in some of the countries [39] p. 76. [37] p. 144., [31] p. 85. The reason for these famines was that the farming and nutritional habits of this area had changed by this time – due to the Mediterranean ideals transported by Christianity – the previous dominance of meat consumption had vanished and it was replaced by grains [31] p. 55. This – first of all ideological – change made the society defenceless against the changes in natural conditions, since the nutritional needs of people was only provided through plant cultivation.

After a temporary thaw, at the end of the 16^{th} century temperatures started to fall again in Europe, and this period called "the small ice age" – alternating with some warmer times – lasted un-

til the middle of the 19^{th} century. At about this time the climate was 1.5 ^{o}C colder and about 20% wetter than today. The permanent cooling of the Carpathian Basin had started in the 1550's and was at its worst in the years of 1595-1602, when the Danube froze many times (1594/95, 1601/02, 1607/08) [39] p. 77. This unusually cold period coincided with the Fifteen Years War, just as the climatic minimum of the 13^{th} century (winter of 1241/42) co-incided with the Tartar Invasion.

Amongst natural factors, besides climate, human living conditions are mainly determined by **hydrography**, more precisely by its changes. From this point of view the history of the Carpathian Basin could be a classic example.

The hydrographic appearance of the country at the time of the Hungarian conquest was totally different from the face of today. A considerable part of the Great Plain was covered by water temporarily or during the whole of the year. This is especially true for the Trans-Tisza region, where – before the flood control of the 19^{th} century – Tisza, Túr, the Körösök and Berettyó fed wetlands as big as counties. The most famous among them is *Nagy Sárrét*, fed by the latter rivers, which was called *Lutum Zerep* i.e. *Szerep-sár* by *Anonymus*[34] p. 104. Contrary to common belief these marshy areas, that were also called *sár* (=mud) or *rét* (=meadow), were not useless and deserted lands. Due to their self-protective nature and difficult accessibility, the archaic forms of cultivation, life style and settlement system could be restored more easily than in other areas.

The conquering Hungarians were tightly attached to waters, most of the time they established the winter settlement on the bank of rivers, thus hydrography had a relevant role in the formation of the settlement structure of the time. Genuinely nomadic nations despised fishing, but contrary to this Hungarians took advantage of this way of supplementing their nutrition. Our medieval rivers were famed far and wide for their richness in fish.

Fishing had a special role in medieval Hungary because of the prohibitions of Lent. Since the transportation of fish can be solved only in their salted form, we can account only for the consumption of fish bred in artificial lakes, which were created by the damming of brooks – not including the markets of riverside towns. There were hardly any Benedictine, Cistercian or Paulican monasteries without these kinds of fish ponds. These lakes can be found even in such extreme places as the Paulican monastery of Pilisszentlélek built on a plateau hollowed into the hillside. Waters were also transportation and trade routes, the poor-quality roads of the land made only the transportation of goods for short distances possible. The merchant of the early period of the Middle Ages transported his own goods, mainly on foot or sometimes on horseback. Not until the 12^{th} century did the use of carts become common. The transportation of large quantities of goods was only possible by river, with one exception being live animals. Though wine was transported on carts, most wines did not stand the permanent shaking and changes in temperature, so rivers were still the main routes for the wine trade.

To illustrate the multipurpose utilization of water let us recall the description of the Cistercian monastery of Clairvaux [18] pp. 288-291. Here we can read that the water of the brook running in the valley first arrived to the garden and the orchard, there it fed the irrigation canals between the parcels of land. After that, it reached the swollen fish pond, which was used for nutrition and the "recreation" of monks. They gained water for the irrigation of the kitchen garden also from this pond. Reaching the monastery the water first turned the wheel of the mill, then arrived to the tanning workshop and finally it flushed through the toilets.

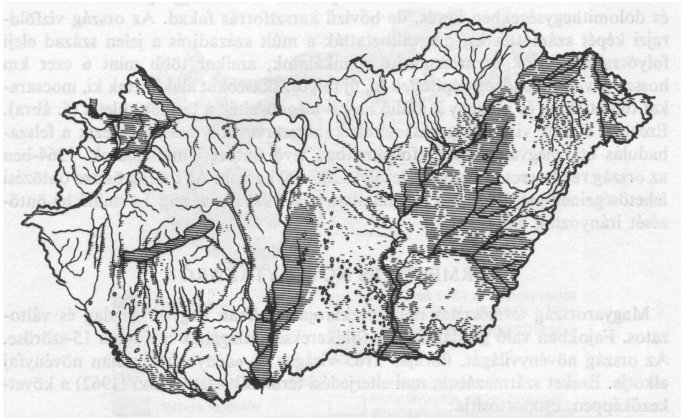

Fig. 1. Water-covered regions of the medieval area of today's Hungary (Keresztesi 1971. p. 101. Figure No. 6.)

After the last ice age the *natural flora* of Europe – together with the Carpathian Basin - was mainly determined by woodland just as the living conditions of the inhabitants of this region were determined by their relation towards the woods.

Around the Mediterranean Sea, especially because of the dry climate and the poor quality agricultural land, the sparse, so called Mediterranean woods were typical. Their destruction had already started in ancient times, as the basic raw material of the classical Greek and Roman culture was timber. Wood was used for cooking, heating and construction, but the main consumers were the shipbuilding workshops. Agriculture, largely based on plant cultivation and sheep breeding, had the primary role of supporting the town population and to do this, it gradually extended over larger and larger areas at the expense of forests. Woodlands of any great size, could only survive in places where the soil proved to be useless for cultivation. The concept of woodland protection did not arise at this time, since civilizations born in the basin of the Mediterranean Sea were fundamentally connected to the town and its cultivated environment, in forests they only recognized the opposition of civilization and the wild nature to be bridled [31] p. 15. As a result of these processes, from the densely inhabited regions and intensively cultivated areas of the Balkan Peninsula, forests had actually vanished by the end of ancient times [37] p. 32.

Most of the areas lying north of the Alpine ridge, were covered by dense leafy woods of enormous size, contrary to the

sparse Mediterranean forests. People living here, their lives framed by trackless forests, used and respected the woods, they did not consider them as obstacles to be cleared away, but a place to take full advantage of. They did not even express the area of the forest with abstract measures, but with the number of swine they could fatten on the given area [31] p. 23. In glades and clearings, in the soil improved with the ash of trees, people cultivated plants, on the fringe of the forest they grazed their animals, deeper in the woods they bred bees, collected mushrooms and fruit, hunted for prey. Forests provided them with the means for construction, firewood, curative herbs, and in case of danger it served as shelter. The dark and impenetrable woods, where they did not dare to go, people filled with ghosts and the mythical characters of fairytales. As a result, this period of Western European history is aptly called the civilisation of woods by several historians [41] p. 26. This extremely rich culture was ended first of all by the appearance of Christianity and the rapid spread of agricultural cultivation.

At the time of the Hungarian conquest the phytogeographical image of the Carpathian Basin was generally determined by loess and wooded plains, and on hilly lands by impenetrable unbroken oak and beech forests. For nearly the whole area of Nagyalföld, loess and wooded plains were typical. These typical zones, similar to the Russian steppe-zones, formed a transition between the treeless grassy fields and the dense wooded-zones [16] pp. 68-69. and 76-77., [17] pp. 103-106. They were made of open, grove-like steppe and oak woodland, rich in hunting-grounds and grazed fields interspersed with huge flood areas and swamps. The river banks were lined with wetland forests and the permanently wet fields were filled with typical grove-like woods.

Higher up, closer to the woody-plain zone, in the hill country and low mountains, closed oak woods were formed, and above this, at the height of approximately 600 metres, the beech woods appeared. Half of the area of today's Hungary which is part of the leafy wood zone was covered with forest at the end of the first millennium [17] p. 104., and the proportion of forest – compared to the whole territory of present Hungary – was nearly 60% [38] p. 51. If we take into consideration the trackless forests of the Carpathians, this proportion could be even higher. Thus the miniature representing the crusade armies of the German Caesar, Friedrich (The Red-Bearded) crossing Hungary, is only the creature of imagination, where soldiers could only make their way by deforestation.

Of course these huge forests were not left intact even in the area of the Carpathian Basin. Their destruction had started long before the arrival of Hungarians. The natural conditions becoming poorer, first of all the drier climate of the 1^{st}-2^{nd} century AD, was not favourable for the forests of the time. The higher density in the annual rings of the Roman oak remains from Pannonia unambiguously supports this [12] p. 4. Nevertheless the decrease in the area of woods was not just in connection with the unfavourable changes in climate but with the deliberate deforestation. However in the background of this process the reason is not the increased demand for agricultural land. In the region of Trans-Danubia, especially in Balaton-felvidék, only the spread of villa-farming – above all based on livestock – could not come without the removal of forests. The significant expansion of the agricultural lands was hindered by the fact that according to data from the age, a field of the same size made half the profit from grains than from one being used as forest or pasture. The most profitable usage of the land would have been the cultivation of grape, but according to the most updated research results, this was not typical cultivation in Pannonia [46] pp. 13-16. In the Roman Age the destruction of woods resulted from the timber extraction of an extremely large quantity of wood needed mostly for building works and for the production of charcoal used for heating [4] p. 6. This is especially true for the feverish fortress building in the 3^{rd}-4^{th} centuries, when against the more and more frequent German intrusions, more settlements, which had not been reinforced before, like the present Szombathely and Sopron, had to be surrounded by walls [11] p. 4. These works

Fig. 2. Caesar Friedrich crosses Hungary at the head of his army (Kristó-Makk 1981. Fig. No. 29.)

required a massive number of trees for the scaffolding of stone walls.

With the decline of the Roman Empire this process of deforestation stopped. The collapse of the central power came together with the deterioration in public security, and this practically halted the regional and national commerce, which resulted in the elimination of the main justification for towns. For centuries farming was only carried out on a self sufficiency basis and the forests re-established their ancient boundaries throughout Europe.

The change that really endangered the existence of forest and woodland, set in when Christianity crossed the Alps and established itself amongst these northern lands. This ideology with its basically Mediterranean roots had been built on the ancient culture's economic, nutritional and sylvicultural customs, and it tried to introduce them in the newly conquered regions. What kind of conflicts arose from this? The basic pillar of economic life in the ancient culture was agriculture and horticulture. The products – wheat, grapes and oil – were the main food for the population, who ate a diet almost entirely of vegetal origins. North of the Alps this vegetal culture – living on bread and wine –was confronted with the barbarian society eating meat and drinking beer. With the transubstantiation of Jesus – bread and wine – Christianity effectively forced the Mediterranean nutrition onto the people of the area, and with this set up a demand for a complete change in agriculture. For the cultivation of wheat, or in colder places barley, maybe millet and grape, new fallow lands had to be cultivated and new clearings gained from woodland. The change to a new agriculture appropriate to Christian principles – which transferred the emphasis from livestock breeding to plant cultivation – led to incredible deforestations. On the level of agriculture of the age, when one sowed grain brought maximum three grains, huge land areas had to be bought into cultivation.

This process started in the 10^{th}-11^{th} century. First the ploughlands already under cultivation were increased at the expense of woods, and then in the next century new, mainly uninhabited lands the size of counties were bought under the plough. During this period, in parts of Germany above the Elba half of the forests were destroyed, and in Britain and Bohemia the area of forest-covered regions decreased significantly [41] p. 30. During the 12^{th} century not only the borders of inhabited areas were extended but the process of settling – lasting for centuries – had started. The population of Western Europe had reached that critical number by this time, when the cultivation methods of the age were hardly able to support the people. The increasing of production was possible only with the cultivation of new lands, but this was very much limited by the unsolved transportation of goods. Thus the consumers moved to farther new places. On one hand this migration eased the population tensions in regions of high density, on the other hand it made the settlers part of a grandiose enterprise defined by the church. The basic thesis of this was the notion, with its Mediterranean roots, that the breaking of uncultivated lands and the clearing of woods is nothing less than a correction of nature depraved by sin. The implantation of the basic elements of "modern nutrition" – wheat and the grape – to the religious symbols served the same purpose. With the transubstantiation of Christ's body and blood to the end-products of these two plants, to bread and wine – the holy church had unambiguously declared that the redemption of the world can only happen with the spread of agriculture.

The most important characters of this process were the monastic communities. The first Benedictine monasteries, like for example Fulda, were built on the outskirts of big forests, although the early monastic foundations did not make any significant changes to the woodland . This situation had changed by the 12^{th} century. With the birth of the Cistercian order, the most enthusiastic soldiers of nature-change appeared. This ideological background was defined in the spread of grangias of the Cistercian order and generally in the praise of labour and nature [41] p. 31.

Fig. 3. The potential flora of the Carphatian Basin at the turn of the 1^{st} millennium (Map of Bálint Zólyomi, published: Györffy 2001. p. 7.)

Legend: 1. Willow-poplar grooves along river bank, highland mature forests mixed with elm-ash-oak, reedy marshes, saliferous lands, oaks of saliferous lands, peaty meadow-bogs. 2. lowland sandy hills with common oak woods and lilly of the valley, poplar woods and juniper, Pontus-sub-Mediterranean sand-plains, saliferous inter-hill lands. 3. Lowland grassy loess-plains with patches of maple and oak trees, low growing almond shrubs. 4. Partly sub-Mediterranean oak wood of the woody-steppe of the Great Plain mixed with maple-oak-Turkey oak, patched with loess-plain. 5. Loess oak woods of the Alpine woody-steppe with maple. 6. Field maple - oak woods with cold continental character, on the edge of lowlands. 7. Broken settled maple-oak woods of the Moldovan-Podolian loess highlands. 8. Eastern European common oak, closed leafy woodland zone with yoke-elm. 9. Steppe zone with rich composition and grass. 10. Steppe zone of short grass and absinthe. 11. Closed matured forest of Pannon-hills with Turkey-oak and oak. 12. Middle European dry oak woods. 13. Sub-Mediterranean

oak and ash-tree karst-woods with closed foliage. 14. Turkey-oak and Farnetto-oak woods of Dacia-Moesia hills. 15. White Lime and common oak woods of Balkan mountains. 16. Sub-Mediterranean-Illirian karst-woods mixed with oak - ash-tree - yoke-elm, eastern yoke-elm woods and their bushy derivatives. 17. Karst-woods with Pontus-sub-Mediterranean mixture. 18. Middle European yoke-elm – mature oak matured forests (deeply shaded) (with beech-islands), with yoke-elm – common oak matured forests on edge of the flood area. 19. Middle and Southern European mountain beech-forests, silver fir-beech woods (deeply shaded), in the south-western Illirian areas and in the north-eastern areas with Carpathian - Transylvanian character. 20. European high-mountain spruce fir woods, sub-alpine Arolla forests and alpine lawns. 21. Middle European oak woods with acidic soil, mixed with Scots fir. 22. North-eastern European weeping birch-Scots fir wood zone, partly mixed with oak, in podsol soil. 23. Provenance of sabretache plates from the graves of the Hungarian nomadic age. 24. Hungarian and Hungarian-like graves and cemeteries excavated east of the Carpathians

The destruction of medieval forest can not only be explained by ideological reasons. Practically wood meant the only energy source at this time. Metallurgy, metal processing, glass art and textile industry set up a great demand for wood. Salt furnaces of the North Sea were heated with wood as well as breweries, and beside households also textile and leather industry used potash from wood. During building works vast amount of trees were used, since not only houses in villages but most of the towns were built from wood, and for the construction of some bigger churches whole forests were needed. The largest numbers of trees were used by shipyards. Workshops of Venice destroyed the forests of the Southern Alps and Dalmatia, and the ships of Barcelona and Genoa ate up the woods of Pyrenees and the Provence Alps. The joint outcome of these enormous deforestations was that by the 13^{th} century in more and more areas of Europe forests had vanished and erosion was damaging the land [41] p. 37.

This process appeared a little while later and in a milder form in the Carpathian Basin. The reason for this was the low density of population, typical for the whole period of the Middle Ages. The smaller population did not need to exploit large areas with intensive cultivation methods.

There is no information on significant deforestation carried out by the conquering Hungarians. The level and hilly wooded fields, where they settled, were perfect for the semi-nomadic people who were mainly raising livestock although next to the winter settlements had also started to cultivate plants. The grazings and woods by the border of the settlements were in undivided common property, the memory of which can be seen in sources for centuries. The dense and in early times uninhabited woods of the Carpathians and the inner medium height mountains, with the strengthening of central power and the establishment of the institutional system of the kingdom, became the private property of the king [24] p. 193. In these areas by the 12^{th} century an independent forest-overseer system had been set up, the profit of which was absorbed by the king and his close court. The ownership of the first areas of land to be transferred were typically areas of woodland or forest, thus by the 13^{th} century most parts of the forests had gone into ecclesiastical and noble hands, while the rest was either absorbed into the neighbouring counties or was used for hunting.

The felling of timber was also taking place within the Carpathian Basin, according to hypothesises there were working mines in Upper Hungary and Transylvania after the conquest, which required increasing amounts of timber. The building of border-gates and wooden framed, panelled earth-castles was also typical for this period creating a high demand for wood [20] p. 207.

During the Medieval Ages, the previously uninhabited areas were also inhabited, partly by the settlement of foreigners (Germans, Cumanians and Jazygians), partly by migration (Romanians) and partly due to internal migration. In these regions colonies cleared settlements establishing them similarly to other parts of Europe. The Cistercian order also played a relevant role in this process in Hungary, the order built monasteries at the turn of 12^{th}-13^{th} century almost entirely besides the previously uninhabited, forest-covered areas.

In spite of these processes the forests of the Carpathian Basin survived the few centuries of the Middle Age. Their final death can be connected on one hand to the increased demand for firewood due to the "small ice age", coming in the middle of the 16^{th} century, on the other hand to the Turkish occupation, which evoked the feverish fortress-building and strategic deforestations.

Fig. 4. Harvest (Magyar Kódex Vol. I. p. 337.)

The Carpathian Basin became a cultivated land, so its natural image was not only determined by woods but by **cultivated plough-lands**, especially in the late Medieval period. But with what and how was cultivated? This question can be answered with the help of field records, market and customs tariffs and notes in commercial contracts. The vegetal remains, grains and pollens preserved in waste pits or filled wells can help to determine the plant species of the time, and the constructed representation of cultivation tools and work stages makes the exploration

of the methods easier.

The conquering Hungarians possessed agricultural knowledge. Their education in this field – based on the words coming from Turkish and Eastern Slavic language – was at the level of the local nations [33] p. 222. They used a plough that differed from the local type, equipped with a wheel, plough-handle, plough coulter, and special scythe. In the fixed settlements (the winter accommodations) they cultivated a field until it was totally exhausted, this approach was pursued until the 11^{th}-12^{th} century. It was then followed by the more structured rotation of fallowing, which meant that the fields, designated for cultivation, were once cultivated then rested. The period between the changes was between 2 and 8 years [45] p. 258. In both cases the exhausted field was grazed and manured by their large number of animals, which was not typical of the rest of Europe at this time.

In the middle of the 13^{th} century the yield of wheat and rye had increased fourfold, in case of barley, oats and millet it was two- or threefold. At the same time in the more developed farming of England, this number had increased fivefold for wheat and fourfold for oats [18] p. 350. This approximately reaches the yield -limit of the Medieval period, even the most developed regions were not able to reach much higher levels until the 18^{th} century.

The achievements of the European agricultural revolution arrived in Hungary with the migration of monks and settlers. One of the most significant achievements of this revolution was the spread of the turn-plough, especially the use of its disc sub-type [45] p. 250. The spread of it in Hungary was rather limited as it demanded great pulling power, at least 6-8 but very often 12 oxen, the possibility of this was very rare in the villages with a low population.

The course rotation first appeared in the 14^{th} century, mainly on lands of the church and in the more developed western parts of the country. First the two-course rotation was followed, when the plough-land and the grazing, or the autumn and spring plough-land was alternated, later the three-course rotation, when the autumn and spring plough-land and the grazing was in rotational use [44] p. 500. The primary condition for this cultivation method was a developed village community and estate-structure, and the higher populations in the villages. This method had been known in Europe since the 8^{th} century, the late appearance of it in Hungary can be explained by the disordered estate-structure and the low density of population, which simply did not have the demand for increased productivity.

The products of agricultural cultivation were not the typical export goods of the medieval Hungary, with the only exception of wine. The cereals were only part of the commerce toward the regional or rather the local market. The notes of the customs tariff in Esztergom, 1288, quoting the cereals, wheat, barley, rye and malting barley as "...goods of daily market." refers to this [32] p. 409.

Beside the cereal cultivation, the natural environment of the medieval Carpathian Basin was very much shaped by the **cultivation of grapes**. Of the nations before the conquering Hungarians, common belief usually considers the Romans as the founders of Hungary's grape-culture. But this is not true. Ampelopsis is native in the Carpathian Basin, it can be consumed without grafting, and its quality can be developed with pruning. Sources of the time pronounced the Pannonian wine "bad and few". In addition, for the prevention of the Italian wine trade, establishing vines in the provinces had been forbidden until the 3^{rd} century. With the exception of Szerémség, in other parts of Pannonia, no traces of relevant Roman viticulture can be found. The provinces tended to consume beer with wines of better quality imported, often in exchange for grains [46] p. 16.

Some of the Bulgarian / Turkish words absorbed by the conquering Hungarians are in connection with grape-cultivation, so it is likely their knowledge about it originated from the practice of grove-like viticulture [40] p. 17. The prosperity of the medieval viticulture can be connected to the Catholic Church supporting the cult of wine in preference to beer, and to the monastic communities. Even the first charters mention vines donated to monasteries and churches. Of course the influence of wine consumption cannot only be connected to the monastic community, it was also typical of all areas and social levels of the country. Due to the pollution of drinking water, practically, only beer and wine could ease the thirst of our medieval forefathers. In early times vine cultivation was followed in landlord's private lands and the settlements of the royal castle-structure. Beside the spreading of monastic-farms, decisive change occurred with the birth of a new method of land ownership in the 13^{th} century, in this way, a foreign landowner could acquire vineyards, and the subsequent and reliable rent gave an enormous impulse to the spread of viticulture [40] p. 19. In this way, the most suited wine producing areas, which remained determinative in later centuries, were formed at this time.

Among the wine-growing areas, Szerém ranks first in both establishment and quality. It is also the only region of medieval Hungary, where traces of Roman viticulture can be confirmed. Of course there is no connection between the medieval wine of Szerémség and the Roman antecedents, since the demanding methods of viticulture, could not survive the six hundred year period. Most of the wine of Szerémség was transported through Esztergom to Bohemia and other areas, mainly by river. Transportation on land was not good for wine and ruined its quality. According to the note of the customs-records written in Esztergom, 1288, beside Szerémség, wine had arrived in the town from Somogy, Zala, Sokoró and Pest [32] p. 408. The wine-growing area of Tokaj, later having so great a reputation, started to be formed at this time, and the start of the mainly local grape-cultivation of Buda and Sopron can be determined also in this period.

The medieval wine culture of the Carpathian Basin was characterised by the dominance of white wines, we only know one type of blue grape from this period [7] p. 21. For the production

of red wine a special treatment of wine is needed, for this, the use of a blue grape is not enough. This process, when must was left on the marc, was unknown for the Hungarian wine maker of the Middle Ages. The first grape-type called Kadarka, actually giving red wine, was established by the races, who moved to Hungary following the invasion of Turks, the spread of the new wine making techniques can be connected to them [7] p. 21.

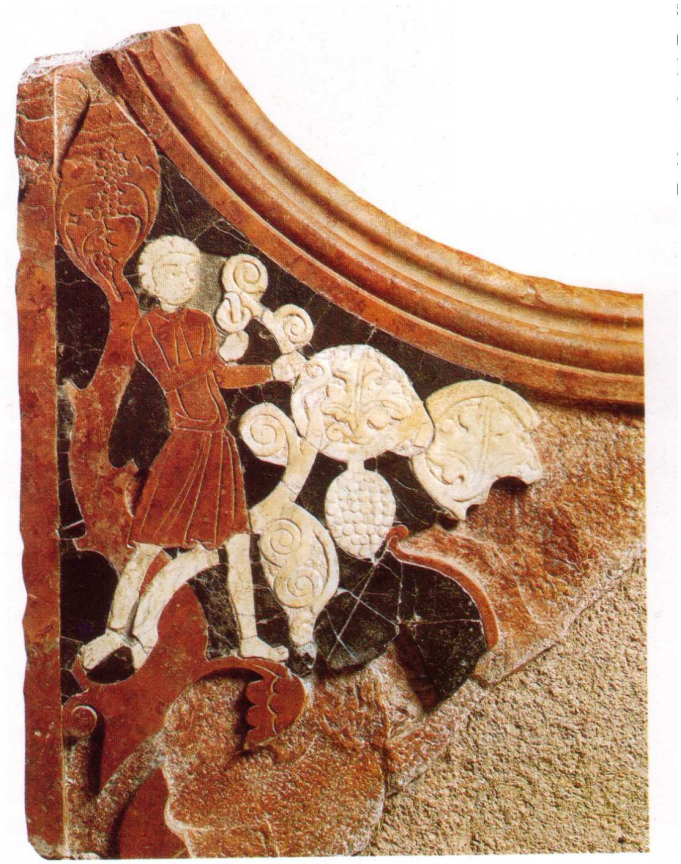

Fig. 5. Wine-growing on the flood plain, on the banks of the City of Esztergom (Pannonia Regia 1994. p. 235.)

In markets, beside cereals and grapes, other products have also appeared, in both the custom registers and in waste pits, it is clear from this that the medieval Carpathian Basin possessed all vegetal products that were known at the time.

In the first third of the 15^{th} century, the law-book of Buda listed all the market-women in its rule orders. According to this there were fruit market-women who were allowed to sell apple, pear, cherry, sour-cherry, strawberry, peas, field bean, Cicer, melon, potato (?), pumpkin, peach, green walnut, every kind of green fruit, in winter juniper and dried fruits, but no grape.

In the next row they were followed by the greens market-women: they could sell dry peas, bean, lentil, barley, cannabis, poppy, coarse oats, coarse barley, coarse spelt, sweet fennel, coarse millet, cemra-seed, dried chive, dried garlic and every kind of greens in their basket. The vegetable market-women could sell green cabbage, pickled cabbage, parsley, red beet, pumpkin, radish, horse-radish, onion, chive, garlic, carrot, spinach and every kind of green plants [5] pp. 178-180. Based on this list we can have an image of the productivity of medieval Hungary, with the exception of the vegetables which were introduced later, like rice, corn, pepper and tomato, everything was available in the market.

Fig. 6. Agriculture (Bartlett 2003. p. 101.)

As we could see earlier, agriculture, especially the cultivation of cereals, became dominant over animal husbandry as a result of the Mediterranean heritage transported by Christianity. This change was not without a hitch, as the methods of grain production with the greatly increased yields (some four- or five-fold) was not developed, only the extension of arable lands could have led to growing production. However this extensive development was very much limited by the forest areas and the difficulties of transportation. The population became dependant on cereal products, which was strongly related to the whims of weather. As a result of this, historical sources inform us of about 29 famines between the 8^{th} and 12^{th} century all around Europe [31] p. 53. And the increased consumption of cereals came with several serious ergot related poisoning epidemics.

From the 12^{th} century the number of famines decreased, since the achievements of the agricultural revolution had matured by this time. In this period people finally changed millet and sorghum to wheat and crop fertilization became widespread.

The excess produced by the high average yields made the development of towns with large populations possible together with a general increase in the population. This process lasted until the middle of the 14^{th} century, when the already unstable balance was upset. The cold and rainy weather between 1313 and 1321 made cereal-cultivation impossible; lands permanently standing under water for years were unusable both for sowing and harvesting. Commerce also became impossible and terrible famines destroyed in particular the towns, the results of which extended to cannibalism in many countries. Due to the high mortality and the consumption of draught animals, whole regions of England became deserted and a huge area of land was uncultivated even in the 40's. Between 1347 and 1350 this

underfed, starving population was reached by the first wave of plague coming from Inner-Asia. By the end of the 14^{th} century about one third of the European population had been killed by this catastrophe that can be traced back to the weather and cultivation problems.

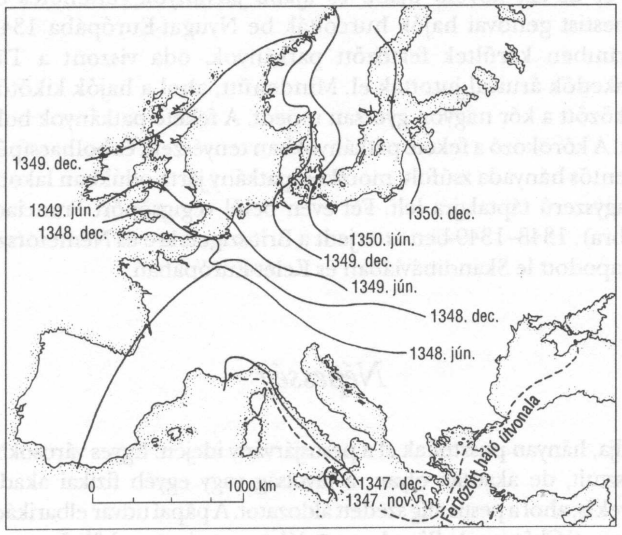

Fig. 7. Spread of plague. (Pounds 2003. p. 214.)

There are no precise data on the number of casualties in Hungary at that time, but we can state with some degree of certainty, that the loss was much less in this area. One reason for this is the low density of population, especially in the most endangered towns; another reason is the increased resistance of the inhabitants resulting from a better food supply. Here the conflict between cereals and meat, crop production and animal husbandry has never been as extreme as in other countries. For the whole period of the Middle Ages the Carpathian Basin primarily stayed as animal breeding area.

The natural conditions of the Carpathian Basin were formed by **animal husbandry** at least as much as by plant cultivation. Though nations living here before the Hungarian conquest, like the Gepidas, were primarily involved with crop production, they also kept animals, mainly cattle and swine. Langobards and Avars are mainly known as peoples largely involved with animal husbandry. The analysis of human bones found in graves showed that while the food of the Gepidan and Slavic population was mainly based on cereals, for the Langobards, it was from milk, butter, meat and fat [6] p. 40. There are data on relevant swine-breeding by Celts and Romans [1] p. 23.

Conquering Hungarians followed a semi-nomadic existence moving livestock between the winter settlement on riverbanks and summer grazing areas. The composition of animal husbandry of the age is hard to reconstruct. The animal bones from cemeteries cannot give information regarding this question as the species composition of them reflects not on the farming but the religion. It is presumable that beside the large number of horses and cattle they kept many sheep, the role of swine in the early period may have been less significant.

Common opinion considers the **horse** as the most important animal of nomadic Hungarians. Actually the proportion of horses compared to other animals decreased significantly during the Medieval period, by the second half of the 13^{th} century within the peasant livestock of villages it was only 4-5%. The importance of sheep breeding also decreased, but the number of cattle and swine clearly showed a growing tendency. What are the reasons and results of this process?

The horse was the favourite animal of the large animal breeding nations from the extensive areas of the steppe countries – like Hungarians before the conquest. The Carpathian Basin did not offer enough space for this kind of breeding. Though there are allusions to some initiatives of stable-breeding and the use of the horse in agriculture, their number gradually decreased. One of the reasons for this could be that the church permanently prohibited the consumption of horse meat. For some unknown reason Kings István and Kálmán limited the export of horses, some experts consider that reasons related to a decrease in the population can be found in the background. Horses, which in a sense became noble animals by the 13^{th} century, were ousted from agricultural work by yoke oxen.

The most sited animal of Hungarians were **cattle**. At least two, according to some researchers, three species were known in the medieval Hungary. Among them the most widespread spread type was a rather small animal with the withers height of 1,1-1,2 m and weight of 1,5-2 quintals (150 – 200kg), probably arriving with the conquerors [3] p. 618. Probably these dwarf-cattle are those registered in the customs-record of Esztergom in 1288, where the price of the cattle and the swine was the same amount [32] p. 409. A much larger kind of cattle was also bred, and according to the customs-tariff of 1356 the customs charges of the "big oxen" was double the price than for the dwarf ones [49] p. 74. Some of the researchers believe that these bigger cattle were identical with the cattle brought by the Cumanians [45] p. 279. Besides them László Zolnay also mentions the ancient oxen, but his reflections on this topic lacks any further comment [49] pp. 71.-83.

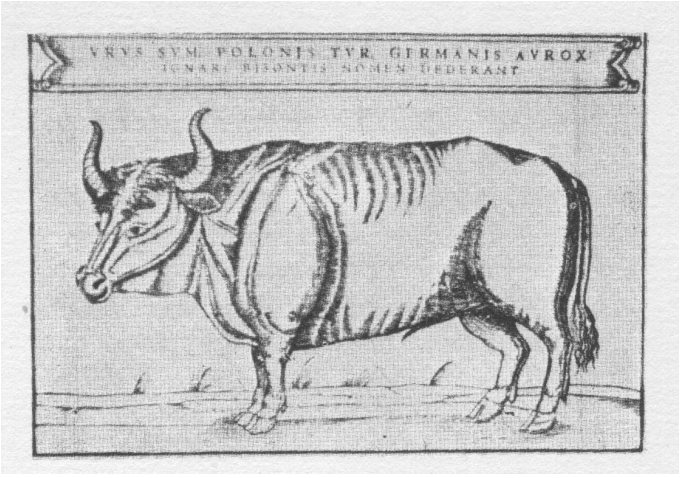

Fig. 8. Ancient Oxen (Zolnay 1977. p. 74.)

The spread of cattle can be related to their undemanding character, capability of hard work, good foddering, good capacity for gaining weight, and the easy transportation of them, i.e. the meat goes to the slaughterhouse on foot. For example at the end of the 13^{th} century in Esztergom approximately 1700 oxen were butchered in the 15 permitted slaughterhouses [45] p. 342. The analysis of bones found in the excavation of Dísz Square showed that half of the animals sold in the second half of the 13^{th} century could be cattle, the rest swine (20%), sheep and goat (15%), poultry and wild animal [45] p. 278. (15%). The extinction of dwarf-cattle and the spread of the large-bodied type can be timed to this period.

From the beginning of the 12^{th} century the main export goods of Hungary were livestock. Swine and sheep can be found among the declared items, but beef cattle made up the biggest proportion of animals exported abroad. The main target of the cattle transportation was Venice and Nürnberg, but in the later centuries of the Middle Ages cattle from Hungary appeared in the markets of nearly every neighbouring country.

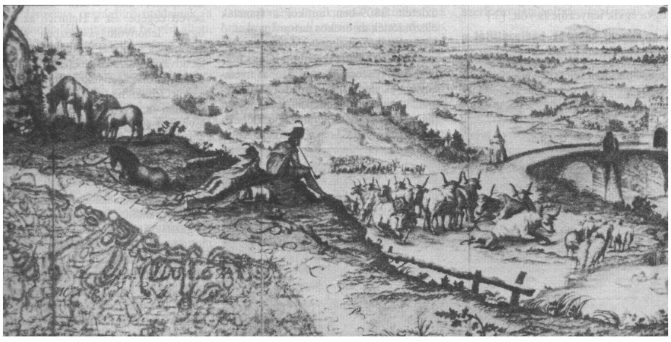

Fig. 9. Cattle Driving (Szakály 1998. p. 15.)

Swine breeding also had a relevant role in the country. The basis of German and Celtic farming was the swine, as well as one of the most important characters of their myths and legends. German mythology imagined celestial Paradise as a place where heroes fallen in war were eating the inexhaustible meat of the Great Boar [31] p. 19. However Mediterranean cultures did not have a high opinion of pork, Jewish and Islamic religion even forbade the consumption of it. In Rome pork consumption was restricted, people sacrificed swine only at the celebration of Saturnalia [43] p. 54. Then again other data refer to the fact that supplying the Roman army was possible with the propagation of swine breeding, some traces of it are also known from Pannonia. It is worth mentioning that the Avars were also involved with this kind of activity, the breeding of our own species can be connected to them, the so called Avar-swine [1] p. 23. There is no information on conquering Hungarians bringing swine to their new country. Some of the experts doubt this with the reasoning that swine cannot be forced into a nomadic life [47] p. 599. Contrary to this, the Hungarian words of Turkish origin relating to animal husbandry, already integrated before the conquest, contain disznó (=swine) and ártány (=castrated hog), which suggests that swine-breeding was not unknown to Hungarians [26] p. 85. Our early charters do not refer to swine husbandry; we only meet swine in the land-register of Dömös, 1138 and in the will of Lady Színes in 1146, in this latter source we can also read about the swineherd. The lack of early references on swine show that in the first period after the conquest the primary multipurpose animals that predominated were cattle and sheep, being able to survive the nomadic conditions. As the locations and borders of settlements became more established, it made the spread of these animals possible. In the spread of swine, its prolific and undemanding nature played a role. These swine probably originated from the further breeding of Avar and Slavic types. The most typical method of swine production was based on the feeding of mast. Swine – to quote István Győrffy's words – "threw thick fat"[15] p. 22. on the mast of the extensive oak woodlands. These swine kept mainly outside were undemanding and resistant, much smaller and thinner than they are nowadays.

There is information on individual villages in Zseglice, having specialized in swine- breeding, since the 13^{th} century. The village of Doboz, Békés County, had already been the village of swineherds in the 11^{th} century and the swine husbandry of Ártánd, Jánosd and Kölesér, Bihar County also originated from this period [45] p. 279.

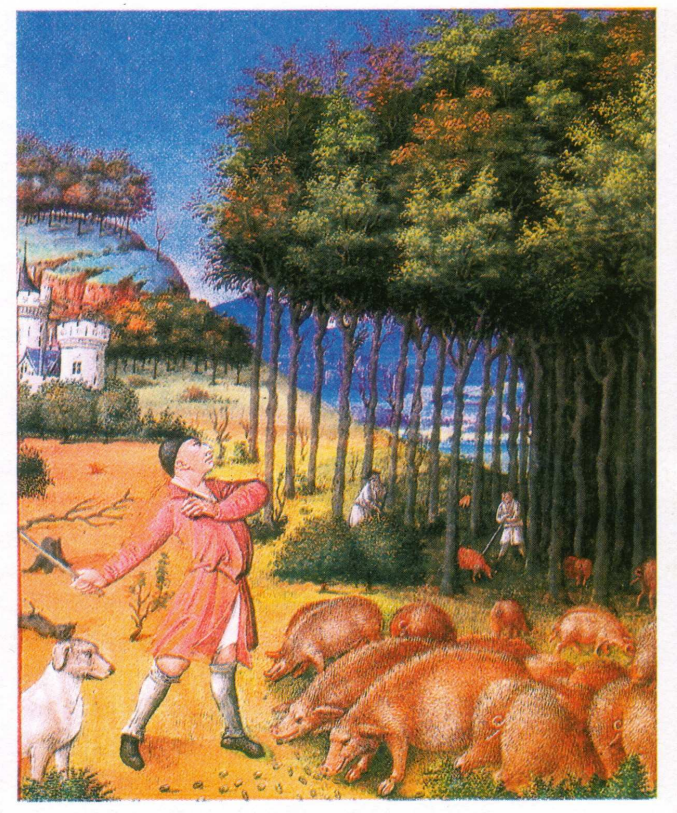

Fig. 10. Feeding on mast in the forest (Magyar Kódex 1999. p. 367.)

In conclusion, it is useful to review the **population data of the Carpathian Basin in the Middle Ages**. In the simplest way the conditions of the natural environment and the standard of the living conditions can be concluded from the number of people. Due to favourable conditions, through natural growth and immigration, the population increases, whilst poor living conditions

lead to emigration, high mortality and a decrease in population. But how can be the numbers of the medieval population be determined? First of all with estimation, which is based on the critical evaluation of the sources of the time, on the land's ability of support it and on the study of the principles of population dynamics. According to these calculations, the population conditions of the medieval Carpathian Basin can be described as follows:

In the results of estimations on the number of conquering Hungarians and nations found here, there are big differences. György Györffy estimated the conquering Hungarians at 400 thousand and the nations already living here at 200 thousand [13] p. 38. According to newer research, the Carpathian Basin may have had many more inhabitants at the end of the 9^{th} century, approximately 1-1.5 million people [21] p. 684. Taking into consideration the area of the country at that time, which was 330 thousand square km, this supposes a density of 3-4.5 persons per square km. The Carpathian Basin could have had 2 million inhabitants by the year 1100, 2.6 million by 1200 and 3 million by 1300. In normal cases this would mean an increase of 3.3 ‰Taking into account the loss of 300-400 thousand people in Tartar invasions and the immigration of 200 thousand partly covering this loss, in the 13^{th} century we can account for a much bigger growth of about 8‰. During these four centuries the population of Hungary nearly tripled, while the population of Europe doubled between 1050 and 1300, increasing from 46 million to 73 million.

These two rows of data show that living conditions in the Carpathian Basin were inevitably better than in most parts of Europe of the time. We can get to the same conclusion by the analysis of the plague epidemic raging from 1347 to 1349. This disease may have killed at least one third of Europe's population, but according to certain estimations this number could be at least 22 million. Europe was recovering from this loss of population 150 years. In this period the population of Hungary grew from 2.1 million to 5.1 million people. Despite this, the population was under the European average during the whole of the medieval period. With the knowledge of this, we can understand that the Dominican monk quoted in the introduction saw the country as nearly empty. Although it is clear that this impression resulted from the huge areas rather than it being uninhabited:

"...but with all this, because of its extension, the country mentioned above seems to be a deserted land."[5] p. 134.

More definitive proof cannot be found in relation to the living conditions of the Carpathian Basin at the time.

(Figures of the author based on the following sources: temperature fluctuation, rain index and sea floods: Rácz 1993. pp. 67-86.; population of Europe: Lőrincz 1999. p. 11.; population of the Carpathian Basin: R. Várkonyi 2001. p. 51.; price of wheat: Zimányi 1994. p. 8.; town foundations in Middle Europe: Pounds 2003. p. 147.; extreme weather in the Carpathian Basin: Draskóczy 1994. pp. 685-686.)

Legend: A = temperature based on O18, B = sea floods pcs/year, C = rain (index), D = population, E = price of wheat in Stassburg, F = price of wheat in Sopron (working hour/100 kg), G = population in the Carpathian Basin, H = town foundations in Middle-Europe, I = barley production in Northern Norway.

We have arrived at the end of our journey. I cannot state that every factor has been taken into account. The influence of mining, industry and commerce on lifestyle was not considered just the life of settlements, villages and towns. In spite of this I feel that the analysis of the connection between natural conditions and living conditions can lead to a better knowledge of the Middle Ages, and I hope in this sense the reader was at least as surprised as this essay's writer.

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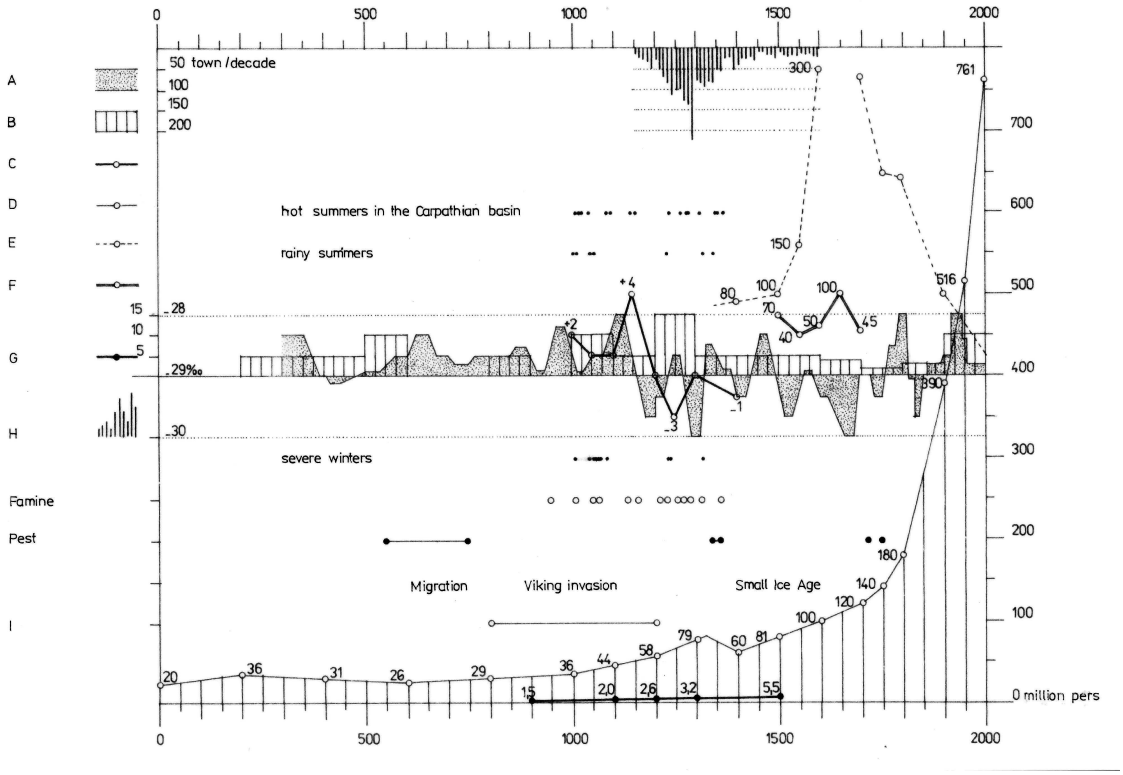

Fig. 11. The change in climate and living conditions in medieval Europe

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