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AGRICULTURAL CHANGES IN POLAND AND THE UKRAINE AND THEIR IMPLICATIONS FOR ENVIRONMENTAL QUALITY

1. Introduction

Socio-economic processes strongly influence how people interact with the environment, especially in the field of agriculture. The ways people are forced, advised, or opt to use agricultural ecosystems vary from country to country and depend on political systems, economic conditions and traditions. From this point of view it is very interesting and useful to examine how agricultural change has occurred as a result of politico-economic change.

Along with the politico-economic transformation that occurred after the collapse of the Soviet Union and its economy, the societies of Central and Eastern Europe (CEE) changed their way of using environmental resources and generating agricultural production in the early 1990s. The socio-economic changes affected both the use of agricultural ecosystems and the consequences for local environmental conditions. It is possible to compare the changes among selected countries of CEE, taking into account the pace of reforms in each of them, and to determine how the pace of transformation is related to the impact of agricultural production on environmental quality.

The research goal of this article is to examine and compare the agricultural situation in Poland and the Ukraine. The main tendencies that are examined include use of fertilisers and livestock numbers.

2. Agriculture in Poland and the Ukraine before the socio-economic changes

Poland and the Ukraine, despite some similarities in their history, have had different patterns of development leading to the current structure of agricultural production. The table below shows the developments that have influenced the formation of present-day agriculture in both of these countries.

The formation of Soviet Ukrainian agriculture started in the 1920s and 1930s with forced collectivisation of the means of agricultural production. Under the Soviet regime, agriculture was viewed as a means of capital accumulation, reliable food supply and a source of currency. The main purposes of collectivisation were to remove production and marketing decisions from the peasantry and put them in state hands, suppress hostile elements in the countryside (richer farmers) and release people for work in factories and plants [Swain, 2000]. Massive collectivisation began in the fall of 1929 and during the next eight years 93% of farming households were collectivised [Swain, 2000]. The newly formed *kolkhozes* (collective farms) were combinations of up to a hundred households; a family could have up to 0.5 ha for their own use. Collectivisation resulted in complete control of the state over agriculture, most prosperous and productive farmers were killed or sent to Siberia and a famine occurred in rural areas, which killed several million people.

Table 1. Major Historical Changes in Polish and Ukrainian agriculture

	Transfer of the land to peasants	Collectivisation	Privatisation	Present state of land ownership
Poland ¹	1921–1937	Insignificant	n/a	Most of the land is privatised
The Ukraine ²	1917–1922	1925–1937	insignificant	Most of the land is collective

Sources: ¹Swain [2000b] ²Csaba [1997]

The products of collectivisation were large collective or state farms, which later received government assistance for drainage and irrigation, chemical fertilisers, new better harvesting technologies and intensification in agriculture. As a result yields improved until the end of the 1980s.

In post-WWII Poland all farms over 100 ha were prohibited and the land was redistributed to poorer farmers. Despite this, private farmers remained and collectivisation covered only a small proportion of Polish farms. In fact, the majority of production took place on family farms.

For these reasons Polish farms are rather small. The small size of farms does not allow farmers to specialise. Specialisation of a farm usually needs some investment in machinery, but later brings more profit, due to its comparative advantages. However, prices of machinery like tractors, harvesters, etc. are relatively high. Therefore, farmers need to develop extensive production to pay the investment costs back. The larger the plot – the larger the revenue – the more easily a farmer can pay back these costs. So only farmers having big plots can afford to use modern technology and utilise the benefits of these comparative advantages. Overpopulation of the Polish countryside and lack of capital (machinery) makes agricultural production labour intensive. Nowadays this type of production is becoming less and less economically efficient, due to technological changes. Mechanical equipment is becoming cheaper, while labour is becoming more and more expensive.

3. Impact of Agriculture on Water Quality in the CEE Region

Due to non-sustainable development practices in the past, former socialist countries must now deal with many problems related to pollution, one of which is pollution from agricultural sources. Statistics from most CEE countries show a sharp decrease in overall agricultural output, live-stock numbers and productivity in the years 1988–1993. What happened in those years was the worsening of the long running ailment of the socialist economies, the lack of availability of agricultural supplies (machinery, chemicals, building materials) to farms, as well as sharp increases in prices. As a result of these events, most farms stopped fertilising land, except for a small amount of manure used in regions with a higher density of livestock. Also, pesticides were mostly unaffordable.

It is logical to predict that such a sharp decrease in the use of chemicals in agriculture must alleviate many environmental problems, such as runoff of fertilisers and pesticides into bodies of water. Although much of water pollution is caused by urban sewage and industrial discharges, the decrease in the contribution from agriculture probably led to cleaner bodies of water.

Ever since economic and political changes started occurring in the region, they have had a profound effect on virtually all processes in the studied countries, including agricultural production and environmental protection. For example, in the Ukraine agricultural pollution is no longer a significant threat, due to the unavailability of agricultural chemicals, because of lack of funds accessible to agricultural enterprises

[Nazarov et al., 2001]. Agricultural emissions have fallen significantly over recent years. However, the general level of water pollution remains above acceptable norms, due to the poor treatment of urban and industrial waste. The most important pollutants produced by agriculture are nitrogen compounds.

Innovative strategies and methods for the monitoring and management of water quality that would be practical and affordable in the short term, yet flexible allowing gradual tightening of water quality standards as economies improve, need to be developed. Water quality in the CEE region is clearly worse than in Western Europe [Marples, 1991]. The reasons include the use of outdated production technologies in industry and agriculture, little prevention of pollution and a low level of water treatment. The high level of pollution results in the depletion of dissolved oxygen, high ammonia levels, nitrate and heavy metal contamination, eutrophication of lakes, rivers and seas, and other environmental problems. These water quality conditions lead to an aquatic habitat unfit for fish and other species, un-aesthetic rivers and lakes, and water unsuitable for drinking. Transition to Western norms of water quality will take many decades – similar to the long process that occurred in Western European countries. Western experience in management is extremely useful, but without adapting it to the local conditions, cannot be applied. The main concerns regarding water quality are nitrogen, phosphorous and organic micro-pollutants. These pollutants get into water mostly by means of run-off, especially when soil is over-fertilised.

However, some Central European countries that are relatively strong economically and have returned to intensive agricultural production are encountering increasing damage from agrochemical pollution [Magnus, 1999]. Knowledge of the relationships between characteristics of various patterns of agricultural production and their impact on environmental quality is important in identifying optimal schemes in rural development and recommending priorities for agricultural policy. Although extremely intensive agricultural systems have been operating in most parts of Poland and the Ukraine for a long time, other areas are effectively still practising peasant farming. These countries have a good opportunity to develop organic and low-input farming systems with produce that would find a ready market in the West. Nevertheless, western aid and agrochemical companies are pushing the development of the type of intensive agriculture that is gradually being abandoned, or at least severely modified, in the rest of Europe [Gatzweiler et al, 2001]. CEE is an ecological disaster area in some respects. However, in other ways it has the potential to provide a reservoir of biodiversity that disappeared a long time ago in most Western European countries. It is there-

fore important that the assistance coming from the West does not destroy the good, while trying to correct things that are wrong.

4. Review of the Present Situation in Poland and the Ukraine

In the early 1990s the economies of former communist countries were exposed to an open market, and all these countries suffered from a severe economic crisis. Not all of these countries have had the same pattern of economic change. For example, Poland suffered a sharp crisis and then a fast recovery of its economy, but the Ukraine started economic reform much later (because of political hesitation) and the recovery only started a few years ago and is extremely slow.

The type of agriculture pursued by each country is somewhat different, because of historical, ecological, and political factors. For example, before the changes (in the late 1980s) cooperatives and small farms did not exist in the Ukraine, but did exist in Poland. Now, almost all state farms in the Ukraine have been transformed into collective farms, co-operatives, joint ownership enterprises, private-rent enterprises, or private and family farms. However, all these large entities are still run according to old methods and the attitude of rural workers has not changed. In the Ukraine, small private farms comprise less than half of the total number of farms. Together, they possess less than ten percent of total agricultural land. While three quarters of agricultural output in the Ukraine is produced on large state owned or collective farms, most Polish agriculture relies on small private farms. Poland is briskly adjusting its legal framework and agricultural practices towards the EU Common Agricultural Policy (CAP) as a part of a larger effort to comply with all the requirements of the future accession to the EU. The Ukraine is struggling to overcome economic difficulties, often without orientation towards the EU, but by trying to restore economic schemes within the CIS, and with some implementation of modern technology, or at least more modern than currently used. Over the last decade in both these countries a considerable shift towards the formation of smaller, privately owned agricultural entities has been observed. Along with a decrease in inputs, particularly agrochemicals, the scale of production has reduced.

Poland relies on private farms with a small share of large government and collective farms. Following more than ten years of transformation and reorganisation, individuals, who in a large number of cases are not the farmers, own the majority of agricultural land. The five most important categories of farms, according to management and ownership, coex-

isting in Poland and the Ukraine are: state (government) farms, corporate farms, cooperative farms, family farms and household plots. In the Ukraine cooperatives and large state and private or corporately owned farms are still very important in terms of primary production and agricultural employment. Poland has a high share of private ownership in agriculture. There is a significant number of very small farms or so-called household plots in both countries. The number of family farms is increasing in both countries and in Poland this is the main organisational form of agricultural production.

In addition to structural transformations, and to some extent as an outcome of them, changes in agricultural production and its influence on the environment have taken place. The general tendency in both countries has been a decline in production; gross output has fallen considerably compared to the late 1980s. The amount of utilised agricultural land as a proportion of the total land area has remained more or less the same during the transition period, although there has been an insignificant decrease in the amount of land used for agriculture. The total harvested area of most crops has decreased in these two countries. The application of inputs has decreased considerably in both countries. The consumption of nitrogen has decreased in both countries, with the decline being greater in the Ukraine. The consumption of pesticides indicates a similar pattern.

There has been a visible decrease in the number of farm animals in both countries. Particularly, the cattle stock has decreased dramatically. Since the quantity of livestock has decreased, the need for feed has diminished. This has had an effect on both the production of feed cereals and fodder; consequently the percentage of arable land used for other purposes or left fallow has increased.

5. Impact of Agricultural Chemicals

There are a lot of concerns that the quantity of chemicals used in agriculture has adverse effects on the environment. It is an important fact that when nutrients are applied to crops, not all of them are taken up by the plants. There is also concern that farmers often apply inappropriate quantities of fertiliser. Depending on the type of nutrient and the existing soil conditions, different kinds of fertiliser input are required, in order to maintain an optimal level of soil fertility. The nutrients and pesticides applied may leak over time into environments where they can cause pollution. Such losses may occur when nutrients run off the land as a result of erosion caused by heavy rainfall; are leached through the soil, beyond the root zone, eventually reaching groundwater, or escape

into the atmosphere as gases. The challenge to the farmer in managing his crops is to use crop nutrients in the form of animal manure, slurry or mineral fertiliser as precisely as possible, matching the input of nutrients to the nutrient uptake of the crop and minimisation of losses to the environment. Any application of fertilisers has to be considered in the context of the overall farming system, including the use of organic manure, soil cultivation and crop rotation, all of which influence the efficiency of nutrient use.

The most important water pollutants generated by agriculture are nitrates, phosphates and pesticides. The conversion from the Soviet type of highly intensive agricultural production to a more sustainable one is enabling the elimination of adverse effects of excessive fertilisation. Moreover, setting aside some land that is unprofitable without the input of large amounts of agricultural chemicals will further decrease any negative impact on the environment.

6. Analysis of Tendencies in Fertiliser Use

The general tendencies in Eastern European agriculture, as mentioned in previous sections, are confirmed by statistical data. Both countries experienced a dramatic decline in the use of artificial fertilisers during the last decade. Figure 1 shows trends in the utilisation of three major groups of fertilisers (nitrogen, phosphorus and potassium), as well as total consumption of mineral fertilisers in the Ukraine during the last decade.

Figure 2 depicts similar trends for Poland, the major difference from the Ukrainian trend is the slight increase in fertiliser consumption in the second half of the decade, which is likely to be correlated with the present recovery of Polish economy.

These data show a clear difference between the pattern of change in an economy with a high rate of transition (Poland) and in a slowly changing country (the Ukraine).

7. Analysis of Tendencies in Livestock Numbers

Livestock is a source of organically derived pollutants (from manure and urine). Although it is not a significant polluter, if intensive methods of production are not used, it may create huge environmental problems if intensive technology is used and large numbers of animals are gathered in one place. Examples of such highly rationalised meat production facilities are US feedlots or Soviet-constructed pig "factories", several of

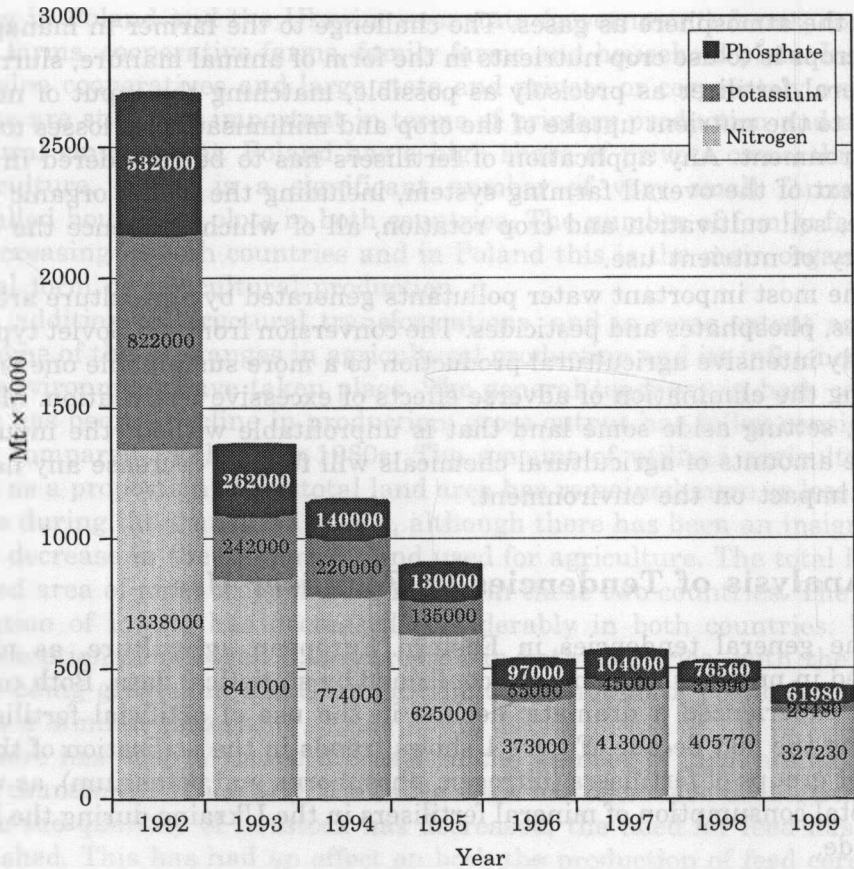


Fig. 1. Fertilizer Consumption in the Ukraine

Source: FAO Production Yearbook, 2002.

which operated in the Ukraine and contained from 52,000 to 104,000 pigs in one location. None of these are intensively operated any longer, due to the danger of epidemics and other environmental reasons. Figure 3 shows the tendency of a decline in the number of livestock of different kinds in the Ukraine.

A different picture is observable in Polish animal husbandry (Figure 4), although there was some decline in the number of livestock in the last decade, it was not so dramatic as in the Ukraine. This might be explained by the organisational structure of Polish agriculture (small farmers), which is more adapted to the market, and more resistant to socio-economic changes. Also, better economic conditions have helped to maintain the level of animal husbandry.

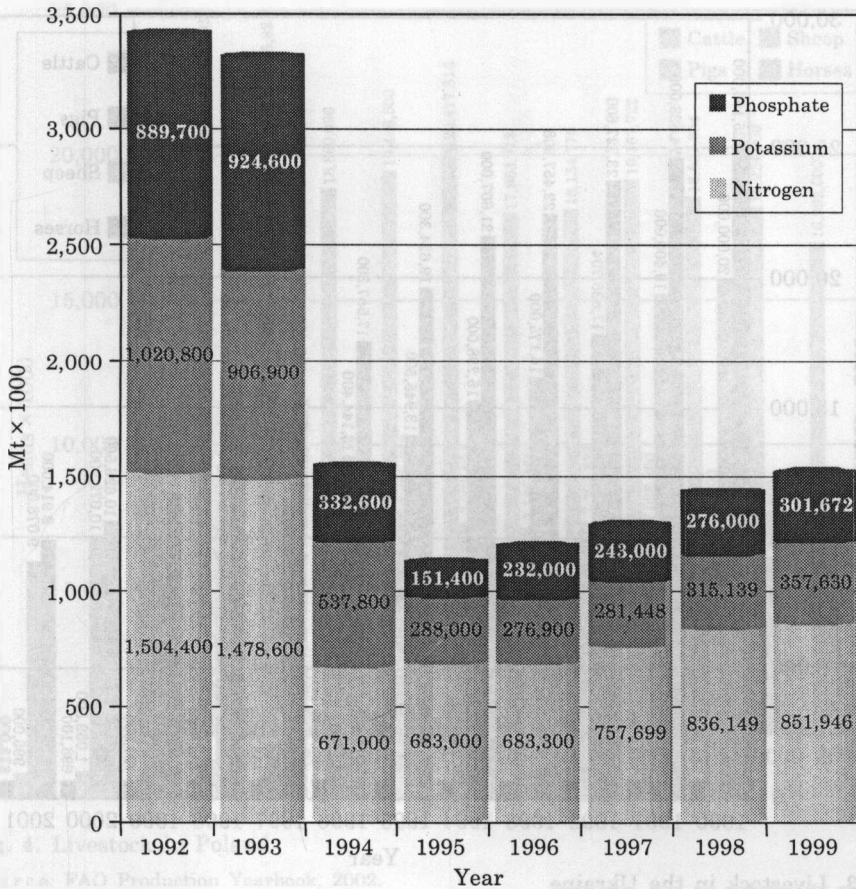


Fig. 2. Fertilizer Consumption in Poland

Source: FAO Production Yearbook, 2002.

Figures 5–6 show the use of land for production of the most important crops in the two countries studied. One notable tendency is a sharp decline of land used for growing sugar beet in both Poland and the Ukraine. This may be explained by the labour-consuming nature of its production and the fact that in soviet times urban dwellers were forced to help harvest sugar beet. At the present time, it is no longer politically feasible to use this source of labour and farms often lack financial resources to attract workers. This might be one of reasons why farms abandoned sugar beet production in favour of cereals, especially barley which is demanded by the market. This shift has probably had only a slight impact on the environment, namely a decrease in the diversity of crops, which has an unfavourable impact on soil. It alone is unlikely to

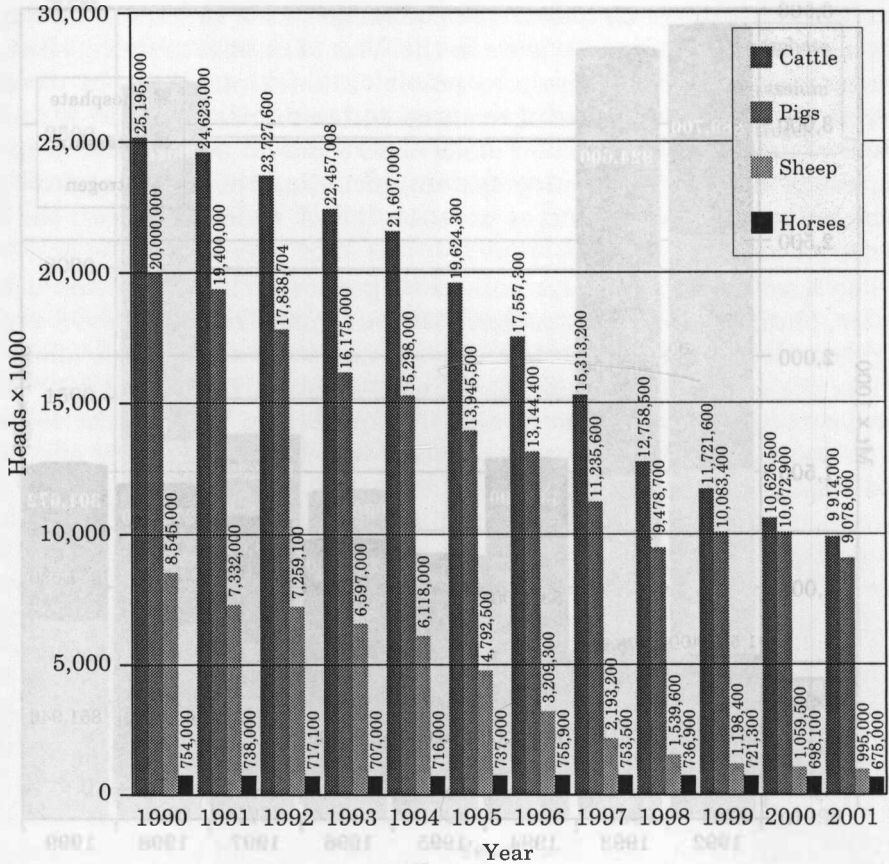


Fig. 3. Livestock in the Ukraine

Source: FAO Production Yearbook, 2002.

affect environmental quality, because the use of fertilisers in cereal production is low in comparison to sugar beet production.

8. Conclusion

The data examined in this paper clearly show that a process of decreasing intensification of agricultural production has occurred in both countries studied. Fertiliser use and livestock numbers have decreased sharply and this is likely to have resulted in a lower load on the environment. Land use in agriculture has decreased too, but this decrease is insignificant and probably has not strongly affected environmental quality.

It is possible to conclude from the data described above that the anthropogenic pressure from agricultural activities has decreased in the

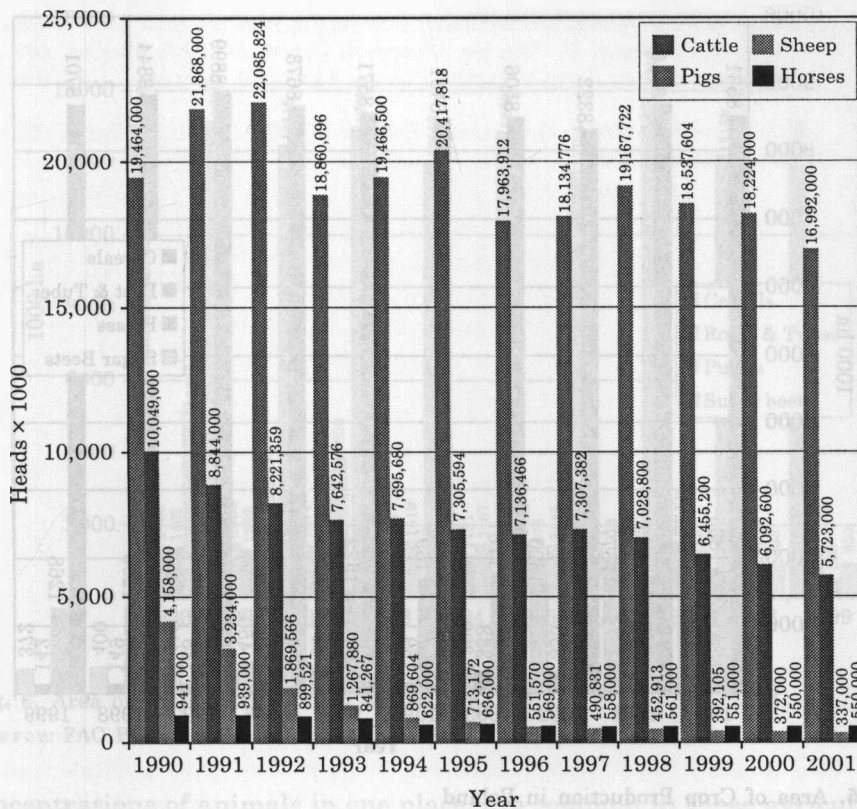


Fig. 4. Livestock in Poland

Source: FAO Production Yearbook, 2002.

two countries. There are some good reasons to speculate that most categories of agricultural pollutants now have a much lower adverse impact on the environmental quality throughout the region than a couple of decades ago. Pollution from the most important agricultural sources, such as agrochemicals and livestock manure, has declined.

The most important factor that most likely has positively influenced environmental quality in the two countries examined is the decrease in the use of nitrogenous fertilisers. It has probably had a positive impact on the quality of underground drinking water in rural areas, as well as in fresh-water bodies (rivers, lakes, ponds, reservoirs). Moreover, because of the decline in the application of nitrogen fertilisers in both countries, excessive contamination of produce, especially vegetables, with nitrates and nitrites is no longer a major problem either in Poland or the Ukraine, although it was a hot issue in the 1980s. It is clear that

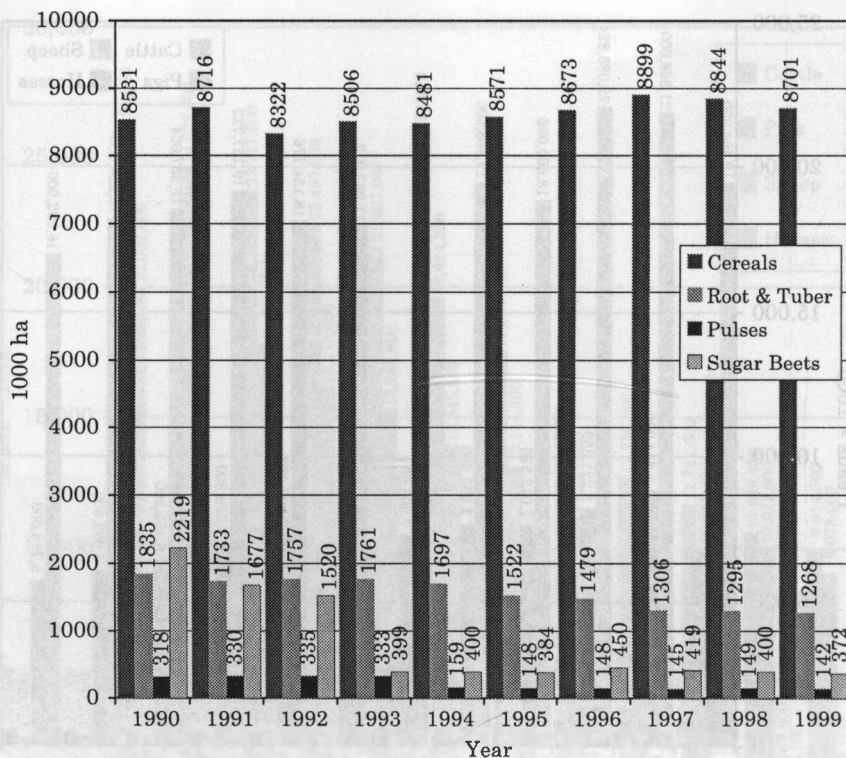


Fig. 5. Area of Crop Production in Poland

Source: FAO Production Yearbook, 2002.

in the early 1990s a decline in the use of mineral fertilisers occurred with no sign of any reversal until the last few years in the Ukraine. On the other hand, there is a slight growth of fertiliser use in Poland, which if continued may revive the water contamination problems observed in the 1980s. Because Poland is often used by economists to anticipate economic changes in CEE countries with a slower rate of reform, the trend in fertiliser use in Poland might be widely observable throughout Eastern Europe in the near future with similar environmental consequences.

Among agricultural factors, the decline in livestock numbers might be the second largest benefit to the environment. Although animal husbandry has never been a territorially widespread source of pollution, the contamination of water by excessive manure accumulation in places where livestock density was high has greatly contributed to pollution of both underground and surface waters. The two branches of animal husbandry that have the strongest impact on environmental quality are pig breeding and cattle breeding. Intensive technologies, as well as large

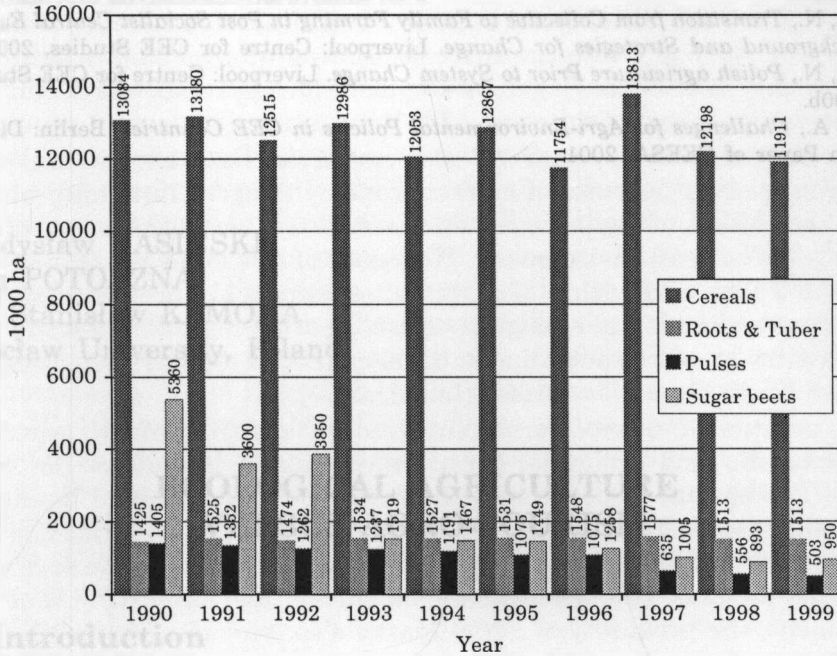


Fig. 6. Area of Crop Production in the Ukraine

Source: FAO Production Yearbook, 2002.

concentrations of animals in one place, are common in these agricultural industries. Sheep breeding, another important branch of animal husbandry in Eastern Europe, is mainly based on extensive technologies.

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