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Prospects for Environmental Benefits**

Natalija Kazlauskiene and William H. Meyers

Baltic Report 93-BR 10
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ABSTRACT

The Baltic countries of Estonia, Latvia, and Lithuania are undertaking rapid economic and structural reforms affecting the food and agricultural sectors. The environmental problems related to agriculture now and in the recent past are more in the area of chemical and animal waste runoff than in soil erosion. The radical change in economic incentives and progressing structural change in farming systems have already reduced chemical use and the intensity of livestock production. Some effects of the transition may also have negative environmental effects, as institutions and farming systems are in an unsettled state. The long-term effects of the reforms on the environment also depend on the choice of agricultural and environmental policies and the speed with which improved technologies for chemical use and waste management are transferred to farmers and farming partnerships.

AGRICULTURAL POLICY AND STRUCTURAL REFORMS IN THE BALTICS: PROSPECTS FOR ENVIRONMENTAL BENEFITS

The Baltic countries of Estonia, Latvia, and Lithuania have been undertaking rapid economic and structural reforms affecting their food and agricultural sectors. Compared with other republics of the former Soviet Union, they are progressing more rapidly in the privatization of land and production assets and in the transition to a market economy. The radical change in economic incentives and the progressing structural change in farming systems have already reduced chemical use and the intensity of livestock production, but these short-run effects may be offset by other factors.

This paper summarizes the prereform structure of agriculture in the Baltic countries, reviews the agrarian and economic reforms as they affect the agricultural sector, discusses the effects of these reforms on the structure of agriculture, and evaluates the prospects for environmental impacts deriving from these reforms and the potential effects of longer term decisions on agricultural policy mechanisms.

Prereform Structure of Agriculture

Although the importance of agriculture in the economies of the Baltics has declined substantially since the pre-World War II independence period, in 1989 agriculture still accounted for 17 percent (Estonia) to 25 percent (Lithuania) of GNP (Table 1). The gross value of livestock production was 69 percent (Lithuania) to 74 percent (Estonia) of the total value of agricultural production. Even in the prewar period, the Baltic states were exporters of livestock and dairy products. During the Soviet period, this tendency increased; about one-half of their livestock and dairy production was sent to other republics of the former USSR.

The resource endowment of forest and agricultural land relative to population is similar in all three Baltic countries, except that the forest land per capita in Lithuania is about half that in Estonia and Latvia (Table 1). The main reason for this difference is that forest area in Estonia and Latvia expanded during the Soviet period as agricultural land was abandoned, but most of these young

forests developed naturally rather than by planting. However, even in Lithuania the forest land per person is twice that of Poland and France and about four times that of Germany and Denmark. About one-third of the agricultural land is meadows and pasture, and most of the arable land is used to produce grains and fodder crops.

Table 1. Agriculture in the Baltics, 1989

	Estonia	Latvia	Lithuania
	(percent)		
Agriculture/GNP	17.5	20.2	25.3
Crop Value/Agricultural GNP	26.2	28.9	31.0
Livestock Value/Agricultural GNP	73.8	71.0	69.0
	(1,000 hectares)		
Forests	1,814	2,594	1,823
Agricultural Land	1,471	2,569	3,523
Meadow and Pastures	533	863	1,103
Arable Land	976	1,685	2,307
Grain Crops	396	680	1,125
Industrial Crops	4	30	75
Vegetables and Potatoes	58	96	137
Fodder Crops	468	819	955
	(hectares per capita)		
Forest	1.15	0.97	0.49
Agricultural Land	0.93	0.96	0.95
Arable Land	0.62	0.63	0.62
	(1,000 head)		
Cattle Population	806	1,472	2,422
Hog Population	1,080	1,555	2,730
Poultry Population	6,923	11,246	17,486
	(per 100 hectares farm land)		
Cattle	54	58	69
Hogs	75	62	77
Poultry	471	438	496

SOURCE: *Lithuania, Latvia, Estonia: Statistical Abstract 1991.*

In 1989 the density per 100 hectares of agricultural land for cattle ranged from 54 (Estonia) to 69 (Lithuania), for hogs from 62 (Latvia) to 77 (Lithuania) and for poultry from 438 (Latvia) to 496 (Lithuania). Converting cattle, hogs, and poultry to cattle equivalents results in measures of 1.6, 1.5, and 1.8 cattle equivalents per hectare of farm land for Estonia, Latvia, and Lithuania. These are one-half or less than one-half of the maximum animal intensity permitted on German farms. In order to be precise, sheep, goats, and horses should be added, but these numbers would have a very small effect on these measures.

Water Pollution

Although the average density of animals was relatively low by European standards, many very large cattle, hog, and poultry complexes were built during the Soviet period as part of collectivization of small private farms and intensification of agriculture. Large-scale dairy and beef cattle enterprises (1,200 or more cows) along with large hog complexes (20,000 to 50,000 hogs) created serious waste management problems. Poorly constructed and maintained waste storage facilities resulted in high leakage, and inadequate waste storage capacity led to short manure storage periods. In Lithuania, for example, water bodies are affected by 28 large-scale hog enterprises, 5 poultry farms, and more than 500 dairy complexes that neglected environmental protection requirements and particular landscape features in their construction. In order to soften the negative impact on the environment, the number of hogs in large-scale complexes was decreased by 5 percent during the past five years. Also, fluid dung fractioning equipment was recently installed in 19 hog complexes, and in 14 complexes manure storage tank capacity was enlarged. The majority of hog complexes started to spread fluid dung filtrate over pastures and grasslands in order to increase soil productivity and make greater use of nutrients.

Productivity measures indicate that the Baltic countries were significantly above the average of the former USSR, but significantly below Finland (Table 2). Application rates for fertilizer were generally higher than in neighboring countries, except for the former East Germany. The high rates of chemical fertilizer use were based on maximizing production with relatively low fertilizer prices and easy access to fertilizer supplies. Contamination from fertilizer use was relatively high due to toxic substances in the ballast, very poor and highly centralized storage facilities, inadequate application technologies, and low quality, inefficient application machinery that resulted in an uneven distribution and high leaching.

In Lithuania, mineral fertilizers contain only 35 percent active ingredients, and the rest of the fertilizer is different kinds of waste substances, some hazardous. As a result, plants utilize only 15 to

20 percent of applied chemicals. From the late 1970s to the mid-1980s aerial application of fertilizers and pesticides was even used in some areas. The governments of Lithuania, Latvia, and Estonia have estimated that 40 to 50 percent of the nutrient load in river basins and discharges into the Baltic Sea are from agricultural runoff and that 50 percent or more of the shallow wells in rural areas exceed the limits for bacteria and nutrient contamination. More than 40 percent of well water in Lithuania cannot be used for human consumption. Groundwater is polluted with organic substances, oil products, nitrates, ammonia, pesticides, and other chemicals whose concentration exceeds allowed medical standards. Radioactive substances are found in the groundwater around the Ignalina nuclear power station.

Table 2. Productivity and input use comparisons for 1989

	Finland	Estonia	Latvia	Lithuania	USSR	East Germany	Poland
Commodity							
Grain (mt/ha)	3.2	2.4	2.4	2.9	1.9	4.4	3.2
Potatoes (mt/ha)	21.9	16.6	16.2	16.2	11.1	23.4	18.5
Sugar Beets(mt/ha)	32.0	- ^a	29.4	31.2	26.7	30.2	34.0
Milk (kg/cow)	5,246.0	4,217.0	3,636.0	3,806.0	2,780.0	3,821.0	3,278.0
Eggs (units/hen)	n.a. ^b	250.0	219.0	246.0	246.0	220.0	169.1
	(kilograms per hectare)						
Fertilizer Use							
Nitrogen	100.0	83.3	101.1	137.0	44.7	141.3	69.0
Phosphorus	30.0	61.9	65.9	83.0	36.8	56.4	41.0
Potassium	56.0	103.2	101.1	132.0	28.8	94.4	54.0

SOURCE: Compiled from various government publications.

^aSugar beets are not grown in Estonia.

^bn.a. =not available.

It is hard to estimate exact quantities of pollutant substances discharged by agricultural enterprises into water reservoirs. Among the main pollution sources are manure storage at livestock facilities, storage for oil products, agro-chemicals, and toxic solutions. Soil erosion, as well as intensive drainage of wetlands, are considered to be contributing factors to surface water pollution. For example, in Lithuania wetlands declined from 12 percent of land area to 7 percent during the last 100 years. Inappropriate agricultural technologies led to the aggravation of pollution. It is estimated

that in Lithuania about 40 percent of total pollutants discharged from nonpoint pollution sources find their way to surface water. Poor agricultural practices and the excessive use of mineral fertilizers cause the discharge of a substantial quantity of different chemical substances from the drainage system. In Lithuania they are estimated to be from 350 kilograms to 550 kilograms for each hectare of the drainage system.

The negative impact of agricultural activities on the quality of groundwater has been to some extent reduced by arranging special protection zones. The goal was also to preserve the landscape and to reduce and prevent further erosion. Thus, 89 nature conservation reserves were formed in Lithuania. A system of protected areas was based on research results. It includes 4 reserves, 5 national parks, and 236 nature-conservation reserves of different sizes and types. In 1991, protected areas covered 6 percent of the total area in Lithuania. Economic, and especially agricultural, activities in these nature-conservation reserves are restricted according to the kind of reserve. However, not all water reservoirs are under such protection. Special regulations are worked out for conservation and land protection in every protected area. Now there is an urgent need to create a legal enforcement mechanism for these regulations.

Soil Erosion and Contamination

Before World War II the Baltic states were primarily agrarian countries. Private farms dominated the landscape and they had a well-developed network of farm roads. Land reclamation covered only a small part of farming land. Reclamation was carried out by farmers who arranged shallow ditches that did not cause significant harm to the environment. Introduction of large-scale collective farming during the Soviet period required the formation of large fields for application of industrial crop production technologies. In Lithuania it led to additional forest losses, the drainage and cultivation of 250 thousand hectares of wetlands and peat bogs, and the tillage of large areas of natural pastures and meadows. Drained and cultivated area reached 40 percent of the total territory and almost 80 percent of wetlands. This resulted in destruction of natural barriers that prevented water-caused soil erosion. A significant number of waterways were turned into canals. Together with land reclamation this caused a substantial decrease in water level in many lakes, thus opening the way to bank erosion. In Lithuania, erosion has already affected 15 percent of cultivated land, and 38 percent of land has a high erosion risk.

However, soil erosion is considered to be less of a problem than water contamination because scientists and governments have been working together to develop and use soil conserving

technologies. Special zonal agricultural systems were designed and implemented in different regions, taking into account differences in soil composition, terrain, and erosion rates. Crop rotations with up to seven or eight fields were used, and tillage practices and chemical applications were specified field by field. Monitoring and enforcement systems were rather poor so implementation was not as impressive as the plans, but soil conservation was given substantial attention while water contamination was hardly recognized as a problem. Also, soil compaction from frequent passes of heavy farm machinery is another consequence of large-scale agriculture in the Soviet period.

Another serious problem is soil contamination. Soils along highways are contaminated by heavy metals and hydrocarbons. Lead concentration is also high, especially along highways with heavy traffic. Such contaminated areas are often used by the rural population for grazing cattle, so there is potential danger to consumers of milk and meat products from these areas. As a result of the Chernobyl nuclear accident, soils in coastal areas and the southwestern part of Lithuania are contaminated by radioactive substances.

Rural population resettlement programs also contributed to degradation of the rural environment. People were moved from traditional family homesteads to newly created settlements. In Lithuania more than 220 thousand homesteads were to be liquidated in the course of collectivization. Fortunately, only slightly more than one-half of them were destroyed. This was accompanied by a reduction of rural population due to migration and forcible deportation of farmers to Siberia. Since 1950, a significant number of rural inhabitants migrated to urban areas (approximately 10 percent per year in Lithuania). As a result land, and the rural environment in general, lost its guardians.

Agrarian Reforms

Before official recognition of the Baltic states' independence in 1991, their governments initiated economic reforms in order to abolish central planning and state ownership and to move toward market-oriented economies. Agrarian reform was viewed as an important part of general economic reform because of the significance of agricultural and food production in the Baltics. Agrarian reform in all three Baltic countries is oriented towards the restitution of property rights to former owners, privatization of agricultural assets accumulated by large-scale collective and state farms, and formation of market-oriented economic mechanisms. Nevertheless, the design and implementation of agrarian reform differs somewhat in each country.

Agrarian reform actually started in 1989 when Estonia, Latvia, and Lithuania found a way to

begin the process of reestablishing family farms under Soviet law, which still prohibited private land ownership. Individuals were able to obtain land use rights in perpetuity, including the transfer of these rights to heirs. From 1990 to 1992 the primary laws on land reform and privatization of state and collective farms were adopted by the parliaments and the implementation processes were developed and set into motion. Although the laws and implementation mechanisms differed, all three states chose to restore land or equivalent compensation to previous owners, to privatize the production assets of state and collective farms, and to permit competition among a wide variety of ownership and management systems. As a result of these reforms, the number of family farms has been increasing rapidly, but these small farms still operate a relatively small portion of the total farm land. Another important change is that the personal plots operated by collective and state farm workers are allowed to be as large as three hectares, compared with only one-half hectare during the Soviet period.

Although some of the land and assets of the state and collective farms are or will be used in family farm operations, much of it is and will continue to be operated in some form of partnership among groups of joint owners, at least during the next few years. If these forms of joint ownership and management prove to not be viable, they are likely to evolve into relatively large, individually owned farms. Likewise, many of the new family farms that are too small to be viable will have to become larger or survive as part-time farm operations. It will be five to ten years before these reforms play themselves out and the new structure of farming stabilizes.

Price Reforms

During the Soviet period, production inputs in agriculture were heavily subsidized and most of the production was sold through the state distribution system at fixed procurement prices. There also was a system of bonus payments to compensate low productivity farms, which was designed to achieve similar profitability across the farms with different productivity levels. Additional bonus payments were provided for production that exceeded the production level of the previous period. In many cases these bonus payments went to large collective and state farms, who purchased the abovequota production from personal production plots at the lower procurement prices.

The intermediate sector, between the farm-gate and the retail market, was also heavily subsidized. In many cases, retail prices were below farm prices, indicating that the government subsidy exceeded the intermediate processing and distribution costs. Even where retail prices were above farm-gate prices, significant government subsidies for processing and distribution existed. A major motivation of the initial price reforms was to raise retail prices significantly more than

procurement prices in order to reduce or eliminate these very large subsidies.

From late 1990 to the end of 1991 the three Baltic countries virtually eliminated the state pricing system for inputs and for most food and agricultural products and replaced it with a system of producer support prices and retail markup restrictions that allow the market to function with relatively little government intervention. Producer prices in all three states are now generally set through regional consultations between producers and processors; but the governments still have various mechanisms designed to influence prices. Since inputs were heavily subsidized during the Soviet period, input prices have risen far more rapidly than producer prices. Although the largest price shocks occurred between 1990 and 1992 (Table 3), input prices continue to rise more rapidly than producer prices. Both are still below, but are progressively moving toward, world market prices.

Table 3. Changes in input and producer price ratios

	Estonia June 92/90	Latvia Feb. 92/90	Lithuania Jan. 92/90
Input Prices			
Diesel Fuel	130	77	34
Concentrated Feed	26	8	10
Urea	150	30	17
Electric Energy	100	40	10
Producer Prices			
Wheat	48	10	4
Cattle	7	5	5
Hogs	15	6	8
Broilers	10	5	3
Milk	19	11	5
Ratios			
Urea/Wheat	3.1	3.0	4.3
Feed/Hogs	1.7	1.3	1.2
Feed/broilers	2.6	1.6	3.3

SOURCE: Meyers et al. 1992.

The data that we have on input and product prices come from different periods, which partly explains why the Estonian increases are larger. But part of the difference also is that Estonia is the most dependent and Lithuania is the least dependent on external energy sources. Moreover, Estonia

has been liberalizing prices more rapidly than the other two countries.

The price changes have been huge; the largest is urea prices in Estonia, which increased by 150 times from 1990 to mid-1992. All input prices and a few producer prices increased more than the general price index during the period. The price ratios for urea-to-wheat and for feed-to-hogs and broilers have moved more consistently across the three countries than have the individual prices, which indicates the internal consistencies of policies in each country. The large increases in these price ratios, from three to four times for urea-to-wheat and from 1.2 to 3.3 for feed-to-hog and broiler prices, indicate that large resource allocation and product mix adjustments must occur for farm enterprises to remain viable. The direction of these adjustments is toward lower use of energy-intensive inputs, such as chemicals and fertilizers, and shifts from livestock dependent on purchased feed toward pasture-dependent animals.

Changing Structure of Agriculture

Even though agrarian reforms were only beginning to be implemented in 1991, the changing structure of production could already be seen in the changed shares of production (Table 4). The portion of production in the public sector decreased for most major crop and livestock products. The largest declines were for potatoes and vegetables, which use a small portion of total land and have been heavily emphasized by those who operate the personal plots. The large farms still dominated production of grains, flax, and livestock products in 1991 and most of the commercial production of these products will probably continue to come from the group of larger farm units that emerge from the privatization process. Thus, in Lithuania in 1992 more than 60 percent of grain, potatoes, and vegetables, as well as 71 percent of meat and 48 percent of milk, were still marketed by larger cooperative agricultural producers. Small-scale private farms were not highly commercial.

Another significant change is in the composition and level of livestock production. The agro-climatic conditions of the region are very suitable for beef cattle and dairy production, and these were produced in abundance even before the Soviet period. However, large hog and poultry complexes were emphasized during recent decades as a part of the Soviet plan to provide meat to Moscow and St. Petersburg (then Leningrad). These complexes were highly dependent on imported feeds and on external demand for 30 to 40 percent of output. Furthermore, during Soviet collectivization, the small-scale dairy and cattle herds of family farms were converted to large complexes of 400 to more than 1,200 cows.

Table 4. Production shares in 1990 and 1991 in the Baltics

Products	1990		1991		
	Public Sector	Personal Plots and Family Farms	Public Sector	Personal Plots	Family Farms
	(percent)				
Estonia					
Grain	93.4	6.6	83.9	4.0	12.1
Potatoes	51.1	48.9	31.6	49.7	18.7
Vegetables	41.0	59.0	31.7	53.1	15.2
Flax Fiber	87.2	12.8	70.6	0.0	29.4
Meat Total	83.2	16.8	76.5	22.2	1.3
Milk	84.3	15.7	80.6	17.0	2.4
Eggs	82.5	17.5	81.2	18.3	0.5
Latvia					
Grain	93.3	6.7	85.5	7.5	6.4
Potatoes	38.1	61.9	26.2	65.6	8.2
Vegetables	55.4	44.6	37.5	55.6	6.9
Flax Fiber	100.0	0.0	97.2	2.8	0.0
Sugar Beets	92.9	7.1	81.8	9.9	8.3
Meat Total	73.1	26.9	68.8	28.0	3.2
Milk	71.1	28.9	65.1	30.7	4.2
Eggs	89.7	10.3	86.9	12.4	0.7
Lithuania					
Grain	90.6	9.4	79.1	18.3	2.6
Potatoes	26.2	73.8	19.4	76.4	4.2
Vegetables	40.6	59.4	12.4	81.9	5.7
Flax Fiber	99.0	1.0	96.2	1.5	2.3
Sugar Beets	99.5	0.1	95.9	1.9	2.2
Meat Total	75.0	25.0	67.0	31.0	2.0
Milk	58.7	41.3	54.0	45.0	1.0
Eggs	67.9	32.1	69.0	30.0	1.0

SOURCE: Meyers et al. 1992.

Since 1989, however, animal numbers on state and collective farms and total animal numbers have been declining (Table 5). This was accelerated in 1991 by the loss of product markets in the former USSR, the loss of cheap feed-grain supplies through the Soviet procurement system, and the decline in purchasing power in domestic markets as well in markets to the East. The largest decline was in hog numbers (25 to 28 percent), since this sector was heavily dependent on the East both for

feeds and markets. Poultry was dependent for feedstuffs, but most of the market was internal. Compared with hogs, dairy and beef cattle were less dependent on external feed supplies but had similar market dependence on the East. The drought effects on the 1992 grain and fodder crops and pastures are expected to cause further losses in animal numbers. The declines in Lithuania were an additional 12 to 34 percent (Table 6). It is yet to be seen how long the shift from large to small production units for livestock will continue, but it is expected that the most efficient medium-sized complexes will survive.

Table 5. Decrease in livestock inventories on state and collective farms in 1991 compared with 1989

	Estonia	Latvia	Lithuania
	(percent)		
Cattle	18.1	15.2	13.2
Dairy Cows	17.5	13.6	9.1
Hogs	27.3	28.0	24.9
Poultry	n.a.	11.4	6.8

SOURCE: *Lithuania, Latvia, Estonia: Statistical Abstract 1991.*

Table 6. Livestock number and density in all categories of farms in Lithuania

	1989	1990	1991	1992	Change 1992/1991
	(1,000 head)				(percent)
Number					
Cattle	2,422.3	2,321.5	2,196.6	1,813.0	-17.5
Dairy Cows	847.7	842.0	831.9	735.0	-11.6
Hogs	2,730.2	2,435.9	2,179.8	1,565.0	-28.2
Poultry	17,486.2	16,815.0	16,994.0	11,237.0	-33.8
	(head per 100 hectares farm land)				
Density					
Cattle	68.8	66.1	62.6	54.5	
Hogs	77.5	69.3	62.1	45.7	

SOURCE: Lithuanian Department of Statistics 1992.

Prospects for Environmental Impacts

With such large economic and structural changes in Baltic agriculture, there are certain to be environmental effects. Some will be beneficial effects and some may be negative. In the medium and long run it will also depend significantly on the agricultural and environmental policies adopted by these countries. One thing is sure—the citizens and governments of Estonia, Latvia, and Lithuania have already established tendencies, practices, and laws that indicate a strong interest in preserving the environment, a distinct contrast to the disregard that was the norm in the former Soviet Union. We briefly list what we believe to be the positive and negative effects of changes that have occurred so far and speculate somewhat on future directions.

The shift toward smaller farms will lead to replacement of heavy, large-scale machines with smaller equipment. This will reduce the soil compaction and destruction of drainage tiles. Private ownership of the land will create incentives to develop sustainable production practices.

The increase of three to four times in the urea-to-wheat price ratios is indicative of the general increases in fertilizer and chemical prices relative to crop prices. These price changes, combined with severe financial stress in the farm sector, have led to substantial reduction in fertilizer and chemical use. In Estonia it led to a 35 percent reduction in fertilizer and more than 45 percent in plant protection chemical use in large production units (Table 7).

Table 7. Use of mineral fertilizers and chemicals in Estonia

	1980	1985	1990	1991	1992	Change 1992/80
	(kilograms per hectare)					(percent)
Mineral Fertilizers	226	250	220	209	145	64.2
Nitrogen	89	109	76	74	65	73.0
Phosphorus	54	49	56	46	30	55.6
Potassium	83	92	88	89	50	60.2
	(metric tons)					
Plant Protection Chemicals	1555	1929	1408	967	834	53.6
Herbicides	1084	1539	1168	736	630	58.1
Fungicides	408	345	139	206	180	44.1
Insecticides	63	44	30	25	24	38.1

SOURCE: Prepared by M. Pajo, M. Tamm, R. Teinberg (Tallinn, April 1992).

There are also survey data from Lithuania showing that fertilizer application rates on small family farms in 1990 were less than half those on the state and collective farms (Table 8). As

conditions stabilize, fertilizer and chemical use will probably increase but remain below levels of the prereform period. In Estonia, where prices can more easily be converted to dollars, the urea-to-wheat price ratio by June 1992 was about equal to the world market price ratio, so future adjustments in fertilizer use will be more related to availability of credit and other financial means than to additional changes in relative prices.

Table 8. Major agricultural inputs in different categories of Lithuanian farms, 1990

Inputs	Family Farms	Public Sector Farms
Fertilizer (physical weight, kg/ha)	303	910
Nitrogen	110	385
Phosphorus	110	305
Potassium	83	202
Manure (mt/ha)	5	11
Gasoline (kg/ha)	133	118
Diesel Fuel (kg/ha)	253	252

SOURCE: Lithuanian State Department of Statistics 1991.

Note: Private farm survey data are from 145 respondents.

On every state and collective farm there used to be a specialist responsible for use and proper application of fertilizers and pesticides. With many new private farms and the division of the state and collective farms into smaller operating enterprises, it is expected that many people untrained in proper fertilizer and pesticide use, handling, and application techniques will be handling and applying chemicals. In the short run, financial constraints and poor input supply services will reduce the significance of these factors. In the longer term, extension services should provide information on improved practices that will help private farmers use chemicals more efficiently and safely.

The increase in feed-to-animal price ratios, along with the rise in other purchased input costs, has put great financial pressure on large animal production units, especially hog production complexes. These units typically had 3,000 to 5,000 hogs but were as large as 30,000 hogs in some cases. When these enterprises left the command system to face the realities of a market where demand was weak and profits disappeared, many were liquidated. (Many hog and poultry enterprises had no land for feed production and were completely dependent on purchased feed.)

Dairy and poultry have been similarly affected but to a lesser extent. Also, while total animal numbers are declining, animal numbers on personal plots and family farms are increasing, so the average size of animal production units is declining. At least in the medium term, export demand will be weak and animal numbers per hectare will continue to be smaller than in the recent past. On average, animal production units will be smaller. These structural changes have and will continue to reduce the waste management problems associated with animal production. However, it will create an urgent need to design and construct small to medium scale wastewater treatment facilities.

Offsetting the positive effects of reduced livestock numbers and smaller production units are other impacts of the structural changes. One is that some of the new farms are being established at former homesteads, which are near lakes and streams. This could result in greater water pollution from chemicals and livestock waste. However, some of the new owners in these locations will petition local authorities to use the land for nonagricultural purposes, such as recreation. Also, many of the former state and collective farms had waste management systems and specialists. Some of these systems were poorly designed, improperly maintained, or for other reasons ineffective, and the use of these systems may deteriorate even further when state and collective farms are subdivided into smaller units.

Implementation of Economic Reforms and the Environment

In implementing economic reforms it is very important not only to prevent further damage to the environment, but to improve the system of environmental protection and make environmental requirements an essential part of each project to be carried out during the transition period and beyond. Special environmental protection policies still need to be worked out, paying special attention to environmental quality standards adopted by European Community (EC) countries, as well as standards and requirements specified in international agreements and conventions.

In the highly centralized planned economy there was not enough attention paid to the use of economic performance indicators or to the creation of incentives for better use of the environment. It was not taken into account that environmental damages have to be adequately covered by polluters. In 1988 Lithuania set up the Government Environmental Protection Fund to provide funding for various activities to correct environmental damages already done.

Recognizing the importance to preserve the environment and to create adequate economic policies, the governments have adopted new environmental standards and practices. Two main considerations determine current and future state regulation regarding the use of environmental

resources: a major part of natural resources are announced to be state property with privatization of only a small part of them, and users of natural resources have to pay obligatory fees. It is hoped that economic and environmental policies based on these main principles will create incentives for the introduction of resource-saving and more efficient economic practices. New regulations include introducing natural resource use and pollution taxes, executing punitive and compensatory measures, and creating economic incentives by means of pricing, state grants, and credits.

Great changes are predicted for forestry policies. In Lithuania, up to 5 percent of unused agricultural land is to be used to expand forest areas. The total area under forests in the future is supposed to be 30 to 33 percent of the total because that is considered optimal. Expansion of forest areas and regulation of timber harvesting in Lithuania are meant to be efficient measures for preserving wildlife diversity, expanding protected areas, and controlling and fighting soil erosion and water pollution. Land reform in Lithuania includes privatization of forest land through the restitution process but limits privately owned forest area to 25 hectares. Under these conditions not more than 30 percent of Lithuanian forests are going to be privately owned and the remainder is going to be managed by the state.

Conclusions

On balance, we believe that the short-term changes brought about by the transition reforms have been beneficial to the environment. In the medium and long run, farmers need to be provided with information on improved practices that will be economically attractive and will reduce chemical and waste contamination. Economic incentives will be influenced by the choice of pricing policies for agricultural inputs and products. If input subsidies are restored or product prices are supported significantly above world market prices, more intensive chemical use would be induced. Severe price distortions such as those in the European Community or nearby Scandinavian countries are unlikely, due to very limited financial resources. Environmental laws and institutions have been established to monitor environmental practices and implement regulations, taxes, and subsidies designed to improve and protect the environment. In addition, all three Baltic countries have signed the 1992 Rio de Janeiro accord and have joined the Baltic Sea Convention with other countries around the Baltic Sea. Other international environmental agreements have been signed or are under discussion. However, severe financial constraints will limit the ability of the governments to implement monitoring and enforcement mechanisms. These financial constraints can be relieved through financial aid from international agencies and the Organization for Economic Cooperation and Development member countries, especially those sharing the Baltic Sea.

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