Richard A. Weismiller, Andrzej Łysak

The tragedy of the commons – agricultural soils and water resources within the United States of America, Russian Federation and Poland[1]

Much of the world's population considers the earth's natural resources, which include the air, water and soil, as if they are free to use. This often results in the attitude that they are to a large extent unlimited or at least they do not need to worry about their immediate supply. These are often referred to as the 'commons', resources that are shared by people or groups of people. Hardin[2] in 1968 discussed this topic and points out that the commons can be abused in at least two ways; we can take too much out of the common good for example people grazing too many animals on public pastures or by adding more pollutants to a common than the common can recycle i.e. too many chemicals to the air or water. Much of the world's population has grown up in lands where the natural re-

[1] This paper is an adaptation of *The tragedy of the Commons – is it happening to the American and Russian agricultural soils and water*, Raymond J. Miller, Richard A. Weismiller and Vladimir A. Chernikov.

[2] G. Hardin, *The Tragedy of the Commons*, "Science" 1968, No. 162, p. 1243–1248.

sources were very large in proportion to the population and thus got use to the concept of the ecosystem recycling and disposing of the pollutants. In some countries the demands of time and energy just for existence is so great that the people have no time to worry about the diminishing quality and capacity of the natural resources base to absorb the abuse and renew itself, resulting in abuse of the commons

The United States of America, the Russian Federation and Poland are examples of countries that in relatively recent history had an abundant natural resource base and the people became used to the idea that water, air and land were plentiful and productive enough that as a country they did not need to pay too much attention to their exploitation or abuse. Unfortunately most countries, including these two have exceeded the carrying capacity of their natural resources.

The changing world

How China and India are changing the Natural Resource Base of the World

What evidence is there that we are abusing the commons or what measurement is there that provide an indication of the health of our ecosystems? The World Watch Institute publication 'State of the World 2006, Special Focus: China and India[3] gives some interesting and sobering indicators of the ecological status of some countries. The data is based on data found at 'National Footprint and Biocapacity Accounts, 2005 Edition, at www.footprintnetwork.org.[4] The data is based on the concept of determining the biocapacity of each country (the amount of agricultural land, amount of forests, energy reserves etc.) and the ecological footprint which is a measure of the resource use of each country (energy use, land use, population, etc.) and they can then determine an ecological footprint per person and for the country and also the biocapacity of the

[3] *The World Watch Institute State of the World 2006*, Special Focus: China and India. W.W. Norton & Co Inc., New York, NY 10110.

[4] National Footprint and Biocapacity Accounts, 2005 Edition, www.footprintnetwork.org.

country. The difference between the countries biocapacity and its ecological footprint then indicates whether or not a country is living within the countries ecological capacity or is exceeding it. Table 1 provides the pertinent data for the world and several of the major countries of the world.

Table 1. Population and global ecological footprint, biocapacity and deficit or reserve of the World, China, India, Europe, Japan, Russia, the United States Canada and Poland, all 2002 data. Calculated from data found in National Footprint and Biocapacity Accounts, 2005 Edition

Country	**Population (Millions)**	**Total biocapacity** Gha/person*	**Ecological footprint** (Gha/person)	**Ecological deficit or reserve** (Gha/person)	**Footprint as percent of biocapacity**
World	6,225.0	18.0	22.0	–0.4	122
China	1,302.3	0.8	1.6	–0.8	200
India	1,049.5	0.4	0.7	–0.3	175
Europe	460.9	2.3	4.7	–2.4	204
Japan	127.5	0.8	4.3	–3.5	550
Russia	144.1	7.0	4.4	2.6	62
USA	291.0	4.7	9.7	–5.0	206
Poland	38.6	1.8	3.3	–1.4	183
Canada	31.3	15.1	7.5	7.6	49

* Global hectares per person

From table 1 (last column) it is obvious that as a whole the world population is living beyond its ecological capacity by about 20% and that many countries, at least the developed ones are exceeding their ecological capacity by very large amounts. As population continues to grow the ecological deficit is likely to become more severe. Both Canada and Russia currently have an ecological reserve but it is somewhat deceptive as they have this reserve because of large areas that are not heavily populated. Also both countries have large energy supplies and other natural resources such as large forestry reserves which contribute to their ecological reserve. However, they may be living beyond their biocapacity in some areas of the country such as heavily populated areas or where there are significant pollution problems.

In 2002 the combined population of India and China made up about 38% of the worlds population.

Currently these two countries are using approximately 23% of the world's resources (table 1, column 3) but as their populations and standards of living increase they will use a much larger share of the world's natural resources. If they were to have the same ecological footprint as Europe they would be consuming almost 100% of the world's biocapacity. The USA, Poland and Russia with 0.05%, 0.006% and 0.02% of the world's population respectively are using 9.7% (USA), 3.3% (Poland) and 4.4% (Russia) of the global resources. Even with its vast areas of forests and mountains, the USA has the largest ecological deficit. Even if some of the assumptions and numbers of the footprint calculations are questioned they do provide a reasonable method of evaluating the impact of natural resource use by different countries. The developed countries of the world are exploiting not only their own natural resource bases but through imports and pollution are exploiting the resources of many other countries. The world's ecosystem cannot sustain the way many countries are using the earth's natural resources.

The status of arable soils and water

From an agricultural standpoint the critical questions for any country are: (a) what is the status of the agriculturally important soils and (b) what is the status of the water that agriculture is dependent upon. It is important to realize that agriculture uses about 70% of the water withdrawn from rivers and aquifers.[5] In a special section of the publication Science[6] entitled 'Soils – the Final Frontier' a map of the world that presents an overview of the status of the agricultural soils world wide is included. This map shows that many of the soils worldwide have a significant degree of degradation. The various articles in this special section of Science points out that many soils around the world continue to deteriorate

[5] *The World Watch Institute State of the World 2006*, Special Focus: China and India..., p 52.

[6] "Soils – The Final Frontier", June 2004, Special Section, Science 304, p. 1614–1615.

due to a variety of problems that include; salinization, acidification, erosion (wind and water), depletion of organic matter and decreasing fertility, Eswaran, Lal and Reich have a very good review of Land Degradation.[7]

The soils and water situation in the United States of America, the Russian Federation and Poland

Pimentel et al[8] provide an overview of how erosion can decrease the productivity of soils and how conservation practices can reduce erosion in the USA. An article in Moscow magazine[9] provides descriptive statements as to the general condition of soils and water in the Former Soviet Union. The conditions are basically the same in Poland. Many of the water resources are also being degraded with high sediment loads, nutrients, petroleum products and toxic materials. But none of these sources provides any perspective as to the current situation of the soil and water resources in the USA, Russia or Poland. Neither do they provide any data that shows how the general quality and health of the soils and water in these countries are changing.

United States of America

Soils

A detailed description of land and how it is used in the USA is provided in the publication Agricultural Resources and Environmental Indicators.[10]

[7] H. Eswaran, R. Lal, P. E. Reich, *Land Degradation: An Overview*, eds. E. M. Bridge, I. D. Hannam, L. R. Oldeman, F. W. T. Pening de Vries, S. J. Scherr, S. Sompatpanit, *Responses to Land degradation. Proceedings of the 2nd International Conference on Land Degradation*, New Delhi 2002.

[8] D. Pimentel, C. Harvey, P. Resosudarmo, K. Sinclair, D. Kurz, M. McNair, S. Crist, L. Shpritz, L. Fitton, R. Saffouri, R. Blair, *Environmental and Economic Costs of Soil Erosion and Conservation Benefits*, "Science" 1995, No. 267, p. 1117–1123.

[9] Ailing Land, "Moscow Magazine", June/July 1992, p. 36–42.

[10] Agricultural Resources and Environmental Indicators, 2003, United States Department of Agriculture, Economic Research Service, Ralph Heimlich editor, chap. 1, p. 1–33.

The Natural Resources Conservation Service, an agency in the United States Department of Agriculture conducts an Annual National Resources Inventory (NRI). 'The NRI is a statistical survey of natural resource conditions and trends on nonfederal land in the US – nonfederal lands include privately owned lands, tribal and trust lands and lands controlled by State and local governments'. This survey only includes data on the changes in the rate and amount of land affected by erosion; sheet and rill (erosion due to rainfall and runoff) and wind erosion. Even thought there are areas in the USA affected by salinization and acidification, erosion is the largest land degradation factor in the USA and the only one for which there is good trend data. Data form the 2001 Annual NRI,[11] the latest year for which data is available, summarizes the data as follows:

- Soil erosion on cropland declined from 3.1 billion t/y (tons per year) in 1982 to 1.8 billion t/y in 2001, figure 1.
- Cropland eroding at excessive rates decreased by 39% from 170 million acres (~ 71 million hectares) in 1982 to 103.8 million acres (~ 43.3 million hectares) in 2001, figure 2.
- Sheet and rill erosion dropped by about 41% from 4.0 t/a/y (tons/acre/year, ~9.6 tons/hectare/year) to 2.7 t/a/y (~6.5 t/h/y), figure 3.
- Wind erosion dropped from approximately 3.3 t/a/y (~7.9 t/h/y) to 2.1 t/a/y (~5.0 t/h/y), figure 3.

Significant progress has been made in reducing erosion, as Pimental et al point out conservation practices do work the challenges is to have them practiced on all land. The 2001 Annual NRI does provide data on the number of acres in various conservation programs but not on the number of acres on which conservation practices are used.

Even though progress is being made on various aspects of erosion control there are still many problems that negatively affect land and its degradation these include; the downward pressures on crop prices which force producers to carry out the least costly practices to they can make a profit from their farms, large equipment and the resulting compaction and difficulty of working around grass waterways and other conserva-

[11] National Resources Inventory 2001, Annual NRI, http://www.nrcs.usda.gov/Technical/land/nri01/.

tion practices, not following good nutrient and pesticide management practices. These trends do show that with the proper incentives, education and concern the degradation of land can be reversed and prevented.

Figure 1. Total Cropland Erosion (billion tons per year)

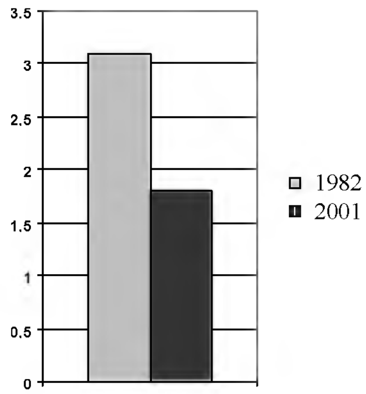


Figure 2. Decrease of excessive rate of erosion of cropland (million hectares)

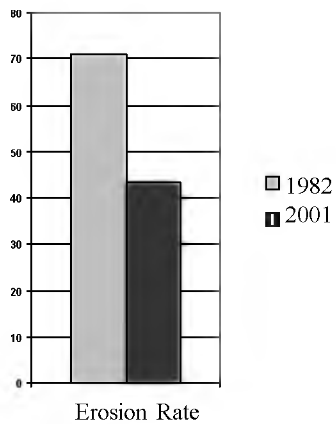
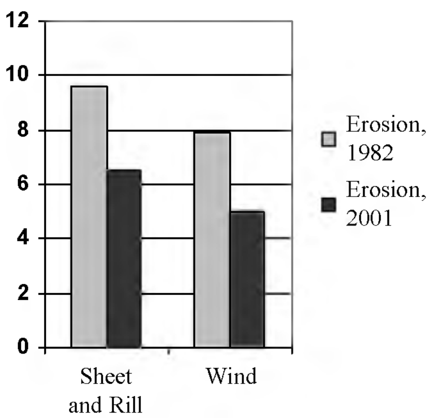


Figure 3. Cropland erosion by type (tons per hectare per year)



Water

Fresh waters include wetlands, lakes and reservoirs, and streams and rivers, ground water, soil storage and permafrost.[12]

'The US contains more than 3.7 million miles of streams and rivers. About 60% of all these streams are found in small, head-water streams. The US also contains more than 60 million acres of lakes, ponds, and reservoirs.[13]

Specific statements on the status of fresh waters include the following excerpts:

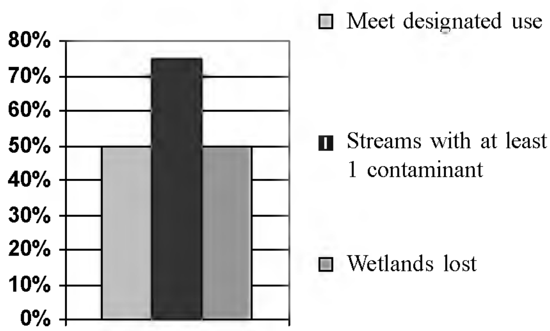
- "According to the most recent 3059B report required biannually under the Clean Water Act, approximately one-half of the lakes and slightly more than one-half of the streams assessed by the states do not meet the designated use assigned them by the state in which they are located i.e. recreation, shellfish harvesting, water supply and/or aquatic life habitat.
- Since European settlement on the conterminous US more than half of the original 220 million acres of wetlands have been drained and filled.
- Half of the fish tested had at least five contaminates at detectable levels and approximately the same number had one or more contaminates at levels that exceeded the aquatic life guidelines.
- Half of the rivers tested had total phosphorous concentrations of 100 PPB or higher. This concentration (100 ppb) is EPA's recommended goal for preventing excess algal growth in streams that do not flow directly into lakes.
- Three-quarters of the streams tested for chemical contaminants had one or more contaminants that exceeded aquatic life guidelines. One-fourth of the streams exceeded the standards for four or more contaminates.
- EPA has estimated that in three US regions, one-quarter to one-third of lakes and streams previously affected by acid rain were no longer

[12] "Vital Water Graphics", United Nations Environment Programme, 2002, http://www.unep.org/vitalwater/.

[13] Technical Document EPA's Draft Report on the Environment, 2003, http://www.epa.gov/indicate/roe/pdf/tdEco5-6.pd.

acidic, although they were still highly sensitive to future changes in deposition. The changes in the acidic status is encouraging that the status of fresh waters can be improved with the proper programs but the other indicators show that a great deal of effort and time will be required before the fresh waters of the USA have attained the quality needed to have healthy and productive bodies of water, figure 4.

Figure 4. Water Quality, USA



Russian Federation

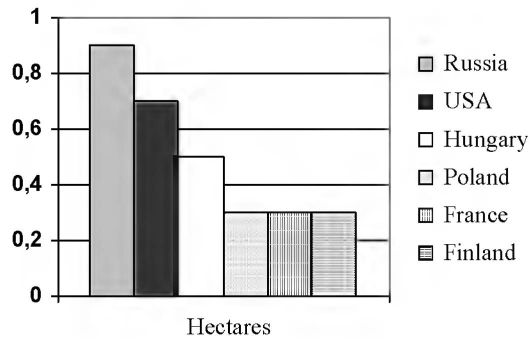
Soils

Agriculture is an ancient form of natural recourses use. As population increases society trespasses on the ecological balance increase, this has been going on for thousands of years. The 20 century is famous for the rapid increase of such a trespass. It is evident as deforestation, loss of croplands, grazing pressure, construction of huge hydraulic structures (which affect the environment), increased fertilizer and pesticide use etc. As a result, the processes of soil degradation, plant cover degradation, environmental pollution, desertification, and biodiversity reduction intensifies. The economical activity of man acts upon the biosphere globally.

On average, there are 3 hectares of land per capita in the world, in Russia it is 11.5 hectares. This parameter varies in different regions of

Russia: 3.65 hectares in the European part, 9.3 hectares in the Ural region, about 37 hectares in Siberia and the Far East. Some large areas in the world are still undisturbed by economical activity (65% of Canada, 60% of Russia, 42% of North America, 24% of Africa and only 4% of Europe). Russia contains 206.2 million hectares of agricultural land, including 124.6 million hectares of arable land (plough-lands) and 74.6 million hectares of hay fields and pastures, (1997 data). The average value is 1.4 hectares of agricultural land per capita, composed of 0.9 hectares of arable land and 0.6 hectares of hayfields and pastures. Taking plant facilities and economical infrastructures into account, there are approximately 1.89 hectares of economical production oriented area per capita. In other countries of the CIS (Commonwealth of Independent States, the former USSR) taken together, the average value is more than 3 hectares per capita. In the USA there are 0.7 hectares of plough-lands per capita, in Hungary 0.5 hectares, in Poland, France and Finland 0.3 hectares, figure 5. In those countries the productivity per hectare is from 3 to 5 times higher than in Russia. The reasons for such differences are the low farming practices in Russia such as the low use of chemical fertilizers, lack of crop rotation, decreased humus content of soil etc. In 1986, for example, the corn crop in the USSR was about 8 tons per hectare assuming that the applied chemical fertilizers were about 1 ton. Under the same conditions the corn crop in India was about 16 tons, in China and the USA approximately 18 tons.

Figure 5. Plough lands per capita



During the 20th century the humus resources in Chernozem (Mollisol) soils were about halved. The humus resources of Russian arable soils decrease annually by 0.3–0.7% of the total content of humus in the surface horizon. In the last decade of the 20 century the anthropogenic load was increased and the humus loss was about 0.64 tons per hectare every year. This calculation shows that if soil fertility was increased so nutrient levels were not limiting crop growth, then the crop production would increase by 120% and the forage productivity would double.

The land degradation processes in Russia affect about 380 thousand square kilometers. The barren areas increase by 4–5 thousand square kilometers every year. Plant cover (hayfields and pastures) degradation is seen on large areas (approximately 700 thousands square kilometers). The degraded deer pastures area in Russia (the north and the east) is 68% of the total deer pastures area (more than 230 million hectares).[14] In the Chernozem zone of Russia surface erosion (especially water erosion) is prevalent. Gulley erosion affects about 70–80 hectares daily and barrens increase by approximately 25–30 thousands hectares annually. This soil loss results in harvest loss of from 10 to 70%. Wind erosion is also a large problem and all of the arable soils are affected by it. Dust storms are a form of deflation in some CIS regions (the Ukraine, the Volga region, Eastern Siberia, Northern Caucasia, Northern Kazakhstan and Central Asia republics). There are 13.5 million hectares of plough-lands in Siberia, but approximately 22% of those lands (especially in Eastern Siberia) have been destroyed by wind erosion.[15]

The International Scientific Project "The Global Estimation of the Soil Degradation" concluded that degradation covers an area about 2 billion hectares. Water erosion degraded 55.6% of the mentioned area, wind erosion 27.9%, chemical soil degradation factors of (salinization, pollution, and exhaustion) 12.2%, and factors of compaction and water logging 4.2%. The processes of degradation are global. Mankind has lost

[14] V. A. Chernikov, A. M. Alexachin, A. V. Golubev et al., *Agroecology*, Moscow 2000, p. 536.

[15] M. S. Kuznetsov, G. L. Glazunov, *The Erosion and the Soil Protection*, Moscow 2004, p. 351.

about 2 billion hectares of fertile land which has been changed into barrens, badlands and man-made deserts. It is necessary to realize that the total area of the world agriculture is just 1.5 billion hectares.

Seventy million hectares of agricultural land in Russia are affected by erosion and deflation. Acidification was detected on the area of 73 million hectares and more than 40 million hectares were affected by salinization to variable degrees. Over wetting and water logging was detected on an area of 26 million hectares. Twelve million hectares have a problem of stones. Low forest and bushes overgrow 7 million hectares. About 5 million hectares of agricultural lands are contaminated by radio nucleotides; more than one million hectares are affected by desertification.[16]

Water

Fresh water is one of the major limiting resources of the biosphere. It is a renewable resource which makes up just 2.5% of the total water resources of our planet. According to professional estimations, the total amount of water is 1370.3 million cubic kilometers. Except for 35 million cubic kilometers of fresh surface water, the remaining volume is accounted for by the world oceans, salty lakes, underground waters etc.

In 1986 there was 7 million cubic kilometers of fresh water in the world per capita (the human population was about 5 billion. Approximately 70% of fresh water is found in the polar icecaps and about 30% are underground waters. Only 0.006% of the total fresh water exists in riverbeds and lakes. Arid and semiarid territories make up about 35% of the world land area. Approximately 14% of the arable lands are irrigated. From 120 to 150 million hectares of arable lands are affected by secondary salinization and have been abandoned (for instance, in Egypt, India, Iran, China, the USA, Mexico). In the CIS (the former USSR) about 10 million hectares of irrigated lands were changed into barren lands, because of salinization.

River flow is a basic fresh water resource in the Russian Federation. The long-term average value of river flow in Russia is about 4300

[16] *The Soil Degradation and the Soil Protection*, ed. G. V. Dobrovolskiy, Moscow 2002, p. 654.

cubic kilometers, which represents about 22,400 cubic meters of fresh water per capita. But the water supply in the European part of Russia is approximately one-third the water supply in Siberia or in the Far East. On average, the water supply from rivers and lakes, make up from 2.5 to 2.7% of the annual river flow. This is a small percentage. On average, each resident of Russia consumes nearly 2000 cubic meters of fresh water annually. It is from 3 to 4 times higher than the world average water consumption rate.

Sea transportation, vessel sources, accidents and illegal discharges result in extensive water pollution. The total amount of oil and oil products, which pollute oceans and seas, is about 600 thousand tons annually. The conditions of water resources were estimated as critical by the International Conference on Water and the Environment held in Dublin, Ireland in 1992.

In Russia water pollution is increasing because of unregulated waste discharge. In 1989, for example, the total effluent discharge was about 76.3 cubic kilometers. The rate of discharge growth was more than 1 cubic kilometer every year. A large part (from 10 to 30%) of the applied fertilizer is a potential water pollution source due to runoff and soil removal. This loss has two effects, an economic loss and the quality of fresh waters (especially river waters, ponds and reservoirs) decreases rapidly. The surface-water flow from agricultural lands (rain-water and snow melt runoff) is about 90 million cubic meters annually. It removes almost 1.5 million tons of soil. The loss of nutrients in the form of chemical fertilizers and manure is large, but the total amount of nutrient loss is about twice as much due to the loss of the native fertility of the soil.

According to the conclusions of the International Eutrophication Committee, non-point pollution sources are a leading cause of eutrophication. This is confirmed by data obtained in different countries. In Switzerland, for example, more than 70% of nitrogen and about 50% of phosphorus transfers from agricultural lands into water bodies. In the USA high concentrations of nitrogen (10 milligrams per 1 liter) were detected in rivers, flowing through agricultural lands. In Germany 54% of nitrogen transfers from agricultural fields, 24% is from factory wastes and only 22% from wastewater. Over the past 20 years the bioorganic matter mass, which transfers into the Dnepr and Volga reservoirs (because of runoff, mainly), has doubled. Agricultural holdings produce 70% of the nitrogen and 36% of the mineral phosphorus that pollute fresh waters. The same situation is typical for the most of rivers and lakes, 50% of their waters is from the small streams of agricultural landscapes. Those streams are directly dependent on the state of the agro-ecosystems.

The destruction of the Aral Sea is a prime example of a major ecocatastrophe of the 20th century. Excessive diversion of flow for irrigation occurred and the annual flow of the supplying rivers (Amudarya and Syrdarya) was reduced from 55 to 0.3 cubic kilometers. As a result two-thirds of the total seawater had been lost and the salt concentration (both in seawater and subterranean waters) has risen sharply and salt deserts have appeared on the former seabed. Now the winds spread salty dust to nearby landscapes. Fish resources have been practically destroyed and the biodiversity greatly reduced. As a result, some dangerous diseases and poor water supply have become a common problem for about 50 million inhabitants.

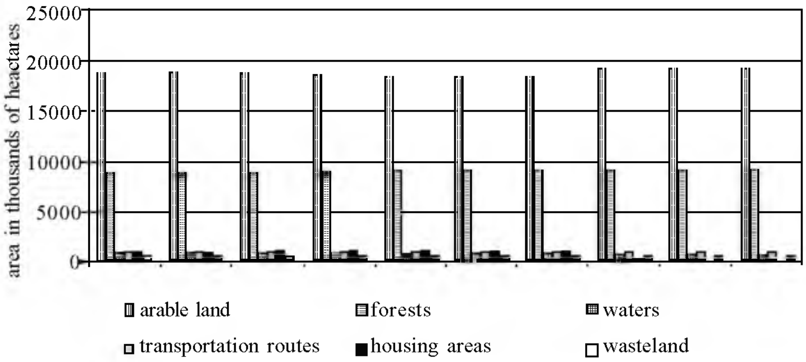
Poland[17]

Soils

Over 90 per cent of Poland's area is used for agricultural and forestry related purposes; 61.4 and 29.6 per cent respectively. Soils rank average or low for agricultural use. The average quality soils, class III and IV soils used for agricultural purposes account for 39.9 and 22.7 per cent respectively of the country's total territory (Official six-grade scale of soil fertility, class I is very good and Class VI is very poor; Polish Central Office of Land Surveying and Cartography). The trends in land use are shown in figure 6. From 1990 to 2004, there was approximately a 5.1 per cent increase in forest land use and this phenomenon was accompanied by a 2.2 per cent drop in the area of arable land.

[17] Polish part of the paper utilized information included in "The state of environment in Poland vs. Eur. Union objectives and priorities – Indicator report 2004", Environmental Monitoring Library, Warsaw 2006, www.gios.gov.pl/.

Figure 6. Land use trends between 1990 and 2004



Source: CSO.

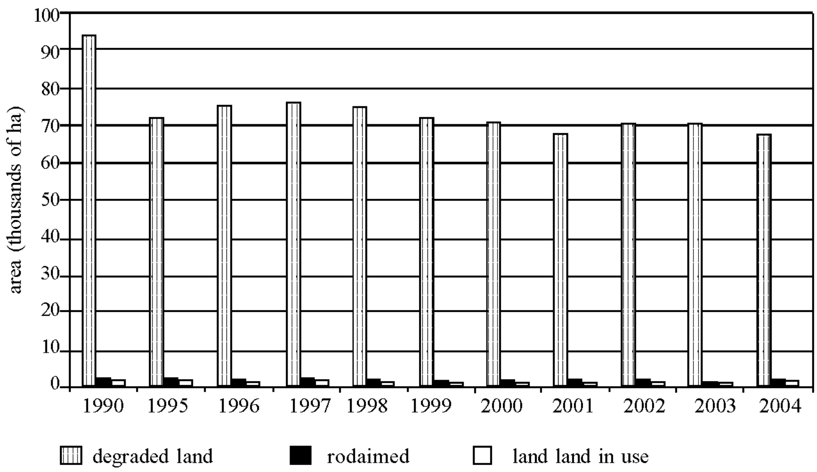
Chemical fertilizer and lime consumption in Poland dropped by approximately 49 per cent to 40 per cent from 1990 to 2004 respectively. In comparison to other European countries, the use of chemical fertilizers and lime in Poland remains at a relatively low level.

Land reclamation measures are undertaken in Poland on a systematic but small scale basis. This results in a very slow process of rejuvenation of the degraded land. In 2004 the area of degraded land equaled 67 550 ha, i.e. approximately 0.2 per cent of the country's territory. However, during the 14 year period from1990 to 2004, the area of degraded land has been reduced by nearly 28 per cent; figure 7.

The area of arable land cultivated in Poland in compliance with the principles of organic farming has increased from almost zero hectares to more than 100,000 hectares between 1990 and 2004; figure 8.

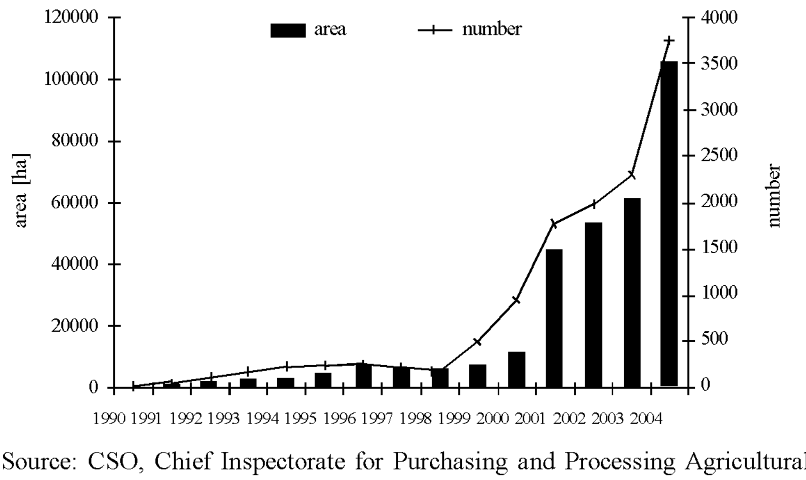
In 2004 organic farming in Poland accounted for approximately 0.5 per cent of the total arable land. In comparison during 2002 the share of organic farms in the EU-15 equaled around 4 per cent of the total arable land, and in 10 new EU Member States it amounted to 1.4 percent. Thus the amount of organic farming in Poland as compared to new EU Member States and of Greece, Iceland and Ireland remains low; figure 9.

Figure 7. Degraded vs. reclaimed and used land in Poland between 1990 and 2004



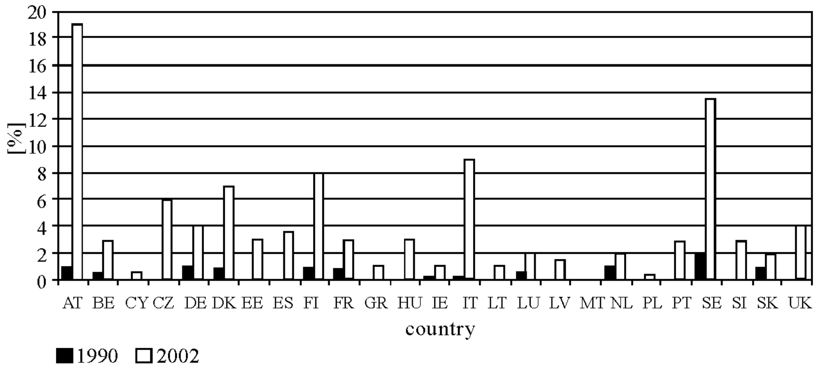
Source: CSO, Ministry of Agriculture and Rural Development.

Figure 8. Organic farms in Poland (certified and during transition period), between 1990 and 2004



Source: CSO, Chief Inspectorate for Purchasing and Processing Agricultural Products.

Figure 9. Share of organic farms in the total arable land in the European Union in 1990 and 2002



Source: European Environment Agency CSI 26.

The area of Polish forests is increasing and in 2004 forests covered 8,972, 500 hectares. Arable lands have low contamination from heavy metals and organic compounds, qualifying them as soils of high agricultural value. Because of government promoting the model of sustainable agricultural management, Poland's consumption of chemical fertilizers and pesticides is subject to a slow but steady decrease when compared to Western European countries. Thus chemical contamination of soils is mainly in industrialized urban areas and to transportation routes, where pollution with heavy metals and crude oil derivatives occur. A decrease in the impact that the industry has on soils has been observed over the past years.

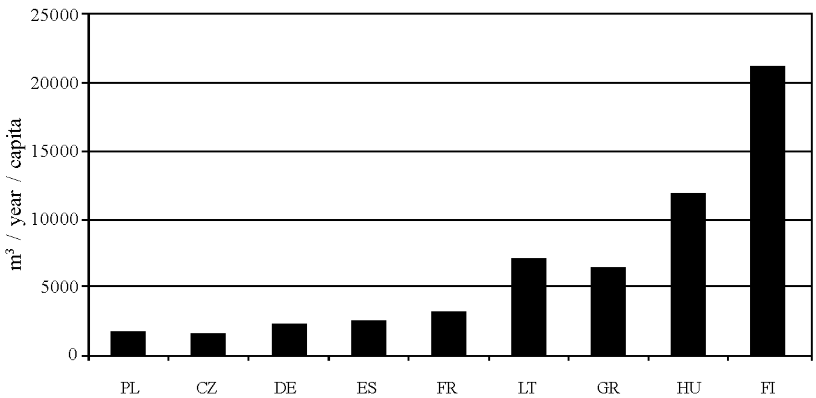
The most acute problems with Poland's soils include the following: reclamation of degraded areas, improving the quality of soils in former industrial areas and the reestablishment of these soils as part of the economic system. The pace at which degraded and devastated areas are reclaimed and reused in Poland remains unsatisfactory, and further, no rapid improvement is to be expected in this field.

The increasing share of organic farms in the total agriculturally cultivated area of Poland is noteworthy. The interest in transforming farms to the organic production system will continue to increase in the future because of the ever increasing demand for organic produce. In time, the percentage of arable land devoted to organically cultivated land will reach a level similar to that observed in Western European countries.

Water

The quantity of water resources is defined by means of the average yearly run-off after subtracting the volume used for vegetation and evaporation. Within Poland the average value was 62 kilometers^3 per year for the period 1951–2000. The figure describing availability of water for the population and for water management purposes, water resources *per capita*, is low, 1,600 m^3 per year (figure 10), compared to the European average of 4,500 m^3 per year.

Figure 10. Drinking water resources *per capita* – Poland vs. other European countries (1950–2000 average)



Source: CSO, IMWM.

In 2003 surface water run-off was the lowest since 1995 and amounted to only 47.8 km^3. Runoff increased to 50.4 km^3 in 2004, but still was among of the lowest in last 50 years. For reference, the surface water run-off in 1999 equaled 80.3 km^3, with the average value for the period between 1995 and 2004 amounting to 58.8 km^3. The exploitation of groundwater resources has been growing continually since 1990 (14.04 km^3), to reach a level of 16.5 km^3 in 2004.

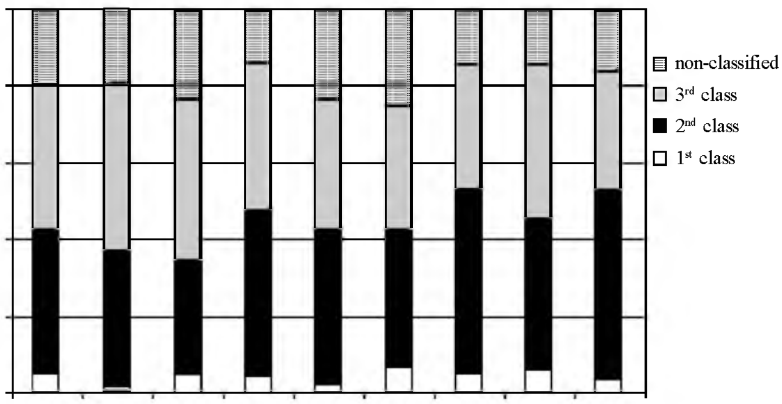
A drop in ammonia content in river waters has been observed, which stems from the implementation of the directive dealing with urban waste water treatment. Also a decrease in BOD_5 has been noted. A similar trend has also been observed in new EU Member States and in candidate countries. This decrease is recorded in almost all states for which relevant data is available, with the phenomenon being most prominent in those countries in which this value was the highest at the beginning of the 1990s (i.e. in new Member States and in candidate countries).

Lake quality is assessed with the use of the "Guidelines for Basic Lake Monitoring" issued in 1994 by the State Inspection for Environmental Protection. Of the 122 lakes assessed in 2003, 91 had been evaluated at least once previously. The majority of these lakes (51 lakes, or. 56 per cent) received the same quality classification over the past several decades. The water quality of only a few of the lakes had improved. This improvement was a result of mainly by dealing with wastewater treatment on their feeding rivers.

A decrease in the quality of water was observed in the case of several lakes, figures 11.

While the amount of good to high quality water is insufficient, the quality of surface and groundwater continues to improve as a result of various clean up efforts and economic transformation. Excessive pollutant discharges from waste water treatment plants and of biogenic substances are the major challenges. The National Environmental Policy is directly related to the quality of water resources and stems from the Water Framework Directive 2000/ 60/EC states that by 2015, Poland should achieve a rating of at least good for all water resources in the country (equivalent to the first and the second class of surface water quality). If this is the case, presently 20 to 40% of Polish surface waters fail to comply with such a requirement. The share of waters that do not meet the sanitary criteria is even greater.

Figure 11. Water quality proportion changes in Polish lakes between 1989 and 2003.



Source: CIEP / SEMS.

Conclusion

The state of the quality health of the soils and surface waters of the USA, Russia and Poland are not good, but evidence shows that with the proper knowledge, policies and incentives the downward trend of deterioration can be reversed. Each country needs to be concerned about the quality and health of both its soil and water resources and develop and implement the needed policies and actions to improve and conserve these critical resources before the deterioration becomes irreversible.