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TRANSFORMATION OF FARMING SYSTEMS IN SOUTHERN UKRAINE AND SOIL DEGRADATION

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1. EXECUTIVE SUMMARY

In the course of agrarian reform 1992–2000 practically all state farms in Southern Ukraine have been transformed into agricultural enterprises of a new type such as co-operatives, joint venture, private-rent enterprises, private and individual farms. Land privatization and change of property rights were proclaimed as priorities of agrarian reform.

Nevertheless, transformation of farming systems (FS) into new forms did not provide their expected strengthening and sustainable use of agricultural lands. Since social and environmental objectives were not considered in agrarian reform, direct influence of this intervention on sustainability of FS in Ukraine was rather negative, than positive. Large-scale farms continue to overexploit natural resources. As to new private farmers, lack of experience and knowledge along with a limited access to physical and financial resources makes them to use obsolete technologies that lead to soil degradation.

The case study is devoted to research the economic, social and environmental determinants of changes in the system "land reform – viability of farming system – inputs – soil degradation". Methodological approach to research is based on the PSR (pressure-state response) models, taking into account OECD quantitative and qualitative sustainability indicators, by using official data, periodical survey, and interviews. Viability of large farms, their inputs/outputs and environmental implications were studied by means of explorative case studies in selected farms and villages, covering all fields of potential ecological damages and benefits.

It was done detailed description of farming systems in the Southern Ukraine, including description of the country and region, climate conditions, landscape and land use. It was analyzed the changes in farming systems environment during 1990ies, resulted from changes in socio-cultural and policy-institutional environment. It was analyzed transformation and ownership rights of major farming systems, dominated in Southern Ukraine. They are: individual household plot (small size farm), private family farm (medium size) and cooperative agricultural enterprise (large size farm).

It was described proportion in arable lands, woodlands and pastures. In Southern Ukraine the agricultural land amounts to 75 % of the total area, arable land amounts to 82 % of the agricultural land and forested land now total ca. 17%. In the region agricultural land and woodland comprise approximately 80% and 8 %, respectively. Being the dominant factor determining the landscape features, agricultural production may represent the single greatest factor affecting soil degradation, in relation to all other land uses including industry, mining, fishery, tourism and domestic activities.

The agricultural land use in the region is non-balanced. Natural pastures, meadows and hayfields in the region are practically absent. Fodder crops and pastures occupy about 9-11% of agricultural land, which is negatively influenced on livestock production. For the last eight years, large-scale farm livestock production has fallen twice as much. At the same time the private farms tends to increase its capacity in producing meat and dairy products. Now more than 70 percent of the total meet and diary products are produced on household plots. Increasing misbalance between livestock and crop production seems to be cause of new environmental problems.

Transformation is influenced destructively on the technological potential of farming systems. At the moment all rural buildings, storage facilities and processing units, irrigation and drain

age equipment are used up 60-70% and need renovation. In last 10 years input of agricultural machinery and techniques is sharply diminished, for example supply of tractors is reduced from 106000 (1990) to 3000 (1999). The same picture with purchasing of new ploughs, planters, harvesters, etc. Public services, electrical network, sewer systems, roads are obsolete and require essential modernization. As for working capital (surpluses, bankrolls, cash, expenditures), it was considerably decreased. Now farmers have a big shortage of financial resources, in particularly bankroll and cash that caused decreasing input. So purchasing of fuel was decreased twice, mineral fertilizers and pesticides in 12 times. The financial resources are insufficient for farming activity not to mention social needs and nature protection.

Explorative phase of case study is devoted to analyze of the economical and ecological indexes of large-scale farming systems. The environmental implications of non-rational farming, obsolete technologies, low level of technological culture and reduction of soil protection measures are discussed. Political, institutional and social causalities of soil degradation are studied. There is a consensus among farm enterprise managers, agricultural and environmental specialists in the local administration, scientists and ecologists that the historical expansion of the agricultural and particularly arable land has gone too far, and that soil fertility is declining. There is also agreement that soil degradation presents a threat from agricultural production in the South of Ukraine.

Explorative research allows to classify determinants of soil degradation in two categories: farm-based factors and external factors, which are beyond of farm control.

Farm-based determinants*:

- Economic (high share of arable lands, low productivity, extensive farming, obsolete techniques and technologies, non-rational land use, farm losses, debts and financial obligations, lack of cash, constrained access to commercial credits, insufficient inputs of mineral and organic matter, misbalance of crop and livestock production.
- Social (farming traditions, lack of incentives and motivations, lack of agronomic and economic knowledge, lack of personal responsibility, weak management skills, poverty, unemployment, quick ageing of farm employees, migration from countryside to town).
- Ecological (non-observance of ecological norms and standards, soil overexploitation, exhaustion and erosion, water and air contamination, loss of biological and landscape diversity)

External determinants:

- Economic (land is not a market commodity, absence of soil monitoring, extension and advisory services, absence of institutions for promoting environmentally friendly agriculture and soil protection, disruptive influence of land reform, undevelopment of agricultural markets, price disparity, tax pressure, inflation, high risks of investments in agribusiness, barter relations, ineffectiveness of governmental support, reduction of soil protection measures).
- Social (public form of land ownership, lack of social services, low level of agricultural education, inconsistent social policy, lack of social guaranties.
- Ecological (environmental stresses (drought, flooding, and acid rains).

Determinants, which arisen after transformation, marked italic:

It can be seen that before transformation the major determinant of environmental problems was non-rational farming. After transformation practically all large farms remain with old problems, moreover, a lot of new problems appear. Transformation caused a lot of negative changes both on the regional and on the farm level. On the farm level they are: farm losses,

debts and financial obligations, constrained access to commercial credit (first-order determinants), insufficient inputs of mineral and organic matter, misbalance of crop and livestock production, poverty and unemployment (second-order determinants). On the regional level they are: disruptive influence of land reform; underdevelopment of agricultural markets, particularly land market (first-order determinants); barter; price disparity; hidden inflation; high risks of investments in agribusiness; reduction of soil protection measures.

It seems that land privatisation and changes in land use amplify the farm-based causalities of soil degradation in Southern Ukraine. It confirms initial hypothesis that transformation of large-scale farming systems, land privatization and change of property rights, implemented under inefficient policy and institutional reforms, caused deterioration of economic viability of farming systems, reducing of inputs of mineral and organic matter and speed up processes of soil degradation. In this case the key recommendations should be focused on policy and institutional reforms.

2. INTRODUCTION

In the course of agrarian reform 1992–2000 practically all state farms in Southern Ukraine have been transformed into agricultural enterprises of a new type such as co-operatives, joint venture, private-rent enterprises, private and individual farms. The goal of the reform was restructuring of state and collective farms into market-oriented agricultural enterprises with private ownership to increase their economic viability in market conditions. Land privatization and change of property rights were proclaimed as priorities of agrarian reform.

Nevertheless, transformation of farming systems did not provide automatically expected sustainable use of agricultural lands. Large-scale farms continue to overexploit soil resources. As to new private farmers, lack of experience and knowledge along with a limited access to physical and financial resources makes them to use obsolete technologies that lead to soil degradation.

The purpose of case study is a research the consequences of agrarian reform and transformation of farming systems on the problem of soil degradation in Southern Ukraine.

3. METHODOLOGY

3.1 Description of data sources

Description of farming systems, ownership structures and organizational forms is based on statistical data from Ministry of Statistics, Ministry of Agrarian Policy and Ukrainian Academy of Agrarian Sciences. The qualitative and descriptive information available from periodical publications (Business, Proposition, etc.), from scientific reviews of Ukrainian Agricultural Policy Project (UAPP) and World Bank, from farm surveys, in EU and OECD publications and other literature.

Information related how natural conditions and farming traditions have shaped production practices, ecological systems and agricultural structures is obtained from Ministry of Ecology and Natural Resources, and standard questionnaire proposed by Partner 2 and designed accordingly local conditions (annex 3). Collection and processing of data and documentation of

interviews was made in close co-operation with the Institute of Sociology, Kyiv.

Production systems and their ecological implications were studied by means of explorative case studies in selected farms, villages and extension services covering all fields of potential ecological damages and benefits.

3.2 Model approach

Explorative research and next quantitative and qualitative analyze is made in the framework of the PSR (pressure-state-response) model approach *[OESD 1999. Environmental indicators for Agriculture: Methods and Results]*, which has been modified specially for our case study (fig.1, fig.2).

Figure 1: PSR-approach to analyze trends of agricultural ecosystem, affected by agrarian reform

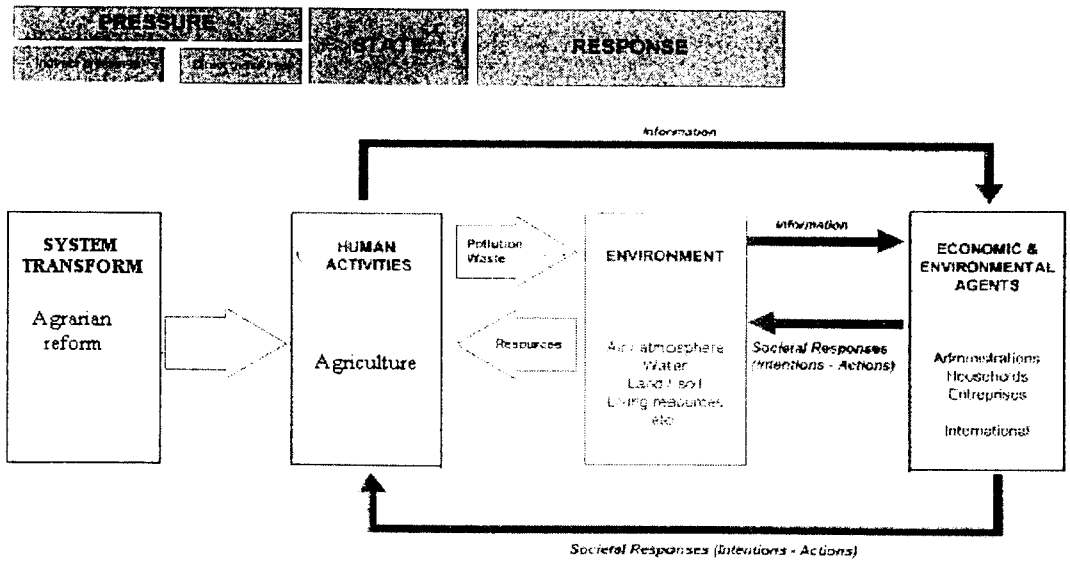
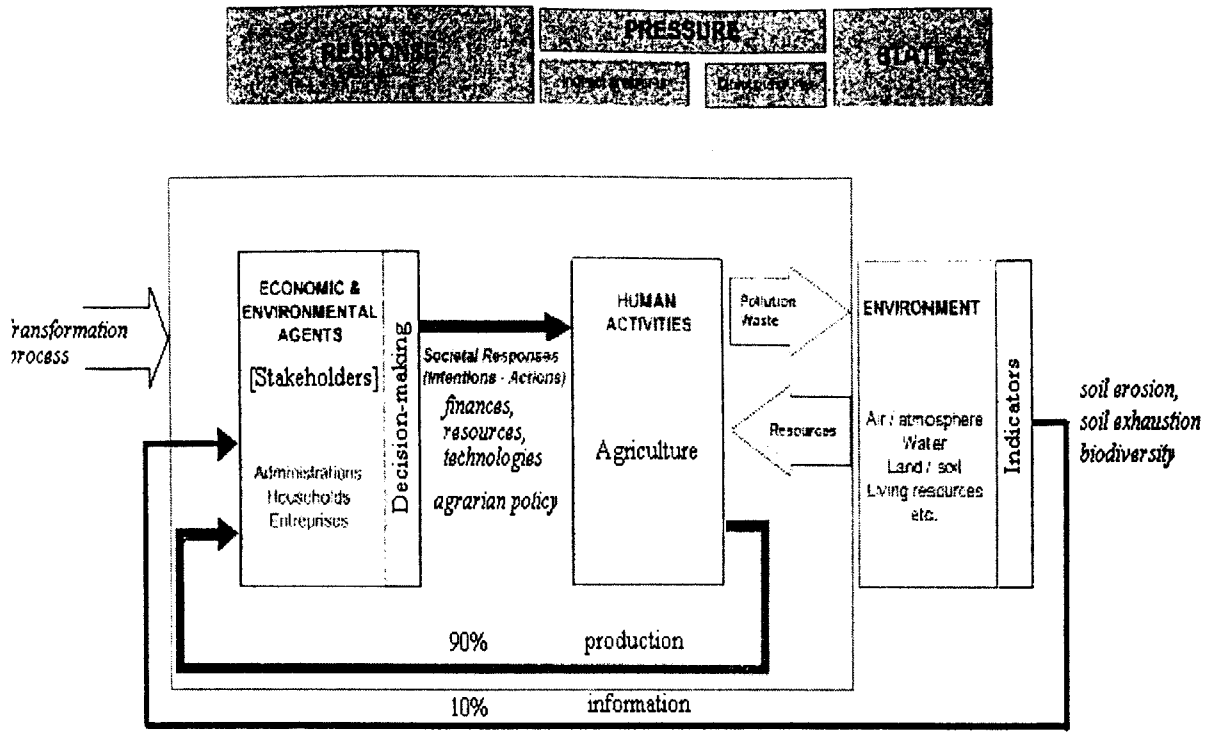


Figure 2: PSR-approach to analyze farming system environmental implications



3.3 Indicators of sustainable land use

Analysis of FS will be made accordingly to OECD quantitative and qualitative sustainability indicators.

As indicators of environmental pressure are used direct and indirect pressures on the natural environment, including transformation of FS (globally) and agricultural practices (locally).

As indicators of state of natural environment are used hydrometeorological, landscape, biodiversity indicators and also qualitive and quantitative indicators of soil degradation.

As indicators of societal responses responces from rural community and stakeholders (administrations, employees, farmers, enterprises) on environmental changes are used. Stakeholders' analysis and SWOT-analysis will be base of strategic plan for conflict resolution through improvement of policy and local regulations.

Analyse of FS sustainability was made on the base of Conway model approach (Conway, 1987) in modification of McConnell and Dillon (FAO,1997), which account quantifiable measures: productivity, profitability, stability, diversity, flexibility, time-dispersion, sustainability and environmental compatibility (Sumelius,2000). As internal features of FS take into account resource base (natural, human, financial, physical and social resources) and productive, economic and social performance of farming system. Indicators of productive

performance are crop and livestock production. Indicator of economic performance is input/output, social performance is estimated in terms of consumption, poverty and employment (social guarantees).

Analyse of farm internal constraints allow to clarify farm-based causalities of soil degradation. Description of farm history and conventional farming practices gives additional information about causalities and trends of farming system evolution.

Analyse of external constraints (margin of stability of natural ecosystem, access to credits, extension and social services, availability of markets, leasing of machinery, processing firms, storage facilities, transportation) allow to find region-based causalities of soil degradation.

Analyse of political, institutional and a mental constraint allows to identify national-based causalities of soil degradation. It is initial point for finding determinants of necessary changes in policy and relevant institutions.

We have used a simplify approach to determination economic, ecological and social components of sustainability, based on calculation of trends of basic parameters and ranging FS as upcoming or degrading system.

For processing and analyzing statistical information the regression and correlative methods were used. On this based of these methods the interrelations between parameters and their statistical characteristics were determined.

4. DESCRIPTION OF FARMING SYSTEMS IN THE SOUTHERN UKRAINE

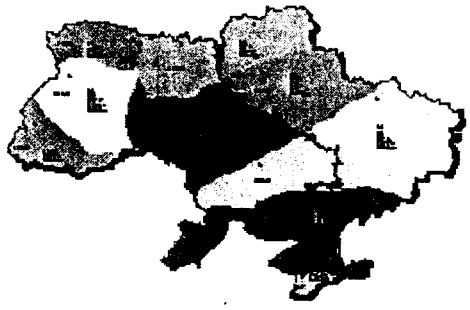
4.1 General information

Description of the country

Ukraine is well known as a breadbasket of former Soviet Union. The share of agricultural land in total land consists of 69%, and this index is one of the highest in the Europe[1]. The territory of Ukraine can be distinguished on 3 main agro-ecological zones: Polissja (Northern Ukraine), Forest-Steppe zone (Central part) and Steppe zone (Southern Ukraine). Their share in GAO makes up 21, 32, and 47% accordingly. The most favorable climate is in the Steppe zone, where dominated intensive crop farming.

The agro-ecological map of Ukraine is presented on fig.3.

Figure 3: The agro-climatic zones: Polissja (red & biscuit), Forest-Steppe (pale & dark blue), Steppe: Northern Steppe (violet) and Southern Steppe (brown)



Source: Oginskiy A. National system of agriculture. Kyiv,1999

4.2 Description of the region

The Southern Ukraine (Donetzk, Zaporizhzhja, Kherson, Nikolajev and Odessa oblasts) along the Black Sea and the Azov Sea belongs to the dry grass/bush steppe zone with high yielding topsoil (black soils and chestnut soils) and a low annual precipitation (less than 400 mm). For a long time natural steppe areas have been extensively used as a natural pastures. Hunting, fishing and livestock were usual for this region with low density of population and satisfied their elementary needs.

In order to increase food production, the majority of the primary steppe areas has been reclaimed and converted to farmland in particular during the last half of this century. This means that the natural steppe was tilled and irrigated. Large areas near wetlands also have been reclaimed and transformed into arable land. To the end of 70th the Southern Ukraine became the region with the most intensive farming by large scale collective and state farms. The share of arable lands achieved 85%. Their long-term extensive use and unregulated irrigation caused inadmissible high pressure on high-sensitive natural ecosystems, deterioration of hydrological regime and soil degradation. Additional environmental problems resulted from building of irrigation canal system at the end of 80th. Irrigated lands were periodically flooded and salinized, while dried lands suffered of uncontrolled decreasing of ground water. 14.8% of total area of irrigated lands were eroded, 1.5%-waterlogged, 4%-degraded to salt marshes. The annual losses achieved 11 million ton of humus, 0.5 million ton of nitrogen, 0.4 million ton of phosphorous, 0.7 million ton of potassium.

Climate conditions and topography

The South of Ukraine is characterized by droughty, moderately hot climatic conditions with a soft winter. The sum of effective temperatures over 10°C amounts to 1400-1600°, precipitation is 350-400 mm. Average temperature of January is -3.0°C, July +23.0°C. Period with temperature over +10°C lasts 220-230 days. Snow cover is not steady. The landscape is rather favorable for agriculture: nearly 80% of the agricultural land is practically flat and the other 20% has slopes between 1° and 3°. Arable land represents 75% of the total area, pasture 9%, hayfields 4% and orchards and plantations less than 2%. The soils are mainly dark chestnut, residually salted, heavy loam on loess.

From 10.3 million hectares of Southern Ukraine total area, forests occupy 1.77 million hectares, wetlands – 1.65 million hectares and only 120 thousand hectares of protected areas. Agricultural land amounts to75 % of the total area, arable land occupies to 82 % of the agricultural land, pastures 7-8% and perennials 1-2%. The level of permanent grasslands is less than 1%. Large-scale farms with average size 4-6 thousand hectares occupy the main part of territory. Being the dominant factor determining the landscape features, agricultural production may represent the single greatest factor affecting soil degradation, in relation to all other land uses including industry, mining, fishery, tourism and domestic activities.

Land use

Large-scale farming, dominated in the Southern Ukraine, is characterised by mixed production (70-75% crop and 25-30% livestock production), an extensive farming with 7-9-field crop rotation, low level of mineral and organic input, power consumptive and low productive machinery. Using of heavy technique and obsolete tillage and cultivation technologies caused soil over consolidation, breakdown of physical properties, erosion and soil degradation. Private farm 15-30 ha is usually specialised either on crop/vegetable or livestock production. They use short 3-4-field crop rotation and low input technologies. Share of arable land in private farm achieves 95%. Household plots engaged 0.5-0.7 ha of arable land, located near rural settlement and specialised on vegetables, dairy and pig production and characterized by intensive farming.

About 48.5 percent of all sowed areas in the region are under cereals. It cultivates a large variety of cereals and pulse: spring barley and spring wheat, winter barley and winter wheat, corn and rice. The main grain producers are large-scale farms. Because of low input of mineral and organic matter, in 10 years the grain yield is dropped from 30.5 to 21.7 centners per hectare. However despite such a dramatic drop in yields, both large scale CAE and private farmers are interested in grain production since grain crops still remain one of a few agricultural commodities which bring cash stripped enterprises some profits. The grain can be easily sold at the domestic and international markets.

The region produce much more grain than necessary for local consumption, especially in good crop years. For instance, in 1997, one of the most productive years, the local grain supply exceeded the local grain demand by 5.1 million tons. The region remains an important cultivation area of such crops as corn and rice: the region's share in the national production of these commodities is 10.7 and 14.3 percents respectively.

The sowed area under sunflower is 14.5 percent of the total sowed are in the region. In recent years, sunflowers have become one of the most attractive agricultural crops for local producers. For the 1991-1999 period, the sowed area increased more than by one and a half times which indicates farmers' interest in cultivating this crop. In the last year, farmers expanded their sown areas under sunflowers by 13.7 percent. In 1999, only Odessa harvested around 255 thousand tons of sunflowers or 12 percent of the country's gross harvest. As in the case with grain production, the main producers of sunflowers are large farms. Their share in the total output amounts to 93.3 percent. During 1991-1999 the sowed area has substantially increased, but the gross yield of sunflower for the same period has been decreasing up to 9.8 centners per hectare or 62 percent compared with 1991. However, even regardless of the low yield, the sunflower seed production in the region is pretty profitable - 58.7 percent.

Because of land overexploitation, many large-scale farms are practically exhausted their possibilities for further increasing sown areas of sunflower. The increased share of sunflower in

the total sown areas negatively impacts the soil quality. The crop exhausts soils, in particular, it destroys the balance of organic matters consuming lots of natural elements. The situations looks especially problematic when due to the profitability of sunflower seed production farmers do not keep rational crop rotation and don't have enough resources to buy necessary inputs, first of all mineral fertilizers to improve soil fertility. This situation is one of the primary reasons of soil degradation in the region.

The sowed area under sugar beets is about 1.9 percent of the total sowed area. The yield of sugar beets averages 162.8 centners per hectare, which is lower than that in other regions. However, the risk of sugar beet production in the Southern Ukraine is less than in other regions of the country and large farms, the main producers of this crop, still produce the majority of sugar beets in the country (91%). It is interesting to note that while large farms are reducing their sugar beet production year by year, the opposite trend has been observed in the private sector (family farms and household plots). A large part of the sugar beat gross harvest actually comes from individual subsidiary holdings (household plots), which have established direct arrangements with sugar refineries. However, chronic problems with debt offsetting between producers and processors, as well as the in-kind tolling payment mechanism, have also had discouraged many farmers from increasing sugar beets' output. Besides, in many areas of the region sugar beets are harvested manually, not only because of a lack or disrepair of machinery, but also due to high fuel prices which make harvesting unprofitable. From environmental point of view the sugar beet cultivation has very negative impact on the soils, accelerated soil degradation.

The natural pastures, meadows and hayfields in the region are practically absent. Fodder crops and pastures occupy about 9-11% of agricultural land, which is negatively influenced on livestock production. For the last eight years, livestock production in the region has fallen twice as much. The large-scale farms livestock output is constantly decreased because of non-profitability. At the same time the private farms tends to increase its capacity in producing meat and dairy products. Now more than 70 percent of the total meet and diary products are produced on household plots. There is no doubt that the private farms and especially individual households, is to be reckoned with. Furthermore, the rate of cattle head reduction is highest in those areas of the region where they are concentrated mostly on specialized collective farms.

For example, in 1999 the livestock production in the large farms was loss-making: for milk and diary production - minus 47 percent, for beef - minus 59 percent, and pork - minus 47 percent. That means that livestock production remains a significant burden on the rest of agriculture. Increasing misbalance between livestock and crop production seems to be cause of new environmental problems.

Changes in farming systems environment during the 1990s

Socio-Cultural Environment

The typical form of rural settling in Southern Ukraine is large community consists of 500-1500 people (1.5 times larger than the average in Ukraine). Most of them (55-60%) are engaged in the agricultural production in the large-scale collective agricultural enterprises (CAE), which is a typical form of farming system in this region.

Depopulation is one of the most negative demographic processes in the region, which is especially problematic for rural area. As a result, in last 10 years rural population of Southern

Ukraine is decreased from 28 to 22 persons per sq. km, at the same time average age increased on 5 years and achieved 45.6 years old. 22% of rural people have primary education, 11% –special technical and high education, 6%–graduated agricultural universities and 39% are not educated. In whole, rural population is characterised with a low level of social activity.

Economical collapse in 1992-1994 caused drastic reductions in real wages of rural population. Devaluation of savings and property resulted from currency reform 1994 year, faced rural people before the problem of their very survival. Three circumstances make this problem even more difficult: a) high risk of investments in agriculture; b) price disparity between industrial and agricultural production; c) quick ageing of the rural population. Currently, a high hidden unemployment is causing the problem of job for a large number of people who due to a historically conceived isolation between the city and the countryside do not have any realistic alternative of their employment. Consequently, the absence of working places leads to serious problem of social protection for retired, children and teenagers. Today, though, the cash part of rural household incomes is practically absent, which has disastrously cut the possibility of rural families to satisfy their socially significant needs. It is negatively affected on motivation to effective collective work and soil conservation.

With the beginning of land privatization, the situation has become even worse. Due to economic difficulties and lack of cash, a majority of farmers are unable to satisfy their elementary needs. The lack of information and limited capacities for independent work reduces a possible progress of farmer's activities in new conditions. Direct links between farmers and consumers are underdeveloped and only begin to be established, at the same time workable links between farmers and government institutions are practically absent. Policy makers and regional administrations neglect both the «voice of farmer». An extension service, mechanisms of governmental protection and institutional network related to sustainable natural resource use not go further discussions. Thus, the incomplete agrarian policy and lack of institutional reforms has had impacted dramatically both on the viability of farming systems and soil degradation.

Policy-Institutional Environment

For the last 10 years in the external environment of the agricultural sector have had a place a number of dramatic changes which had their aims to reconstruct the whole farming system both at local and national levels. These changes related to privatization lands of existing agricultural enterprises, development of new types of farms, in particular private agricultural enterprises, establishment of an agricultural commodity market, and introduction of private property rights. A special hope was put on the transformation of land relationships, institution of an effective agricultural land market and introduction of the private ownership for land and other resources utilized in agricultural production. Unfortunately, this measures within the framework of inconsistent policy and lack of institutional reforms, caused deterioration of economic viability of large-scale farming systems. Economical indexes of these farming systems are permanently decreasing.

During argarian reform, some of CAEs of the region were formally restructured into closed/open joint-stock companies, public corporation, and some other types of enterprises with the collective form of ownership. In this situation, all former CAE members became shareholders by contributing their property shares to the Charter fund and the land and property collectively owned by CAEs passed to collective ownership by the enterprise. However as it happened to be evident later on, organizational and legal structure of "reformed enterprises" these were not much different from that of former CAEs. Having formally become collective agricultural enterprises of a new type, in reality they only "changed their label".

Actually many of them haven't even changed form of ownership or profit-sharing procedures, not to mention farming and management methods. Therefore, this approach to CAE restructuring did not result in the creation of viable agricultural business entities.

The issue of underdeveloped agricultural market infrastructure and other support services is still remaining on the government agenda. Up-to-date there are no enough agricultural exchange commodities and trade houses, where local producers could market thier outputs and obtain vital information about prices and agricultural commodity transaction at the domestic and international markets. Moreover, in the conditions of underdeveloped agricultural credit market, when (according to the current Ukrainian legislation) land cannot be used as collateral, banks are not eager to lend money to farms simply because of their low rate of repayment. The great risks involved still make banks more inclined to lend to traders and the processing sector, rather than directly to farms. When the government reduced supply of agricultural inputs to collective agricultural enterprises, commercial entities have no interest in financing and subsidizing the large-scale farms.

As to support for farming systems (technical, chemical, insurance, credits, social, consumer services), their demand and supply is declined because lack of money. Especially decreased share of *governmental* services. At the same time the sphere of *non-governmental* services is diversified towards transport services, rent and leasing of agricultural machinery, harvesting and supply of small-size technique for new farmers.

At the same time, national and local institutions still do not have a leading role in the development of regional agricultural commodity and input markets. Despite of the fact that there are lot institutions are involved in the development and carrying out agrarian and agri-environmental policies up to date there is no a clear national and local strategy of sustainable agricultural development. This fact along with conflict of interests of different structures makes difficult implementation of agri-environmental measures by local institutions and authorities. Besides, public participation in the development of policies and decision making is strongly restricted what, in turn, makes problematic to factor all stakeholders' interests.

As to future opportunities for the region's agriculture, it should be said that the region's natural favorable condition along with the present socioeconomic potential allow to produce a wide rage of competitive agricultural products, both for local consumption and for selling at the national market. Future strengthening of private farmers, developing agricultural market infrastructure and creating land market may play a crucial role in reversing the grave situation in local agricultural production.

Changes in farming systems during the 1990s

During 1992–2000 years practically all state farms (except special enterprises) in Southern Ukraine were transformed into collective farms, co-operatives, joint ownership enterprises, private-rent enterprises, private and individual farms (table 1). The agricultural lands in collective and private ownership increased to the end of 1999 up to 89% and practically all (99%) agricultural lands in collective farms were divided into land shares, more than 6 miliones peasants got individual land shares.

Table 1: Transformation of FSs in Southern Ukraine for last 10 years

Land users	1990			1999			1999/ 1990,%
	Number	Area (tsd ha)	%	Number	Area (tsd ha)	%	
State farms	1515	3379	24.8	1555	1434	11.0	42.4
Collective farms	2736	9673	71.2	3895	10343	79.3	106.9
Co-operatives	-	-	-	112	35	0.3	-
Private farms	-	-	-	13430	345	2.6	-
Household plots	892985	540	4.0	1878754	884	6.8	163.7

Source: State Statistics Committee of Ukraine: Statistical Yearbook for 1990-1999, Kiev, Ukraine

Table 2: Forms of land ownership in Southern Ukraine (1.01.1999)

Land users	Aveage size, ha	Form of ownership		
		Individual	Collective shared	Collective joint
Collective farms	3000	2%	6%	55% (+35% state)
Household plots	0.5	29% (+71% state)	-	-
Private farms	26	67%	30%	3%

- 52% - in lifetime possession, 17% in usership, 2% - leased.

Source: State Statistics Committee. Agricultural Sector of Ukraine 1998, Kiev, Ukraine, 1999.

Transformation of FS was facilitated by President's Degree "On immediate measures to accelerate reform of agricultural sector"#1529 dated December 3,1999. To May 2000 all state lands were transformed into either private or collective ownership.

Transformation is influenced destructively on the economic viability of farming systems. During 1990-1999 the profitability of large-scale farms has sharply decreased and credits debts have raised in eight times as much. The official debts of large-scale farms are sharply increased since 1995 and to the end of 1999 achieved 50-60% of gross agricultural output. The most part of debts is liabilities to commercial firms (50%), state debts (25%) and arrears of wages – 25%. The accumulation of debts over the years was in many cases due to reducing the responsibility of agricultural enterprises for servicing these debts.

The level of profits and debts vary from one group of CAE to another. Thus, the best 20 per cent of CAEs have an average 19-percent profitability level, but other 80% is extremely low compared with the average level of financially healthy farms – from minus 6 to minus 142 percents of profitability. In 1999 84% of the large collective farms finished the year with losses. Non-profitability of the large-scale farms the main issue of agriculture throughout the region, which in turn entails ineffective use of limited resources.

Transformation is influenced destructively on the technological potential of farming systems. At the moment all rural buildings, storage facilities and processing units, irrigation and drainage equipment are used up 60-70% and need renovation. According official statistics, in last 10 years input of agricultural machinery and techniques is sharply diminished, for example supply of tractors is reduced from 106000 (1990) to 3000 (1999). The same picture with purchasing of new ploughs, planters, harvesters, etc. Public services, electrical network, sewer systems, roads are obsolete and require essential modernization. As for working capital (surpluses, bankrolls, cash, expenditures), it was considerably decreased. Now farmers have a big shortage of financial resources, in particularly bankroll and cash that caused decreasing input. So purchasing of fuel was decreased twice, mineral fertilizers and pesticides in 12 times. The financial resources are insufficient for farming activity not to mention social needs and nature protection.

4.3 Typical farming systems

The three major types of farming systems can be distinguished: household plots (small size private farms), private family farm (medium size) and collective agricultural enterprise (CAE) (large size).

Household plots (small size private farms)

Individual household is traditional for Ukraine form of family farming. The usual size of household plot is about 0,5-0,7 hectares, but due to their high level of intensification and productivity they produce more than 66% of agricultural products. Increases in the number and area of household plots have occurred in 1995-1996 under pressure resulting from drastic reductions in real wages and their proportion to personal incomes of the population. All people occupied on private household plots are either unemployed or partially employed. Individual holdings have the characteristic feature of environmental friendly farming without investments or budget expenditures. The only investment is manual work. Since work by hand is prevalent in the private sector, individual holdings are less susceptible to price increases for fuel, lubricants, energy and inputs.

In individual household private sector is largely concentrated vegetable production. The household plots produce 67 percent of the gross output of vegetables with 25-30% profitability. On the contrary, the vegetable production in the large farms is non-profitable.

Private family farms (medium size)

Private farms became to appear since 1992 as the result of restructuring of state farms. The average size of private farms is 24-26 ha, the land is generally fragmented which makes difficult to implement sustainable crop management. Last year became obvious tendency to integration lands and enlargement average size up to 30-35 hectares. The prospects of private farms are defined by their capacity. First, the main labor incentive is personal interest, second, their organizational structure most widely corresponds to the rural life style; third, this given

form creates integrated living conditions, goals and incentives for all household members, and acts as a consolidating factor in agriculture.

About half of the rural population is oriented towards working at new reformed farms when making plans for themselves. It is significant that in their assessments for their children, under different alternatives from 25% to 40% of respondents would like their children to stay in the village, but to be either occupied with something else or employed by a reformed farm.

The problem of private farmers' sustainability connected with inadequate price-setting mechanism and price disparity between agricultural produce and inputs. Besides, most of the farmers are short of modern knowledge and experience and lack tools for combating erosion.

Large size farms

Large collective agricultural enterprise (CAE) remains the major form of farming system in the region. The average farm size is about 4-6 thousand hectares, number of employees is between 250 and 1000, the ownership is widely dispersed between land and property shares. The management structure of CAEs, as well as their property and labour relations, is based on the principle of membership. Each CAE member has been simultaneously an employee, owner (of land and property shares), and manager. That's probably a reason why the large-scale farms have specific problems of land management.

Farm employees work 7 hours/day in the CAE and 5 hours/day on the household plot. The number of working days for CAE is 290 per year with monthly cash salary is about 40-60 UAH (US$ 8-10). This earning is augmented with payments in kind, mainly grain, sugar, feed and oil, which consist of about 20% of annual salary. The rate of unemployment is about 25-30%, whereas 40% of women have full time employment in the farm and the remaining 60% have off-farm jobs (unskilled work or social services in the village).

Because of deep economic recession large farms continue to utilize obsolete soil cultivation technologies, which is very far from optimal and lead to land overexploitation (table 3).

Table 3: Soil cultivation technologies in the Southern Ukraine.

Parameters	Soil cultivating technologies	
	optimal	actual
Application of organic fertilisers, t/ha per year	10-12	<5
Application of mineral fertilisers, kg/ha per year	200 – 250	<50
Quantity of mechanical operations, machines passages per 1 ha of row crops area per year	5-7	20-25
Quality of soil cultivating operations execution, mark	10	3
Pressure applied to soil by mobile aggregates, kg/cm2	0.5-1.0	1.5-2.5

Source: Collection of Papers by Ukrainian members of European Society for Soil Conservation, 1997/3.

In CAE is concentrated only primary production. As usual, they sell grain or row materials because of absence of local processing facilities. Weak management caused non-rational land use. Non-observance of ecological norms and standards resulted in soil exhaustion, water and air contamination, and loss of biological and landscape.

5. PROBLEM HYPOTHESIS

Transformation of large-scale farming systems, land privatization and change of property rights, implemented under inefficient policy and institutional reforms, caused deterioration of economic viability of farming systems, reducing of inputs of mineral and organic matter and speed up processes of soil degradation.

6. DISCUSSION OF THE EXPLORATIVE PHASE

As result of agrarian reform all state farms in Southern Ukraine were transformed into collective farms, cooperatives and private enterprises, but actually 82% of arable lands remains belonging to large-scale agricultural enterprises. The ineffective changes in ownership, continuing of extensive farming and careless allocation of farmland have entailed further deterioration of environmental conditions in the region. Nowadays, Southern Ukraine, where this study took place, is a leader in farming expansion and provides an example of the problems that have arisen. An analysis of the land designated for farming shows that the fertility of these lands is 5-10 points less than normal. Thus, ineffective land use and deterioration of soils are observed for both large collective and private farms.

In the past decade the soil degradation in Southern Ukraine became catastrophic. The annual rate of soil dehumidification achieves 0.6 to 1.0 thousand hectares and now eroded land occupies 40% of the region area (table 4).

Table 4: Eroded agricultural land in the Southern Ukraine

Oblast	Agricultural land, tsd. ha	Eroded agricultural land, tsd. ha				Arable land, tsd. ha	Eroded arable land (tsd ha)			
		total	weak	moderate	severe		total	weak	moderate	severe
Donetsk	1917.3	1271.2	811.6	303.2	156.4	1592.8	1041,2	757.6	226.6	57.0
Zapo-	2160.5	769.8	370.2	232.4	167.2	1853.6	593.6	340.9	187.2	65.5
Nikolae	1934.8	903.0	565.8	266.9	70.3	1647.4	722.4	511.6	191.4	19.4
Odessa	2445.9	1255.8	775.2	367.2	113.4	1988.2	970.4	695.8	246.6	28.0
Kherson	1908.6	229.3	169.5	40.1	19.7	1712.2	191.4	152.9	29.5	9.0
TOTAL	10367.1	4429.1	2692.3	1209.8	527	8794.2	3519	2458.8	881.2	178.9

Here and below in the section we use the data of Ministry of Environmental Protection and Natural Resources, the National Report on the Environment in Ukraine, 1990, 1992, 1993, 1994-95, 1996, 1998

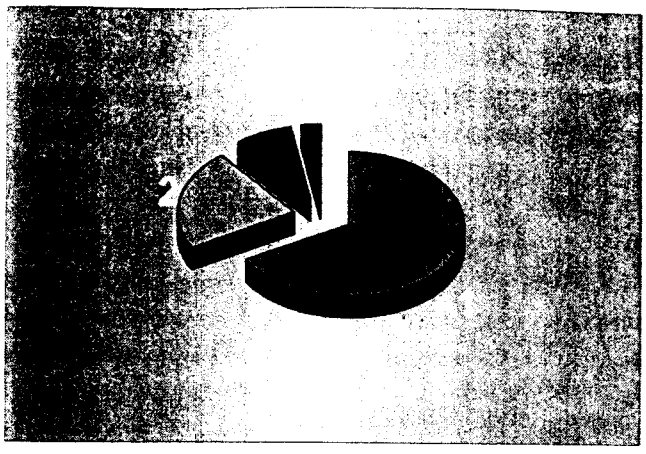
Figure 4: Map of eroded lands in the Southern Ukraine. Level of erosion: green – 9%, yellow – 26%, orange –43%, brown- 77%, red – 86%.

Source: National Report on the State of Environment in Ukraine, 1998.

The level of erosion in the Southern Ukraine is average: from 9 to 86% depending on landscape.

The agricultural lands in the Southern Ukraine include dry lands (75%) and irrigated lands (25%). Dried lands suffer of uncontrolled decreasing of ground water, while irrigated lands are periodically flooded and salinized. Annually up to 500 million tons of ground are washed out from the hillsides. The negative balance of nitrogen in 1999 achieves 40.1 %, (-32.7 kg/ha), phosphorus – 36.6 % (-11.6 kg/ha), potassium – 20.3 % (-43.9 kg/ha), and negative balance of humus is 370 kg/ha. Annual surplus of eroded land in Southern Ukraine comes to 80-90 thousand hectares. These lands include 4.4 millions weak, moderate and severe degraded lands, counting 68 thousand ha of those fully lost humus layer. It is a result of negative balance of organic matter and mineral nutrients, economic pressure and misbalance of agricultural land use. For the last 10 years only humus content decreased from 3.5 to 3.2 %.

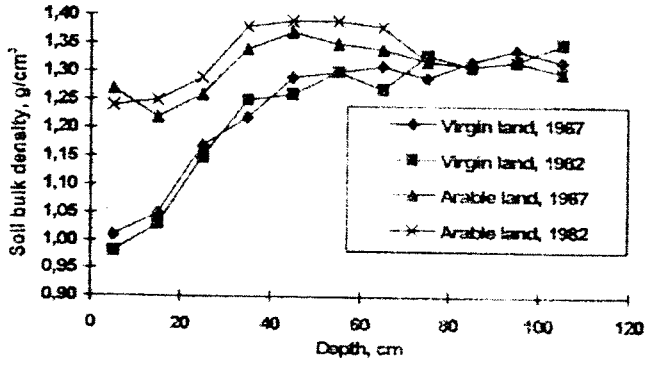
Figure 5: Soil degradation in the South of Ukraine
1 –lands of sufficient quality (61%); 2 - weak degraded (26%);
3- moderately degraded (9%); 4 - severely degraded (4%).



Source: The Ministry of Environmental Protection and Natural Resources, Kiev, 1998

The primary reason of soil degradation is a great amount of violations in soil cultivating technologies, they are: the pressure of agricultural vehicles and devices is 2 - 3 times greater than permissible one; extremely high amount of mechanical operations; prolonged time of cultivation. Application of obsolete technologies of crop cultivation, heavy machinery and intensive tillage causes soil over consolidation to 1.5-1.8 gr./sm^3 (1.1-1.3 gr./sm^3 in norm).

Fig.6: Bulk density of southern chernozem in the virgin and arable conditions (Ascania Nova, Kherson oblast).



Source: Collection of Papers by Ukrainian members of European Society for Soil Conservation, 1997/3

Difference in bulk density between arable and virgin lands is significant down to the depth of 0.5 m. Speaking about farming as major factor of soil degradation, in the table 5 given comparative values of virgin and arable chernozems, which have been tilled over a long period.

Table 5: Physical properties of southern chernozem in the virgin and arable lands

Land	Equilibri-um bulk density, g/cm3	Content of dry aggre-gates, %	Water resis-tant aggre-gates >0.25mm, %	Water permeabil-ity,mm/h	Humus content, %	pHK Cl	Soil loss due to ero-sion, t/ha/ year
Virgin	1.13	80	53	71	4.8	5	0
Arable	1.27	66	31	55	4.2	5	12.8

Source: Collection of Papers by Ukrainian members of European Society for Soil Conservation, 1997/3

Lack of enough quantity of organic fertilizers and significant mechanical pressure on soil causes its compacting, lost of structure, deterioration of water, air, and root penetrability. All these are so-called old, well known phenomena. Simultaneously, new kinds of degradation are developing considerably deteriorating restorative and productive ecological functions of top-soil:

- decreasing of root layer thickness due to gradual accumulation of deformation in subsurface layer;
- narrowing of available water range (due to increasing of soil bulk density);
- deterioration of technological parameters of arable layer due to lumps formation increasing (caused by shortening of time during which soil is in physical tilth condition);
- deterioration of arable layer water regime (due to decreasing of layer capacity, increasing of evaporation, and internal soil down-tending streams at the plow pan boundary);
- frequent dry periods and crusting due to greater contrast of wetting and drying regimes and loss of calcium from absorbing complex in arable lands.

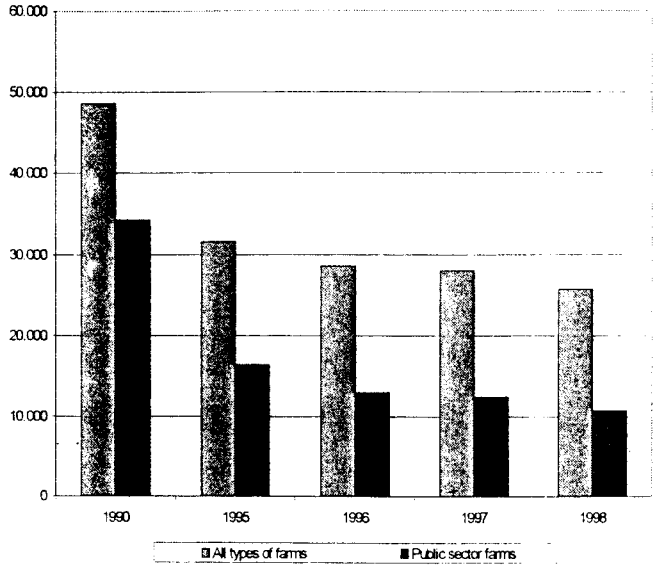
Physical degradation deteriorates water, air, and gas regimes, conditions for vital functions of different cenosis, renovation of organic matter, it decreases harvest, efficiency of fertilisers and irrigation water, soil resistance to destructive influence of water, wind, contaminants. This is why soil degradation should be taken into account in the system of soil conserving measures and generally in the concept of sustainable land use. In the Ukraine greater attention should be paid to the physical degradation because set of objective soil-climatic and management factors are operating here causing compacting development. Among them are: soils heavy texture, usually high moisture (near physical tilth) in subsurface layer of arable land in spring, significant values of soil bulk resistance limiting possibility to combine soil cultivating operations, fertilisers application, and seeding. On this general unfavourable background, in the country operates a great amount of heavy energy-consuming vehicles and devices, areas where minimum technologies of crop growing are used are insufficient, amounts of manure applied are diminished (factor favouring to increasing of soil resistance to degradation).

Presented above experimental data proved that soil degradation in the Southern Ukraine gains a great importance. In chemozems that have been tilled over a long period, humus content is significantly decreased, acidification and water permeability increased, and processes of organic matter accumulation are inhibited. Total economical damage from soil degradation is estimated at 4 billion USD.

Research of political, institutional and social causalities of soil degradation

Since Ukraine became independent, adjustment to the new political, social and economic environment has had its strongest effect on the large-scale farms. Output of large farms (fig.1) is falling, and their financial-economic condition is worsening, as well. That is, in 1998 agricultural enterprises lost 3406.5 million hr (23.9% losses). Losses of 2786.1 million hr (23%) are received in 1999. The number of loss-making enterprises is amounted 2.3 percent over 1997, increased to 88.3 percent of the total number of agricultural enterprises in 1999 year.

Figure 7: Gross agricultural output of farming systems in Southern Ukraine (brown – collective sector, blue – overall).



Source: State Statistics Committee of Ukraine. Agricultural Outlook 1990-1999. Kiev.

Decline of yield up to 30% was resulted from long time non-rational use of available physical, financial and natural resources, first of all arable lands. Non-rational farm organization, insufficient input of fertilizers and pesticides along with exhaustion of soil fertility caused nutrient depletion and soil degradation. Misbalance between arable land, natural pastures, and forested areas, inefficient tillage technologies led to loss of lumpy-granular structure, over-consolidation, deterioration of water permeability and aeration capacities, all with negative environmental implications.

Economical problems, absence of institutional reforms and effective state support lead to economical collapse of farms and caused essential reduction of soil conservation programs, i.e. land reclamation, melioration, liming, reforestation, and inputs of organic and mineral fertilizers (table 6).

Table 6: Dynamics of soil protected measures (1995-1999)

	Unit	Years					1999/1990
		1995	1996	1997	1998	1999	
Afforestation	tsd. ha	9.9	8.3	6.7	3.9	3.7	0.95
Shelter belts	-«-	1.3	1.0	0.8	0.34	0.34	1.0
Recultivation	tsd. ha	8.4	6,8	3.1	3.3	4.1	1.24
Antierosion pounds	ha	177.4	105.8	29	18	9	0.50
Use of organic fertilizers	Kg/ha	3000	2500	2000	1500	1000	0.66
Use of mineral fertilizers	-«-	30,5	21	22	21	15	0.71

Source: The Ministry of Environmental Protection and Natural Resources, Kiev, 1998

Relatively to 1990 year afforestation was decreased in three times, building of anti-erosion pounds – in seven times, input of fertilizers practically was stopped. It determined stable tendency to soil degradation and loosing soil fertility.

In the conditions of liberalization of socio economic relations, commercialization of agricultural production, market orientation of farms caused an increasing share of more profitable crop/vegetable production (cereals, vegetables and sugar beat) and reducing low profitable animal production. No matter how positive these changes could be from the economic point of view, from the environmental prospective they negatively contributed to the ecological situation in agriculture. The misbalance between animal and crop production dropped input of organic matter with following quick exhaustion of soil fertility.

Thus, the problem of soil degradation equally depends on both farming system organization (management plan, land-use according to landscape, farm specialization, technologies of crop production, internal technical problems such as insufficient harvest, post-harvest and processing facilities and general logistic problems, etc.) and changes in policy and related institutions.

How do the key actors think it could be solved?

The main actors involved in problem are farm administration, farm employees, private farmers, banks, suppliers (agri-service organizations), consumers, governmental institutions and ecologists. The priority in motivations is profit (except last two actors). Environmental goals and indicators are practically not considered yet in decision making. As for opinions of key actors, the actual outcome of transformation processes on soil degradation has next mode:

- Representatives of official bodies and some scientists – considerate that changing of property rights and privatization play key role in increasing of effectiveness production and sustainability of farming systems, including stopping of soil degradation.
- Representatives of agricultural managers – considerate that stopping of soil degradation requires renewal of central budgeting and state order on agricultural production.

- Representatives of some scientists and state agricultural managers – considerate that base of soil improvement is complete reforming of farming systems along with institutional reform and necessary regulation of farm incomes.
- Farmers estimate transformation processes positively (45%), negatively (20%) and by no means (35%). The main opinions are: willingness to be independent (46%), desire to start own business (33%), future for family (29%), desire to earn more (22%), to realize creative potential (5%), and 2% identify nature conservation as important for himself, because today's priority for farmer is profit.

There is a consensus among farm enterprise managers, agricultural and environmental specialists in the local administration, scientists and ecologists in general that the historical expansion of the agricultural and particularly arable land has gone too far, and that soil fertility is declining. There is also agreement that soil degradation presents a threat from agricultural production in the South of Ukraine.

7. DETERMINANTS OF CHANGE AND THEIR IMPACTS

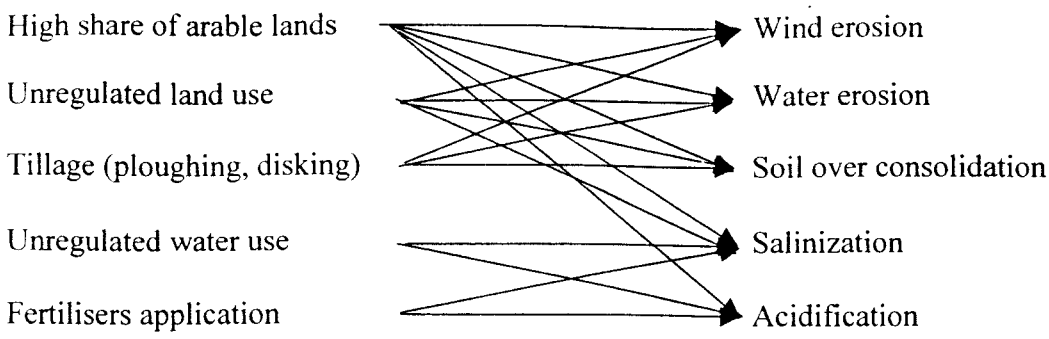
Explorative research allows classify determinants of soil degradation in two categories: farm-based factors and external factors, which are beyond of farm control. Determinants of soil degradation before transformation are classified in table 7.

Table 7: Determinants of soil degradation before transformation (before 90ies)

Internal (farm-based) causalities	External causalities
Economic	**Economic**
High yields at any price	Land was not a market commodity
Non-rational land use	Absence of soil monitoring, extension and advisory services
Obsolete techniques and technologies (deep tillage, soil over consolidation, irrigation, power-consumptive machines, etc.)	Absence of soil protection policy
Absence of manure storage facilities	Institutional factors (absence of legislation and enforcement mechanisms for promoting environmentally friendly, organic agriculture)
Social	**Social**
Farming traditions (extensive farming, intensive use of manual work)	Public form of land ownership
Lack of incentives and motivations	Lack of social services
Lack of agronomic and economic knowledge	Low level of agricultural education
Lack of personal responsibility	
Weak management skills	
Ecological	**Ecological**
Soil overexploitation	Environmental stresses (drought, flooding, and acid rains).
Non-observance of ecological norms and standards	
Soil exhaustion and erosion	
Water and air contamination	
Loss of biological and landscape diversity	

It can be seen that before transformation the major determinant of environmental problems is farming activity. Below lists 5 main categories of conventional farming practices and negative environmental implications of farming on soil degradation. Their causal links determine framework of future research.

Table 8: Determinants of soil degradation after transformation (1999-2000)



Land privatisation and changes in land use amplify the farm-based causalities of soil degradation in Southern Ukraine (table 8).

Internal (farm-based) causalities	External causalities
Economic	**Economic**
Farm losses, debts and financial obligations	Disruptive influence of land reform
Lack of cash, constrained access to commercial credits	Underdevelopment of agricultural markets
Low productivity	Land is not a market commodity
Non-rational land use	Price disparity
Misbalance of crop and livestock production	Tax pressure
Obsolete techniques and technologies (deep tillage, soil over consolidation, irrigation, power-consumptive machines, etc.)	Inflation
Insufficient inputs of mineral and organic matter	High risks of investments in agribusiness
Social	Barter relations
Poverty	Ineffectiveness of governmental support
Unemployment	Reduction of inputs (mineral and organic fertilizers)
Ageing of farm employees	Reduction of soil protection measures, drainage and melioration
Farming traditions (extensive farming, intensive use of manual work)	Absence of soil monitoring, extension and advisory services
Lack of incentives and motivations	Absence of soil protection policy
Lack of agronomic and economic knowledge	Institutional factors (absence of legislation and enforcement mechanisms for promoting environmentally friendly, organic agriculture)
Education and training	**Social**
Lack of personal responsibility	Public form of land ownership
Weak management skills	Ageing of rural population
Ecological	Lack of social services
Soil overexploitation	Inconsistent social policy and guaranties
Non-observance of ecological norms and standards	Low level of agricultural education
Soil exhaustion and erosion	Migration from countryside to town
Water and air contamination	**Ecological**
Loss of biological and landscape diversity	Environmental stresses (drought, flooding, and acid rains).

It is obvious, that number of both farm-based and external determinants of soil degradation after transformation is considerably increased. On the farm level they are: farm losses, debts and financial obligations, constrained access to commercial credit (first-order determinants), insufficient inputs of mineral and organic matter, misbalance of crop and livestock production, poverty and unemployment (second-order determinants). On the regional level they are: disruptive influence of land reform; underdevelopment of agricultural markets, particularly land market (first-order determinants); barter; price disparity; hidden inflation; high risks of investments in agribusiness; reduction of soil protection measures, drainage and melioration. In this case it seems that after transformation the key recommendations should be focused on policy and institutional level.

The negative environmental implications of observed changes resulted from inefficient strategy and absence of relevant institutions, agricultural markets and commodities, price disparity, high tax pressure, lack of an effective state support for agricultural producers. It turned out that traditional for Southern Ukraine large-scale farming systems were not able to transform due to the lack of:

- internal physical and financial resources,
- absence of economic effective and environmentally neutral technologies,
- relevant farming traditions and knowledge;
- qualified managers.

1. Today, the large-scale FS do not have enough funds and resources for carrying out intensive operations (using mineral fertilizers and pesticides), that under certain conditions may be the basis for the development of sustainable farming. Large areas of land and pastures owned by one large-scale farm provide a great opportunity for sustainable management. Less intensive land-use and animal husbandry imposed by the current economic recession in Ukraine gives chance for an earlier introduction of ecological methods of agricultural management in comparison to the countries in Western Europe that still maintain fairly intensive FS. Policies for agricultural production in Ukraine should therefore take account not only of increasing yields, but also to factor of environmental conditions of the production making it in that way ecologically sound.

2. Agricultural practices in Ukraine have their roots in the Soviet model of maximum production with little attention given to the wise management of natural resources and inputs. There are no traditions of ecological farming. It should be changed farming traditions from extensive, non-rational farm organization to a) new forms of farm management; b) modern economic-effective and environmentally friendly (neutral) technologies; c) new ecologically sustainable principles of land use. Only due to improvement of farm organization the economical indexes can be improved twice (Oginskiy 1999).

3. Absence of economic effective and environmentally neutral technologies seems to be one of the most important obstacles. Large-scale farms need complete modernization of technological park. Technological modernization of large scale farms is possible either through leasing and common use of agricultural machinery and equipment or due to better utilization of existing processing facilities, which would generate higher levels of financial resources for implementation of modern technologies of land-use. Another way of re-equipment is external investments.

4. To facilitate positive changes in regional FS and address the issue of farmers' incomplete knowledge in agri-environmental aspects of agricultural production, an effective extension and advisory services should also be developed. It can be implemented through farm-based training courses, retraining of managers as well as raising the level of one's skill in local agricultural colleges. Farming, and especially ecologically sustainable farming, requires a lot of professional knowledge and skills.

From this prospective, new forms of agricultural institutions have to be developed and put in place. It concerns, first of all, agricultural extension services, both public and private, which provide a real help to agricultural producers on a number of urgent issues: how to develop a business plan, how and where to market agricultural output, how to rationalize and make more efficient production process, and etc. This issue looks especially urgent given the diversification of agricultural production and the appearance of new economic agents with a low if any knowledge on efficient and environmentally friendly production.

8. FRAMEWORK FOR FUTURE RESEARCH

The explorative research demonstrated that case study is feasible. On the base of research of natural, ecological, economic and political determinants it was identified relevant causalities regarding the environmental impact of farming systems.

8.1 Analysis and measurement of environmental impact of farming systems

The main objective of future research is measurement and quantitative comparative analysis of environmental impact of different farming systems in Southern Ukraine. It means developing a set of indicators, serving as frame of reference for impact measurement, modelling and assessment of farming systems. For quantitative estimation a special questionnaire for different farming systems will be developed. It takes into account the bookkeeping documentation, farm economic indices, farm lands environmental quality as well as social issues.

In the next step, basic strategies as well as specified objectives on farm level of sustainable agricultural production for the Southern Ukraine have to be defined. A system of indicators that combine both environmental and economic sustainability of farming systems should be developed. The goal of research is finding of the farm type, most perspective from environmental, economic and social points of view.

8.2 Analysis of alternative sustainable farming systems and effects

On the base of comparative analysis of different farming systems the basic requirements for sustainable farming system will be determined. Alternative farming systems, evolving property rights regimes for nature components, will be proposed. It will be determined, what incentives would be necessary to change farmer's behaviour towards environmental friendly agricultural practices and policies, which led to SAD.

Effects of farmers' property rights restrictions on natural resources (WGA) and possible incentives, provided by policies (WGB) will be incorporated in model of alternative farming system.

8.3 Recommendations on farm-based measures promoting SAD

On the base of assessment of results of farm modeling, the final recommendations on farm based measures promoting SAD will be developed. Sustainability of farming systems in the Southern Ukraine may be achieved due to:

- improvement of economical indices;
- elimination of soil degradation;
- improvement an agri-environmental policy and relevant institutions.

The real alternatives will be achieved due to goal-oriented investments in farming systems, first of all through setting of new technologies. In this case it will be improved the set of indicators (both environmental and economic) for quantitative estimation of sustainability and working out model of sustainable farming system. It allows to give some recommendations to policy makers on the national level.

9. CONCLUSIONS

In the framework of insufficient agricultural policy and institutional reforms it is caused deep recession of farming systems – economic, social and environmental degradation. In these conditions attempts of FS to increase their economical indexes resulted in rather overexploitation of natural resources and accelerated soil degradation.

Stopping of soil degradation requires essential improvement of large FSs from economic, environmental and social points of view. It could be achieved only due to improvement of agricultural policy in whole, including financial and credit system, market regulations, developing agricultural land market and extension service. Land should become the market commodity with cost, depending on soil quality. In this case problem of soil degradation could be resolved by complete inventory of all land and soil resources with next conservation at least 5 mln ha of less productive and eroded arable land, increasing the area of fallow up to 3,5 mln ha, and reforestation.
On the farm level it requires optimization of land use of FS, implementation of modern equipment and technologies. As for cultivation technologies, it needs complete technological modernization and adaptation relatively to natural conditions of Southern Ukraine. It may be set of environmental good agricultural practices, for example nutrient management, integrated pest management, irrigation management, conservation tillage, soil-protected measures, planning of territory and even business planning. Transition from current to sustainable FS is possible by using good management practices (annex 4).

The government itself should be an agenda-setter in developing a set of such measures and policies. These measures would encourage the maintenance of integrity of the large farm and the introduction of sustainable farming methods. They might include tax incentives, free consultancies, training of certain specialists (members of the collective farm and their families), and tax credits for investment in the development of ecological production. It is necessary to involve farmers, sociologists, environmental NGO, etc. in policy making, establish feedback between FS and policy makers.

10. ANNEX

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10.3 List of the interviews conducted

Volodimir Demianchuk, Head of Inter-Ministrial Committee for Agrariam Reform.
Roman Shmidt, Ministry of Agrarian Policy, Deputy Head Minister.
Sergiy Demjanenko, Natonal Economic University, Department of Agrarian Management.
Volodimir Yurchishin, Institute of Agrarian Economy, Head of Department.
Valeriy Galushko, National Agrarian University, Director of Institute of Agrobusiness.
Lidija Romanova, Director of Center of Agrarian Reforms.
Lubov Moldovan, President of Center of Agrarian Reforms.
Ivan Tomich, Head of Farmers Association of Ukraine.
Vasiliy Dykun, private farmer.
Anatoliy Bykin, private farmer.
Valentina Belous, Director of private-rent agricultural enterprise.
Larisa Sergeeva, Researcher, Institute of Plant Physiology.

10.4 Annex 4

Transition from Current to Sustainable Farming Systems using Core Management Practices			
Environmentally–harmful agricultural practices (Current FS)	Threats to environment	Problems as perceived by the agriculturist	Environmentally-friendly Core Management agricultural practices (Sustainable FS)
1.Tillage Operations (plowing, disking)	Wind and water erosion	Loss of topsoil and plant nutrients to neighbouring land or water surfaces Salinization Eutrophication	No-till, mulch-till, ridge-till
1a. High share of arable lands	Landscape monotony	Extensive agriculture, low efficiency of using land resources	Conservation Buffers/ Medowing, pastures, shelter belts
2.Unregulated water use	Water erosion Leakage	Loss of arable land Salinization Eutrophication Waterlogging Elimination of organisms-aerobionts	Irrigation Management / Technologies of efficient water-use
3.Pesticides Application	Pesticide pollution, toxication of natural flora and fauna	Low pesticides efficiency Resistance development with pests and diseases Reduced amount of organisms beneficial to crop production	Weed and Pest Management (IPM) / Planting resistant crops, using beneficial insects, crop rotation. Appropriate storage of pesticides
4.Fertilizers Application	Chemical pollution, toxication of natural flora and fauna	Low chemicals efficiency Destruction of soil microbiota	Nutrient Management (NM) / Planning of rate, timing and application of mineral nutrients, organic matter recycling, manure bioconversion, legume crops, etc. Appropriate storage of chemicals & manure