Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 120 (2014) 318 – 325

Procedia Social and Behavioral Sciences

The 3rd International Geography Symposium - GEOMED2013

Economic crisis and its impact on land-use of lowland drained landscape in western Ukraine

Nina Lishchuk*

National University of Life and Environmental Sciences of Ukraine, Vasylkivska str., 17, 03040, Ukraine

Abstract

Internal and external economic conditions have significant impact upon agrarian policy, activities and production. In Ukraine they are also associated with rural employment, land-use changes, and natural resources protection. The aim of this paper is to identify economic and environmental impact of economic crisis in agrarian sphere at regional level, focused on ameliorative land-use changes and discover potential of Geographic Information Systems (GIS) in assessment of the phenomenon. The analysis was carried out during 1990-2011 in Volyn' region in Western Ukraine, region which borders on EU (Poland) and Belarus. The methodology focuses on multidisciplinary approach in order to measure consequences of changes in agricultural production, ecological conditions of lowland drained landscapes before economic crisis and in current situation using SWOT analysis of the system. We also identified strengths and weaknesses of different land-use scenarios to achieve optimal use of opportunities. Mechanisms, actions and innovations for development were analyzed in the article.

Keywords: Agriculture; drained landscape; economic crisis; environmental impact assessment; land-use.

1. Introduction

Recent world economic crisis affects all sectors of human activities. Agricultural sector has the same tendency. It has low resilience ability and need for innovation, offering new opportunities and encouraging environmentally friendly practices. Economic crisis may help detect sustainable land-use, management activities, social and

* Corresponding author. Tel.: +38-093-723-62-90.
E-mail address: ninelutsk@gmail.com

doi:10.1016/j.sbspro.2014.02.109

environmental capabilities. Agriculture and food sector plays a key role in ensuring food sufficiency, well-being of rural population, preserving natural resources by preventing environmental degradation.

Survival of rural inhabitants during economic crisis is usually possible because of intensive exploitation of agricultural land. On the other hand, agricultural companies usually reduce exploitation of lands during the crisis. According to study of 50 companies (Ernst & Young, 2008) 56% of them feel reduction of consumer expenses, 53% – delay of payments and 46% – inaccessibility of loans. Respondents mainly choose several ways of solving negative influence of crisis. 76% decide to decrease expenses for production, 28% –- to reduce number of managerial stuff, 27% – to conduct reorganization within company. Low resilience capacity of agricultural sector shows the need for innovations and sustainability enhancement, offering new opportunities and encouraging environmentally friendly practices.

The main aim of the paper is to identify economic and environmental impact of crisis in agrarian sphere at the regional level and propose mechanisms, innovations, and strategies in order to create new opportunities for region development. The assessment is focused on research of weak points and strong sides that can prevent agricultural lands from degradation and lead to revitalization. This is an undergoing study, currently we present its main section.

2. Characteristics of the study area

Volyn' region covers an area of 20.143 km^2 and has a population of 1.04 million, 48% of it is rural and distributed over 16 districts (Main Department of Statistics in Volyn region, 2012). It is complex region in terms of environmental and socio-economic aspects. Nowadays percentage of total arable area of amelioration territories is 58%, grasslands occupy 16% of the territory, hayfields – 18% and 6% correspond to forest cover. It is obvious that distribution of the abovementioned elements is poorly balanced. On the other side, requirements of agricultural production should be considered. In other words, there is a high demand for landscape structure optimization. Odum and Reimers propose maximum of ecological, social and economic effect as an optimization criteria. This effect is achieved when intensively used lands make 40% of total area.

Drainage in Volyn region is active anthropogenic factor which causes changes in basins of two biggest rivers: Prypiat and Western Bug. It also influences agricultural practices. These changes are complex and multifaceted processes. Under the certain conditions, these changes lead to occurrence of adverse effects and land degradation. Prevention of the abovementioned threats requires development and implementation of environmental measures (ecological, agricultural and technical).

Public authorities have been working on a regional protection program "Ecology – 2015 and forecast to 2020" (Volyn Regional Council, 2010), general policy and land-use plans at both regional and local levels to manage such complex environment.

3. Methods

The methods adopted to identify economic and environmental impact of economic crisis in agrarian sphere at regional level are based on multidisciplinary approach. They combine environmental concerns, spatial analysis and economic criteria.

SWOT-analysis (strengths, weaknesses, opportunities, threats) of ameliorative land was carried out. It identifies strengths and weaknesses of different land use scenarios (past and present) and helps to achieve optimal future use of opportunities and threats control. SWOT-analysis is a commonly used tool to study external and internal factors that affect a decision situation (Wheelen & Hunger, 1995). Strengths and weaknesses represent internal factors and are assessed by considering the state of environment. Opportunities and threats are external factors, e.g. opportunities are expected proper actions in the current state of environment, and threats refer to inappropriate or negative actions (Geneletti, Bagli, Napolitano & Pistocchi, 2007).

4. Results of lowland drained landscape indicator evaluation

In this section some indicators to characterize studied area are presented. The figures created for the selected indicators result from mean values obtained from regional statistic, than, these values are compared to past (1993 or

2005) and present conditions (2012). We took as a main crisis period an end of 2008-2009 according to the data of State Statistics Service. Then, these values are compared, resulting in zero (0), positive (+) or negative (-) evolution. Other indicators, apart from those presented in this paper, are also fundamental to analysis of lowland drained landscape stability. However, absence of records on some administrative structures makes certain measurement impossible. Simultaneously, it shows existing reality for SWOT analysis. In addition, Ukraine changed currency in 1996 that makes economic assessment of the periods before and after unreliable.

Condition of drained land reflects the cumulative effect of confounding factors. The analysis allows us to assess suitability of drained land for purposes of agricultural production and exploitation. Land-use structure of ameliorative territories has changed during crisis (Table 1) according to epy official data obtained from Volyn Regional Department of Water Resources. Ukraine was hit heavily by economic crisis during end of 2008-2009. Ukrainian economy shrank 15 percent in 2009 and recovered during the first quarter of 2010. (Ukraine agrees budget with IMF, funding seen from May, 2010)

Table 1. Indicators of lowland drained landscape

	Before crisis	During crisis	After crisis
Agricultural land, ha	+106.11	346 955.65	-0.23
Arable land, ha	-240.84	152 778.51	+23.63
Hayfields, ha	-1498.14	97 083.77	+908
Grassland, ha	+1629.87	96 562.32	-931.86
Land owners and users, no.	+1120	75 897	+715
Operating costs of inter-farm drainage assets, thou. UAH	-3593.2	18041.4	+1866.8
Drainage system overhaul, thou. UAH	+186	0	+1339.2
Drainage system maintenance, thou. UAH	-91.8	805.5	-38.8

Total area of drained agricultural land did not change significantly during the analyzed period. There were no ameliorative measures. But land-use structure was influenced by agricultural activities and economic situation. Land owners and users increased amount of hayfields by 1.5% before crisis and after recession period the rate dropped slightly. However, area of pastures was constantly decreasing. Probably people don't have need to feed cattle and domestic animals or use other, not drained, territories for this purpose. Soil is compacted under perennial herbs growing on the same fields, also there is reduction of aeration and biological activity in it. This is caused by accumulation of a large amount of grass roots and lack of soil cultivation.

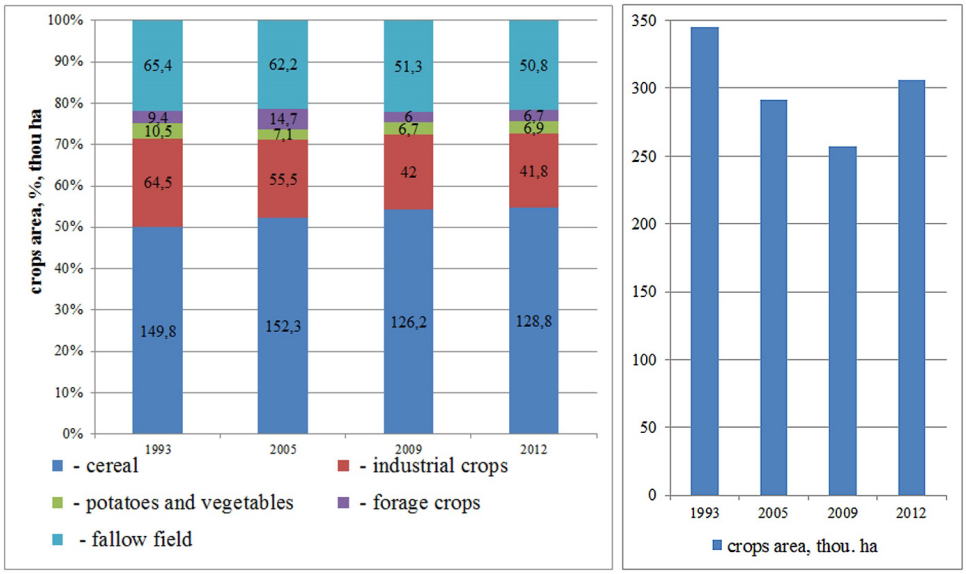
The area of arable lands did not change over the studied period. Instead, agricultural crop structure varies (fig. 1, a) and there are changes in total crops area (fig. 1, b).

When analyzing structure (fig. 1, a) of agricultural crops that are grown on the drained lands in Volyn' region, we can see that around 50% of them were cereals (winter rye, wheat, barley, oats). The second place took industrial crops (oil radish, winter rape, sugar beet). Its production decreased significantly during crisis and did not recover until now. The same tendency is noticed for potatoes and vegetables. Volyn region has never been main producer of those cultures. Usually, these crops are grown for self-consumption by local population. The fifth place took forage crops (maize, fodder beet, clover) – 3-4% of total production. Peat soils could function without use of nitrogen fertilizers with proper crop rotation. That is because mobile nitrogen compounds are formed by mineralization of organic peat matter. We can observe reduction of total area for crop production until 2009 (fig. 1, b). Agricultural sphere also started development after economy retrieval until 2012.

Ecological land-use sustainability of low land drained landscapes should be analyzed for general understanding of processes and its impact on environment. For this purpose effective land use is characterized by ecological stability index of the territory (K_c). It is commonly used index in Ukraine (Granovska, 2009) for defining the level of land-use intensity (fig. 2). It shows ability of landscape to maintain it basic.

$$K_C = \frac{\sum_1^n f.k_1}{\omega}.k_2 \qquad (1)$$

K_c – ecological stability index; f – area of land-use component in landscape; k_1 – comparative coefficient of ecological significance of component; k_2 – relief geomorphologic stability coefficient; ω – landscape area.



a b

Fig. 1. Distribution of crops used in agricultural production (a) – structure, (b) – available amount).

Ecological stability assessment is based on the following scale: K_c<0.33 – unstable; 0.34-0.5 – insufficient stability; 0.51-0.66 – moderate stability; >0.66 – stable. Coefficient k_1 depends on type and productivity of vegetation cover, physical and chemical, microbiologic land properties. It varies from 1.0 (forest), 0.79 (natural waters), 0.68 (grassland), 0.62 (hayfield), 0.43 (gardens, bush-wood), 0.38 (forest belt), to 0.14 (arable land). These numbers are general for the country and do not take into account soil and climatic conditions.

Economic and environmental conditions of Volyn' region influence land-use structure in a way of intensive land exploitation. Our calculations show that drained lands as ecosystem element is insufficiently stable, because average ecological stability index equals 0.35. It is determined by a number of factors: losses of biomass with harvest and water, deterioration of soil as biochemical barrier. It is very important from agricultural point of view that grasslands and hayfields have high ecological value. Sector of gardens and bushwoods is not visible on the diagram, but we have to show that those components are taken into account (fig. 2). Built-up land covers around 1 thousand hectares. They are mainly peateries that operate, or others exhaust pits and mines that are not exploited.

Landscape structure substantiation in melioration management demands preserving ecological stability and minimization of negative effect of agricultural activities on biodiversity. We can see that distribution of these elements is not balanced. Consequently, according to recommendations of Odum and Reimers the area for tillage should be reduces on 18%, this land should be changed according to natural conditions and economic value of biotic elements.

The up given recommendations about landscape structure normalization and keeping sustainable agrocoenosis should be taken as limitations for agricultural activities. Ecological stability index should be higher or equal 0.51-0.66. Land-use system should include not only landscape structure optimization, technical system optimization, technologies and technical means, but also ecological, economic, social and political factors.

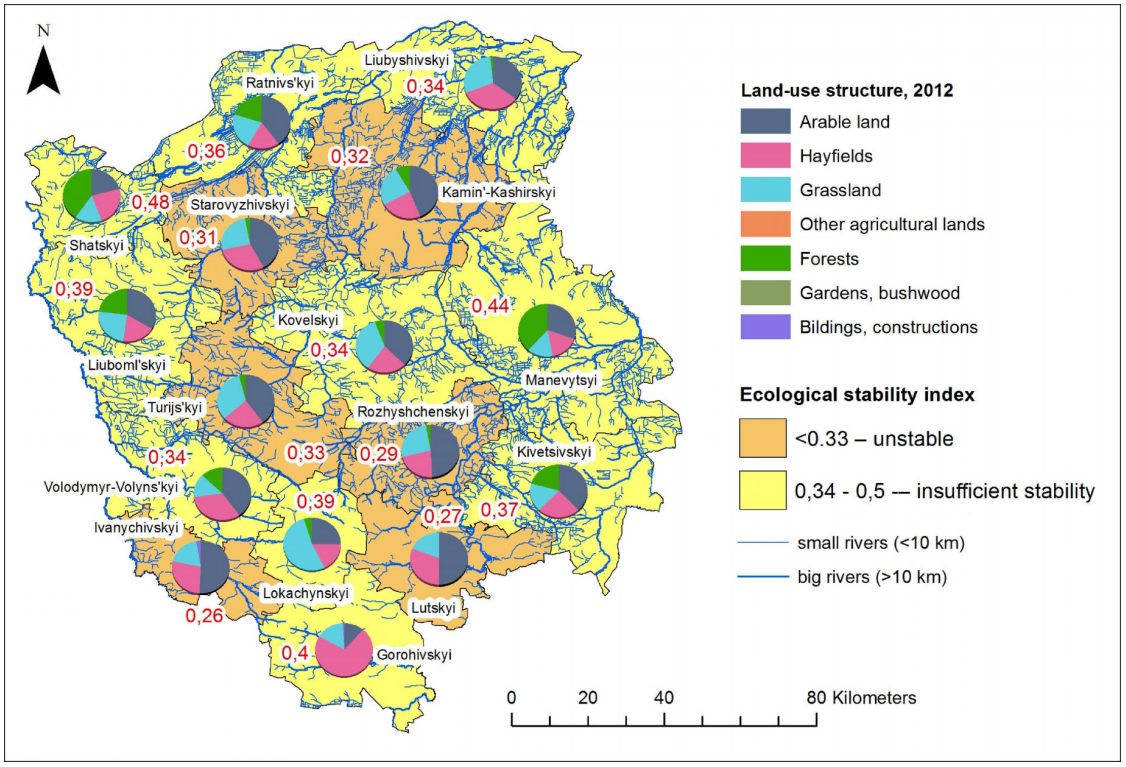


Fig. 2. Land-use structure of low-land drained landscapes and ecologic stability in Volyn' region in 2012

Economic indicators of low-land ameliorative landscapes were analyzed (fig. 3, a, b), mostly costs for exploitation of drain system, maintenance and repairing.

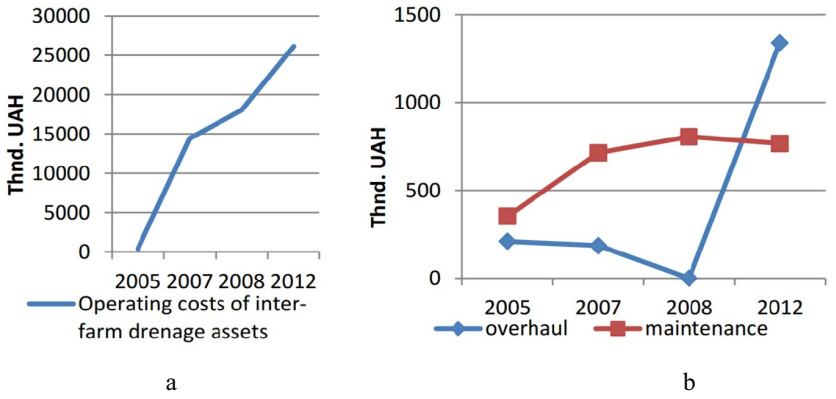


Fig. 3. Economic indicators of inter-farm drainage system support (a) – operating costs, (b) – repair.

Expenses for operating, building and overhaul of inter-farm drainage systems are usually financed from national budget. Those spendings were cut back during crisis. At the beginning of the economic crisis in 2008, there were no costs for overhaul. But maintenance work was done more intensively. The tendency has changed now, and we can

notice rapid growth of operating and overhaul expenses. Book value of fixed assets in service area has an increasing tendency from 1043 to 1204 thousand UAH.

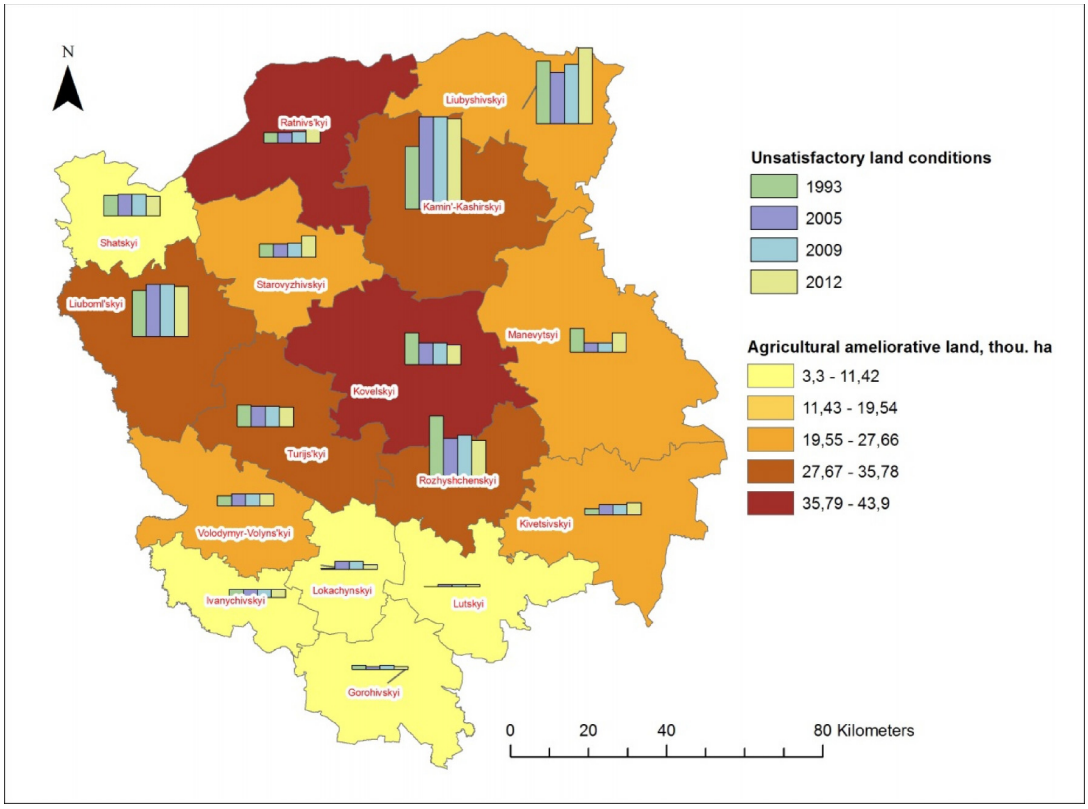


Fig. 4. Unsatisfactory ameliorative land conditions.

Distribution of drained lands according to reclamation conditions is not balanced. Only 19% of drained lands are in favorable conditions, 69% – have satisfactory land conditions and 12% (40,3 thou. ha) – unsatisfactory. The main factor that negatively influences land conditions on this territory is ground water level, which usually is very high and causes floods on agricultural lands, losses of harvest and property damage. An average ground water level is between 0.25-1.25 m below ground surface. Part of the territory has very small slopes and it does not dive possibility for fast water drainage. Most of these problems can be solved by reconstruction of drainage systems.

Comparing tendency of unsatisfactory land conditions on the drained lands (fig. 4), each district is unique in this respect. North of Volyn' region suffers from high water level, old drainage systems cannot cope with water flow. So, here we can see more lands with worse reclamation situation.

5. Results of SWOT analysis

This stage is aimed at securing framework for assessment of changes caused by economic crisis on land-use of lowland drained landscape in western Ukraine. Opportunities and threats (table 3) can be evaluated with reference to strength and weakness factors of the studied region (table 2).

This part of analysis shows possible ways of economic and ecologic improvement of low-land drained landscapes, problems which users might face and strong sides of land-use. All these elements should be specifically assessed in relation to previously set values, and associated criteria. The aim of SWOT analysis is to identify the key internal and external factors that are important for achieving sustainability of land-use on drained landscapes.

Table 2. Strengths and weaknesses of Volyn' land-use on lowland drained lands

Strengths		Weaknesses	
• Economic • High availability of agricultural lands • Big experience at farming, agricultural production on drained territories • Final production of land-owner, in some cases, main source of income for family • Minimal or no additional expenses for fertilizers with proper crop-rotation • 212 available drainage systems • Close to border location	• Environmental • Natural and seminatural low-land landscapes • Enough plant available water • Fertile organogenic and mineral soils • Reserves of alternative energy sources (peat), ability to grow energy-plants	• Economic • High initial investments for reconstruction • Poor maintenance of interfarm drainage systems • Season dependence of land-users (not fixed monthly income) • System financial support - dependence • Low profitability of the system • Not developed infrastructure of agricultural market	• Environmental • Low ecologic stability of landscapes (K_c) • Land degradation • Dependence on environmental conditions (floods) • Harvest damage because of lack of machinery • Not environmentally friendly behavior of land-users

Table 3. Opportunities and threats of Volyn land-use on lowland drained lands

Opportunities		Threats	
Economic	Environmental	Economic	Environmental
• Animal farms development because of high availability of pastures • Marketing opportunities because of transborder location • Opportunities for green tourism • Lack of alternatives for rural inhabitants for agricultural activity • Collection of food for households	• Rational agricultural and livestock planning (better adaptation of activities, use of land and livestock – to soil and climate skills) • Green farming • "Healthy" way of life • Conservation of biodiversity, ecosystems and landscape	• Long term loan system inaccessibility and financial assistance • Ineffective innovation and investment policy in agriculture • Physical and moral decrepit of production capacity • Unstable demand for local agroproducts (high competition with imported goods) • Weak role of NGO and associations of producers • Inability to certify products • Difficult access to distribution channels	• Problems relating to the commons management • Fragmentation of landscape • Lack of monitoring of measures applied to conservation and protection zones • Poor life conditions of farmers

6. Conclusion and future needs

Sustainability improvement of land-use drained landscapes can be based on aspects of SWOT-analysis and analysis of indicators. It may help to overcome consequences of economic crisis in Ukraine.

40.3 thousand hectares of drained lands require improvement of reclamation condition, drainage system reconstruction according to the data of State Water Management Committee that was analyzed in the paper. These actions are time and cost consuming. Conditions of reclaimed lands would become better if every land-user would be responsible for his part of the land; and state water and land management organizations would provide reconstruction of engineering infrastructure. It would be possible for land-users to take opportunities that these lands could provide.

The main solutions are as following:

- formation of highly efficient land-use system with different forms of ownership on reclaimed land and reclamation engineering of infrastructure systems;
- implementation of new resource-protective and alternative technologies of agriculture reclamation;
- development of agricultural market and land market in Ukraine, protection of national producers;
- formation of environmentally sustainable agricultural landscapes and soil fertility improvement on drained territories.

However, we cannot fail to mention that in order to achieve sustainability of drained landscapes and land-use on them, certain measures concerning organization of activities and their relationship with unions of producers will have to be started up, for an effective technical support, adequate flow of products and availability of inputs at a good price.

References

Ernst & Young (2008). 80% of Ukrainian companies feel influence of economic crisis Access: www.epravda.com.ua/publications/2008/11/6/168338/ (in Ukrainian)

Geneletti, D.; Bagli, S.; Napolitano, P.; Pistocchi, A. (2007). Spatial decision support for strategic environmental assessment of land use plans. A case study in southern Italy. *Environmental Impact Assessment Review*, 408-423

Granovska, L. (2009). Ecologicaly balanced use of nature at the conditions of polyfunctional territories, Kherson, HSU, 239-256 (in Ukrainian)

Main Department of Statistics in Volyn region. Population of 1.01.2012. Access: http://www.lutsk.ukrstat.gov.ua/18_1_r11.htm (in Ukrainian)

Marta-Costa, A.; Costa , H (2010). The economic crisis and agrarian sustainability: weakness and potentialities. France: *Innovation and sustainable development in Agriculture and food*, 1-11

Ukraine agrees budget with IMF, funding seen from May (2010) by *Reuters*. Access: www.kyivpost.com/content/business/ukraine-agrees-budget-with-imf-funding-seen-from-m-63058.html

Volyn Regional Council (2010). About regional ecological program “Ecology – 2015 and forcast until 2020”. Access: http://volynrada.gov.ua/session/2/42 (in Ukrainian)

Wheelen, T.L.; Hunger, J.D. (1995). Strategic Management and Business Policy. fifth ed. Reading, MA: Addison-Wesley.