Studia Universitatis "Vasile Goldiş", Seria Ştiinţele Vieţii
Vol. 20, issue 2, 2010, pp. 55-59

CONDITIONS THAT LAND RECLAMATION MUST ENSURE SUSTAINABLE AGRICULTURE

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ABSTRACT. In order to protect the natural resources used, it is necessary that vegetable production has such a concept that its influence with the optimization minimizes the required yield. For this purpose it is necessary to adjust the measures taken for the purpose of regulation of water-air regime, especially in the area where land reclamation applied. This difficult task represents a harmony of attitudes and approaches that are often contradictory; therefore it is necessary to make preparations for the changes in the existing principles of the existing land reclamation practices. These changes reflect primarily in the rational use of resources that could result in the protection and improvement of biodiversity and therefore stable ecosystem in the agricultural area.

Keywords: Land reclamation, sustainable land reclamation, sustainable agriculture, biotechnical measures

INTRODUCTION

Adjusting space to the needs of plant production and life of people in Vojvodina, is the activity that has been happening ever since it started being populated. This process has contributed to significant changes in nature. At the same time, in some parts agricultural production is still taking place at the border or below the limit of profitability. This applies, primarily, to the lowest geomorphological units - alluvial plains where the cost of agriculture is not able to track possible and required intensity of the applied measures. The need to reorganize the current agricultural production and increase its quality requires that other activities also be adjusted. This also includes the decrease of bad impact on the environment. When it comes to plain of Vojvodina, it primarily refers to the land reclamation. This measure, which has the biggest impact on the environment, which has drastically changed the water-air regime of soil, should be given due attention in the future, which will enable easier, more efficient and simpler transition from conventional agricultural production to sustainable. From a wide range of activities that land reclamation include, this paper makes an attempt to reflect only the possibility of applying vegetation to increase the efficiency of drainage and protection of water quality in channel network.

POSSIBLE ALTERNATIONS IN LAND RECLAMATION

The questions that in the UK listed as crucial Sutherland et all (2006) and that should enable greater synergy between policy, practice and research, and inform researchers and by their financiers on how to direct their efforts and work and land reclamation in the best possible way, are:

• How will the CAP (Common Agricultural Policy) reform affect biodiversity at the landscape scale?

• How do farming systems such as conventional, integrated farm and organic compare in terms of their effects on biodiversity and other environmental impacts?

• How do current agricultural practices affect the conservation value and extent of non-agricultural habitats such as woodland edges, hedgerows and ponds, and how can detrimental impacts be mitigated?

• What are the impacts of agricultural activities and practices (e.g. fertilizers, pesticides, physical disturbance) on soil biodiversity and soil functions?

• What lessons can be learnt from agri-environment schemes to optimize their biodiversity gain and ecological benefits?

• What is the environmental aspect, the similarity of Agriculture analyzed areas with agriculture in the region and the world?

• What are the benefits of the natural environment by planting of forest areas?

• Where should accommodate the new forest area?

• What is the total number, age structure and spatial distribution of trees is necessary to ensure long-term survival of species?

• What are the benefits of biodiversity after planting?

• What impact does plastic-derived litter have on the water environment?

• What are the critical limits of input of nitrogen and phosphorus in the recipient?

• What are the chemicals, those that are currently released or that will potentially be discharged into the natural environment, which will likely represent significant problems in the natural environment and that this will be the problems?

• What are the long-term effects of organic waste in agro-environmental systems?

• How can catchment management be used to reduce diffuse pollution?

• What will be the ecological impacts of changing agricultural patterns in response to climate change?

• What scale and type of land use change is required to halt the decline of biodiversity in the future?

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Article received: March 2010; published: May 2010

• How should ditches, dry and wet, be managed for the greatest benefit for biodiversity?

• What hedgerow structure and what type of hedge management produce the greatest wide life benefits?

• How do recreated habitats differ from their semi-natural analogues?

• How can we effectively prioritize the most important large-scale ecological restoration projects that could be undertaken in the analyzed area?

• What is the most appropriate and ecologically sustainable way to dealing with excess nutrients during terrestrial and freshwater habitats?

• What is the value of the linear habitats, such as hedgerows, railways, road and riparian strips, as corridors for dispersal between fragmented habitat patches?

• What have been the consequences of past and present riparian engineering works, such as weirs, culverts, graver removal, habitat fragmentation and damming, on biodiversity within and alongside rivers?

• What are the likely consequences for biodiversity of changes in water quality and sedimentation in rivers?

• What methods most accurately measure 'ecological status' of the EU Water Framework Directive?

• How can flood control be assisted by appropriate habitat management and restoration, and what are impacts on biodiversity?

These issues arose as an attempt of well-known scientists and experts from various fields to define the 100 most important environmental issues in order to facilitate their solution. Of all the questions, only the once that refer to the land where chosen, with emphasis on the possible introduction of biological measures in the land reclamation. Introducing this type of land reclamation has the multiple role that can be reduced to rational land use, increase of biodiversity as an indicators of ecosystem stability, energy saving for the correction of water-air regime of soil and the increase of the area covered with trees. It would certainly a be useful for this group to also add questions that refer to the water surrounding agricultural area or the water that is used on it, but that can be considered some other group of activity in the process of transition from land reclamation to some other sustainable form. In addition, the above mentioned approach can be compared with so far insufficiently used and well-known approach (Piperski, Belic, 2002) where the environmental problems directly involve social science and the wider social community.

Contrary to the formed ecological issues that present possible problems and directions for future development Falkenmark (2009) with another aspect highlights the present problems. This same author points out: "Over the next few decades, the agricultural production is expected to produce enough food for a growing population. Since it is estimated that the need for food will be doubled by 2050, there is concern about the use of water. The growth of population, income, changes on the market and interest in human demands for food will mean that more water be needed for food production. Any increase in water use in agriculture will affect the correction of water use for other purposes - including the need to preserve the health of ecosystems and biodiversity and to reduce changes in their ruining. Lack of possibility to return to the initial state leads to the creation of sensitive systems and possible changes in the ecosystem and leads to unwanted conditions and less system stability. So, in the future, agriculture will have to find a balance between the demands for water production of food and water required to preserve the health of ecosystems. Below, Falkenmark (2009) highlights the following recommendations for the education development strategy:

• The strategy should ensure that ecosystems are healthy enough to fight with the changes without a loss by their functions,

• The strategy should be to balance socio-economic activities with measures to protect ecosystems,

• Strategy-makers should protect biodiversity and ensure that ecosystem change without struggling with the sudden degradation. Alternative possibilities of profit in arid areas and in areas susceptible to flooding should water the improvement of the recovery environment,

• The strategy should assist water users to work together to increase efficiency,

• It should be make more effort to maintain the ecosystem at the level of the basin and identify links between them,

• The strategy should ensure that excess water is evacuated in order to improve the ecosystem and maintain "healthy"

• It is necessary to provide care to certain institutions in the project, the ecosystem and the use of water resources, equally involved,

• Landowners should be involved in the use of ecosystems and water resources and be trained in order to improve knowledge of the system,

• Try of monitoring should help communities and people who decide how to respond to changes that may affect ecosystems and the environment that depends on them,

• Since the complex ecosystem changes that can happen is difficult to predict. Therefore, the competent institutions that manage the area should plan variations to better use these systems.

• Approximation of use, which has drawn the public and which is based on "learning activities", can be a good way to face the changes,

• Efforts need to use to upgrade the experience and knowledge at all levels, for example. landowners constantly monitors the state of their environment and are often in the best position to notice errors in the ecosystem and about him,

A similar approach has and Rodriguez (2009), which makes the following recommendations:

• Change the way we think about water and agriculture (agriculture is a multifunctional ecosystem and to protect the natural resources on which it is based and from which it depends).

• Reduce poverty by promoting access to agricultural water and its use of (investment in facilities for water protection and distribution network while increasing the value of water)

• Manage agriculture to improve the ecosystem

• Increase productivity of water (to achieve higher yield and value of using small amounts of water, limiting environmental degradation and facilitate the use of water)

• Improving the system of dry farming

• Adjusting the current situation with the needs of the future (Modernization, the combination of technological and management processes, improves the reliability that is required of land owners and ensure productive and sustainable irrigation)

• Reform the reform process - the impact of state institutions (the major policy changes required for investment in the use of water)

• Dealing with changes in quality and making tough decisions

These approaches from recent world literature point to the conclusion that the focus of future activities put on the protection of the resources used by applying biotechnical measures in land reclamation and agriculture, better management of production and arrangement of space and distinct social approach. This complex of measures requires a team of experts appropriate education that will specifically go and apply. Set of measures could be divided on some important activities (Belic, Rajkovic, 2010).

• Regulation of agricultural space taking into account the elements of environmental protection,

• Selection method - irrigation technique in which the rational use less water,

• Use of water for irrigation, appropriate usability which should guarantee obtaining the expected yield rational level, required quality and reduce adverse impacts on land and used equipment,

• Format of canal network in accordance with the requirements of the natural regulation of rivers resulting in a significant increase biodiversity, improve water quality and reduce sediment transport in the channel,

• Application biotechnical measures in drainage,

• "Natural" regime of working some parts of drainage system which will require lower power consumption and in most cases to raise the productivity of land use,

• Application of wet fields - biological methods of waste water treatment and purification using the processed products in the form of organic fertilizers in agricultural production.

Presented something more concrete view of land reclamation measures and activities would represent a milestone for the development of practically applicable land reclamation actions that should provide the conditions for conducting some of the contemporary forms agricultural production.

BUFFER STRIPS AND WATER QUALITY CHANNEL

According to data from statistical yearbooks cannot reliably determine the amount of nutrients expended in the production plant. However, some data indicate a significant reduction in the amount of nutrients in the last twenty years when he registered the reduction of their use for several times. For example, the municipality of Zrenjanin and Novi Bečej amount of nutrients in the period 1978-2002 years oscillatory range 55-303kg/ha (Leleš, 2007a). These amounts can be taken as the basis for calculation of feed used in the plain part of Vojvodina. Are you aware that the catchment areas for drainage channels 1.800.000ha a channel length of about 19.000km, simply comes to data that the catchment area of about 95ha kilometer channel. This indicates that on the catchment area of channel, length of 1km application 5225-28.785kg nutrients.

It is known that vegetable production as the dominant water surface pollutants in the agricultural area. When it is clear that should be included and spent nutrient. Quantification of the intensity of pollution is a complex process as reliable and can be considered the world's widely used methods Kolenbrandera (Vajagić and Belic, 1989) and methods of Loss coefficients, SFT Report 1795/2000.

Depending on soil, climate and agricultural engineering change the quantity of unused nutrients from which a part is coming up channels for drainage. Some earlier research (Vajagić and Belic, 1989) indicate a very diverse amount of nitrogen that is rinsed with agricultural površina within 25-150kg/ha/year (amount of nutrients is used when this was 561-582kg/ha. Therefore, 4 - 26% of nutrients and the surface is rinsed and subsurface flow moves to the water. Leleš (2007) for the area of the Middle Banat finds that about 33% or 35kg/ha/year used nutrients reach the canal network. If this data link with the catchment area of unit shares channel, obtained information that the channel reaches an average 3.325kg/god nutrients. For once applied amounts of mineral nutrients (Vajagić and Belic, 1989) these amounts are much higher and ranges 2.345-14.250kg/year. It is clear that arithmetical values obtained indicate that these are huge amounts of nutrients that can directly affect the creation of highly favorable conditions for intensive growth and development of vegetation in the channel and significantly interfere with its functions, make it difficult to use and increase the volume of work on its maintenance.

It is necessary to emphasize that these are the total annual-seasonal quantities of nutrients that can run into the channel. Dynamics of nutrients in the inflow channel is spread to the entire period, and the burden of water in the channel difficult to define (Belic, Belic,

Rajkovic, 2007). Important role in the correction of inflow of pollution in the drainage network of drainage systems has buffer strips of various forms (Rajkovic, Belic, 2008). As previously shown, buffer strips has multiple significant role in environmental protection reducing the inflow of nutrients and protective resources in the channel, forming a line structure that may be desired in order to increase habitat biodiversity and protect the channel from adverse impact of eol and water erosion.

POSSIBLE APPROACH TOWARDS EFFICIENT DRAINAGE

Application bio-drainage is favorable biotechnical measures, especially in conditions, usually at lower geomorphologic units or difficult soils such as some hydromorphic soil, where agricultural production is on the verge of profitability, or below it. Therefore, it is acceptable to think about the introduction of biological drainage (Heuperman et al., 2002), using appropriate plants (Letić, 2002), which eliminate problems such as occurrence water on the surface of soil that in certain areas practically prevent execution of agricultural operations. Biological drainage of soli with water on the surface, in some way returns to the situation before using land reclamation (Sloots & Vlies, 2006). In addition, in this way will be reduce the load of drainage facilities, mainly pumping stations. The main disadvantage of this arrangement of land is the length of the production cycle. In this way, it could be treat the land planned to increase the area under the forests around the area of Vojvodina. Planting trees on less productive land or lower geomorphological units, would be in order to reduce the capacity needed for pumping stations, to increase the efficiency of drainage systems for drainage where these measures were applied, and increase income per unit for this measure used surface.

Application of biotechnical measures could be carried out according to two criteria. The criteria for application of biotechnical measures meant to combine the buffer strips and bio-drainage based on lower geomorphological units, while other criteria included combinations of buffer strips and bio-drainage based pedologic and geomorphological units. The surfaces on which to apply biotechnical measures would be also in function of optimal covered with trees of 14.3%. The data were taken from the Water Management the basis of Vojvodina (Stojšić et all. 1987) and are processed by the look in parts of Vojvodina it shows that in Backa has about 600.000ha suitable for the application of the criteria bio-drainage geomorphological units and suitable for 100.000ha bio-drainage application of the criteria pedologic units. In Banat has about 700.000ha suitable for the application of the criteria bio-drainage geomorphological units and about 400.000ha suitable for use by bio-drainage criteria pedologic units, and in Srem has about 200.000ha suitable for the application of the criteria bio-drainage geomorphological units and about 60.000ha suitable for the application of the criteria bio-drainage pedologic units. Spatial Plan found that the optimum is 14.3% covered with trees, but in the work was adopted 14%. Areas that could be used to implement biotechnical measures are shown in Table 1.

Table 1

Accommodatingly areas for usig biotachnical measures represented by part of Vojvodina

Delovi AP Vojvodine	Površine do 14% za pošumljavanje po kriterijumu geomorfoloških jedinica (ha)	Površine do 14% za pošumljavanje po kriterijumu pedoloških jedinica (ha)	Površina uz kanale predviđena za zaštitne pojaseve (ha)
Bačka	85625	16706	24439
Banat	94033	51939	32407
Srem	32736	8048	23447
Ukupno	212394	76693	80293

Such data could show that might make better use bio-drainage by geomorphological units as would be achieved before the optimal covered with trees, but it would not be proper interpretation. There are many factors that affect that in certain locations cannot be based bio-drainage planted or established buffer strips. For these reasons, it offers two criteria by which could be applied biotechnical measures. The biggest area of application bio-drainage is in Backa and amounts to 43%. This is important to emphasize that this fact only a consequence of the current state covered with trees, which is concentrated along rivers, on Fruska Gora and Vrsac hill. The data relating to the surface for application biodrainage by both criteria for afforestation should point to a relatively regular schedule covered with trees in Vojvodina after the application of biotechnical measures (Belić, Rajković, 2008).

CONCLUSIONS

Agricultural development is increasingly moving towards a sustainable approach. In the plain part of Vojvodina, where land reclamation has a key role in creating conditions for agricultural production, this measure has an enormous impact in creating conditions that will enable the transition to sustainable agriculture.

Transformation land reclamation process is a difficult and complex. There is no doubt that it is necessary to work primarily through education at all levels. When it comes to sustainable land reclamation in this paper offers some directions for action by applying biotech measures in the drainage, protection of water quality and protect the channel from the effects of erosion phenomena. All this follows a higher level of protection resources used in agriculture and increase biodiversity as indicators of more quality and more resistant ecosystems.

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