

UNIVERSITY OF DEBRECEN
Centre of Agricultural Sciences

**THE EFFECT OF EXCESS WATERS ON THE DEVELOPMENT
OF THE GREAT PLAIN REGIONS**

Theses of Dissertation (PhD)

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1. SCIENTIFIC PRECEDENTS, THE AIM OF RESEARCH

Research work concerning excess waters actually began in the 1860's when analyses of the faults of the regulatory works on the river Tisza between 1846-79 first appeared. The final solution was offered by the XXXIX. Act of 1871, which served as a scientific foundation regarding the drainage of excess waters.

Most experts insist that the frequent occurrence of excess waters is the consequence of the regulation of the Tisza. Initially the flood-protected areas were pastures and meadows, where excess waters did not make serious damage. However, as soon as flood protection security increased and these areas were made into agricultural lands, communities and villages were founded, railroads and roads were built, protection against excess water damage was started too. Excess water damage reoccurred through the years, so the construction of a drainage system, sluices and later pumping stations.

The Trianon Peace Treaties had an effect on water management research in Hungary too. The previous initiations stopped, due partly to the changed geographical circumstances and partly to the economic conditions. The tasks had to be reconsidered and it was also necessary to take into account water management problems the solution of which was to be found outside the borders of the country. (The majority of these problems are still unsolved today!)

The development of the regulation of excess waters was not a popular issue in the 1930's with its really dry years ('engineers have drained the Great Plain'), till a wetter weather period came.

In the history of water management the years 1940-1941-1942 are regarded as having the most excess water problems in the past hundred years. In the half a century excess water flooding exceeded 300,000 hectares only in three occasions (1966, 1999, 2000).

The tragedy of the latest excess-water period was that the areas most suffering from the damage were the poorest parts of the country with the weakest financial background, where in many cases agriculture is the single source of income.

These problems directed the attention of not only experts but of the government and the public to the urging necessity of decreasing the damage caused by flood and excess water.

Reasons for the project

The chosen topic has relevance because of two reasons. **The first: the government of the country make significant efforts to develop the geographical and agricultural regions most affected by flood and excess waters.** The previous programmes were mostly of a 'drainage' nature and the tasks of agrarian, rural or regional development tasks were taken into account only to a lesser degree. Regional development cannot be separated from rural and agrarian development, and more effective development and improvement have to be found in their harmony.

This new way of thinking and the flood and excess water situation of the past few years and its extreme figures in the past century make it necessary to re-think the excess water problem in

Hungary in a way that we again take into account the conditions in the whole territory of the Carpathian basin and our possibilities and that we handle the whole excess water management within a complex framework to satisfy the requirements of environment protection, regional and rural development.

The other factor what makes the topic an up-to-date one is the fact that we are about to join the European Union. This influences the realization of our ideas to a great extent in technical and in financial questions as well.

It is a well-known fact that among the EU requirements there is the decrease of the 10% decrease of the agricultural lands of the country. This size is approximately equivalent to the agricultural lands constantly threatened by damage caused by excess waters. Since the process of the decreased is financially supported by the EU, we have to consider the utilization of these areas (e.g. afforestation, which is also subsidized by the EU).

The aim of the research activity is

- a) to find out the reasons for the appearance of excess waters,
- b) to examine the effect of excess waters on
 - agricultural production
 - environment
 - rural development

based on the results of previous research activity and with the processing of the figures of my own research.

The main aim is to outline planning, organizational and cooperational methods which in the long run result in the decrease of the damage caused by excess water and in a situation which makes it possible to live together with excess water.

2. MATERIALS AND METHODS

In my thesis I will investigate the reasons for the appearance of excess waters, the possibilities to decrease the damage based on the following points of view: hydrological, hydro-meteorological, water management-technical, environmental, settlement-drainage, economic, social, national health, co-ordinational and co-operational, to sum up: **from an area-management point of view.**

The collection of the analysed data was based on the studies, publications, different registries available in the area proper and on the results of my own research (data on climate and soil, information concerning agro-technology and irrigation).

The compilation - for the sake of the possible solutions - does not focus its examinations, conclusions, suggestions on a narrow field but handles the question of excess water in a wider sense. It takes the different interests and efforts into account, such as local governments, water management, environmental, agricultural, tourist industry etc.

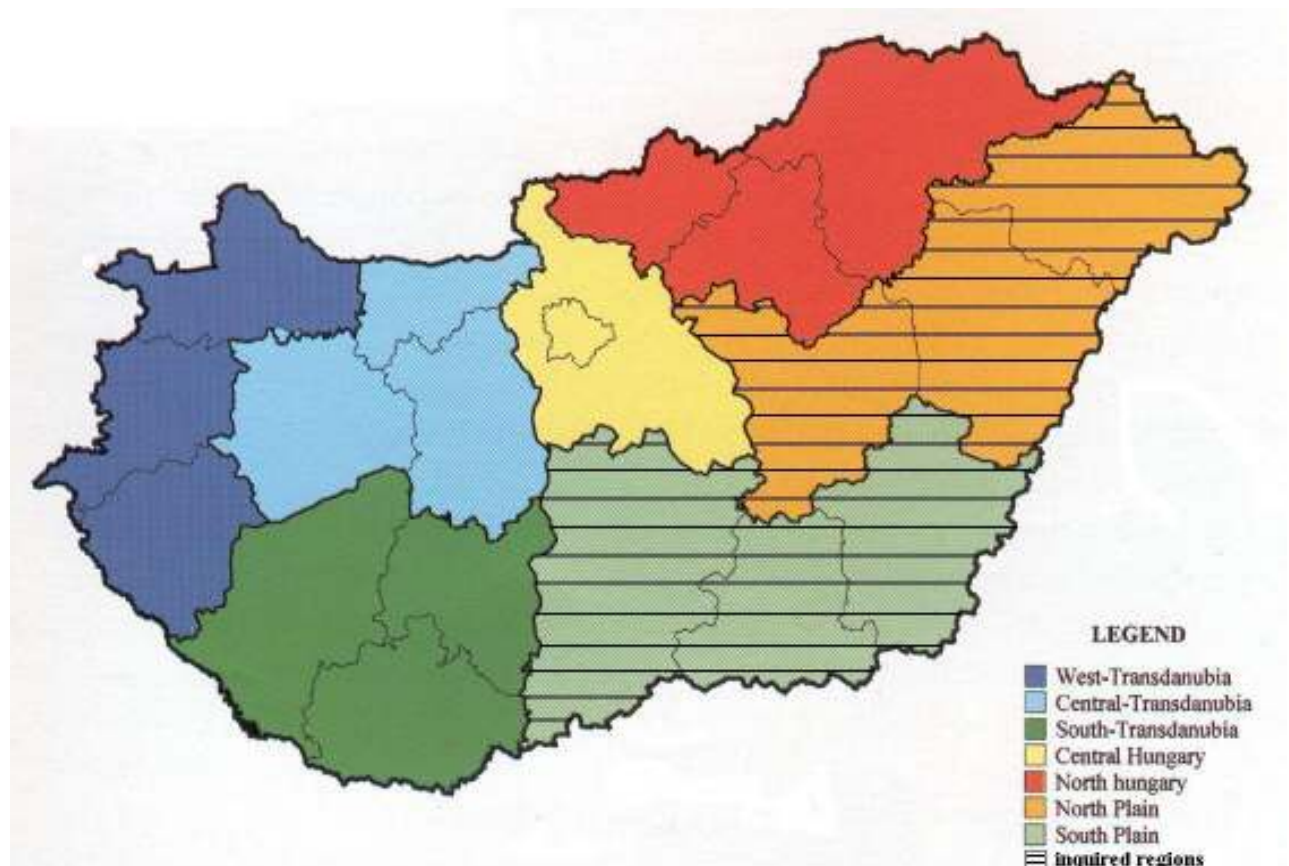
The study covers the water public utilities in the authority of the Ministry of Transport and Water Management, the Ministry of Agriculture and Rural Development and the Ministry of Environment Protection on the level of the national economy, while it becomes broader on the area level with the similar activities of the different participants of the market (I surveyed the latter with the help of a representational technique).

The processing of the data was based on their systematization, calculations with the help of different indexes and registers, with certain methods of presentation used in technical practice, and by giving a critical analysis of the works consulted.

The **evaluation of the processed data** made it possible to highlight the causal relations of excess waters in the Great Plain regions, to present the economic and social effects of excess waters and their interaction.

I included my conclusions into studies, among which I find the most comprehensive the following: VAMOSI S. (1999, 2000, 2001). I have given lectures on some important questions: VAMOSI S. (2000 a, b, c).

Naturally, in my thesis I took into account the different international and national trends of development, concepts and programmes in order to formulate as many solution drafts as possible to the land use and other consequences of the accepted technical steps.



3. RESULTS AND CONCLUSIONS

3.1 Reasons for excess waters

The effect of unfavourable natural conditions on the appearance of excess waters has been analysed with the critical examination of

a) **meteorological circumstances:**

- too much rainfall
- fast rise in temperature
- the decrease in evaporation
- the sun-spot (macula) activity

b) **soil conditions:**

- soil covering
- soil frost
- land use
- soil texture

c) **configuration of the terrain:**

- the size of deep areas
- groundwater movement
- drainless area

but I also had to take into account the reasons for damage caused by excess waters as a result of **unfavourable artificial effects** (human intervention).

I included the following human activities into my scope of analysis:

a) **agricultural activity:**

- soil tillage methods
- forestry activity

b) **technical interventions**

- water regulation
- the condition of the drainage system
- the effect of irrigation on soil
- river canalization

c) **the analysis of other factors:**

- radical changes in ownership relations
- the changes of land use
- the deficiencies of engineering activity
- the modification of the built-up area.

The examinations clearly show that the **solution of the problems** - the domestic damage caused by excess waters, excess water control and our whole excess water management - depends not only on our efforts and financial means within the country but **it is significantly dependent on**

the activities connected to land formation outside the borders (water regulation, river basin management, silviculture etc). This nature-produced circumstance (together with the numerous factors influenced by politics for many years) is the basis of our belief: the key to the right solution of the excess water problems of Hungary lies - among others - with the observation of the characteristics of the Carpathian Basin and with the cooperation of the neighbouring countries (Ukraine/Kárpátalja, Romania/Transsylvania, Slovakia/Felvidék, Little-Yugoslavia/Vajdaság).

Based on the consulted works and my own observations I introduced not only the reasons for the appearance of excess waters but the problem-groups caused by excess waters.

3.2 Problem-groups

- a) **Subsurface flooding on agricultural areas** is closely linked with surface water movement, the deterioration of the drainage systems of areas with excess water (natural water movement, artificial canals), the increase of the level of groundwater.
- b) **The flooding of settlements** is determined by two important factors:
 - the changes of village-structure as a result of agricultural activity,
 - the increase in the level of groundwater stemming from the water public utilities of the settlements of plain regions.

The fact that **the maintenance of the drainage systems within the settlements is unsatisfactory** and that most of them needs renovation (approx. 2/3 of them) is true not only for the settlements affected by flood damage and damage caused by excess water but for the whole country.

- c) **The deterioration of soil quality** can be attributed to the suspension of melioration methods, to the inefficiencies of cultivation ('sole of the plough-disease') and, with some of the new farmers, to the lack of expertise or to the forced sparing.
- d) **Erosion** is the cumulative result of the uncovered soil surface (at cut forests), rainfall and unfavourable slope conditions.
- e) The appearance of **human problems** can be originated from the fact that **the sensitivity to damage caused by flood damage and by excess waters of those people living in the affected areas has risen**. The long-lasting excess water periods - an important factor of which is the increased level of groundwater - infect the water of dug wells present in great numbers in the examined territory, excess water floods cemeteries, rinses sewage basins and these things might lead to the appearance of a major epidemic and give the State National Health and Municipal Health Authority significant tasks.

After giving a detailed description of the problem-groups I offer a solution to the utilization of the arable lands in the region proper (the Great Plain regions).

3.3. The possibilities for the utilization of excess water land

The economy of the past few decades has not inspired large-scale industrial companies to utilize soils more sensibly. The possibility of insuring for flood and excess water damage and the support system for areas of less favourable parameters with excess water, proportionate with the income has not prevented companies from taking too much risk. The liberalization of domestic markets, the loss of eastern European markets, the decrease of the possible income from agriculture has proven it totally by now that there is an urgent need for a new concept concerning the utilization of 400-600 thousand hectares of land.

The necessity for a new concept is best justified by the following important factors:

- because of the shorter ripening time there is less plant production
- the value of the inner contents of the plant varies significantly, the quality is weaker
- the sensitivity of herbaceous agricultural plants to flood damage and damage caused by excess water is significantly greater
- in many cases the protection and soil cultivation for fruit plants is sometimes impossible to solve or is too expensive to carry out.

3.3.1. The utilization of alluvial plains, areas without the protection of a flood embankment or underseepage areas being on the protected area of the flood embankment:

The area of these can be estimated to be 170-180 thousand hectares in the country. 35% of this is suitable for cultivation almost exclusively with plants with sowing of the spring corn. Among them the production of forage with a vegetative purpose is important. Because of the high costs it is worth producing them only in some outstanding areas, at other places it would be best to change to a new cultivation branch.

Possible direction of utilization:

- **afforestation** at a deep area exposed to constant effect of water (where stagnating water is shorter than 3 weeks, running water is shorter than 2-3 months): willow, white poplar, alder, ash. At higher areas maple and poplar, on neutral or slightly sour soil walnut etc. is best. In the changing social and economic system of the country there is a strong desire from the side of the society and mainly of the professionals for **the protection and expansion of a nature-lover silviculture**.
- **sowing with grass** with species tolerating temporary coverage with water better. It should be limited to the smallest possible scale because of the constantly low number of ruminant livestock and the many times 100 thousand hectares of grass plots without utilization. It is necessary, however, at holiday resorts and as a means of flood protection because of technical reasons.
- **We have to rethink the later fate of areas protected by summer dikes** according to the altered circumstances.

3.3.2. The utilization of areas with excess water protected by embankment:

In the case of saliferous areas

- crusty meadow solonch can be afforested after melioration similarly to the other solonch types (pedunculated oak, certain poplars),
- amelioration of water bodies for fish culture in case of a good water-blocking layer,
- on solonch meadow soil, namely south of the Debrecen-Szolnok line, rice production would be the ideal solution,
- finally it sowing with grass is possible for all saliferous areas, but it is not supported the present market unfortunately.

On marsh-and-flooded forest areas

pedunculated oak, red oak and alder, while on crude soddy alluvial soil willow, ash, maple and poplar can be used.

These two groups are flooded every 1-3-5 years, so it is not sensible to do agricultural production there. From these areas approximately 60-70 thousand hectares is arable land and fruit production.

3.3.3. The utilization of weak and average quality areas being flooded for a longer period every 6-12 years:

This area is 300-400 thousand hectares. Farmers try growing plants sowing of the autumn corn but because of the little height differences within the field there is a yearly 10-40% damage caused by excess water. Agricultural production on this type of land is risky, on the whole it is not profitable.

It is best to afforest the area on the weaker part, while on the more fertile half cultivation is possible to be made secure with surface drainage.

3.3.4. The utilization of average and good quality areas being flooded for a shorter period every 6-12 years:

On these areas of **700-800 thousand hectares** production conditions can be improved for most plants at a relatively low cost with the help of area levelling, soil loosening at the right time and chemical soil amelioration. Damage caused by excess water is characteristic in the case of plants sowing of the autumn corn or because of the extreme amount of rainfall in the course of the ripening time. The scale can be said to be 0-20%.

We have to mention wetlands whose maintenance and the increase of their area is necessary. We have to select them primarily from the 1st and 2nd groups and we have to pay attention to their protection and improvement.

The analysis of the appearance and effects of the excess waters of the past hundred years and the emergency situation of the present day and the damage caused have shown that **we have to examine land drainage in a close relationship with regional development.** With respect to the

above mentioned factors it is inevitable to **formulate a new common agreement** observing modern requirements and the creation of a corresponding **National Strategy of Excess Water Control**.

3.4. Suggestions for the creation of the National Strategy of Excess Water Control

1. We have to outline the tasks of agrarian, rural and regional development taking into account the basic principles of the appearance of excess waters and the interaction of flood and excess waters.
2. We have to designate the flood and excess water areas with the most damage and - observing priorities - plans have to be made for their utilization.
3. The total overhaul of the state-owned waters, the local government-owned waters and the private waters is necessary in the regions with the most damage caused by water and based on this the necessary renovations have to be made.
4. We have to make sure that the program is based on the R+D tasks necessary for the solution of the problems highlighted in the Development Strategy.
5. We have to supervise the Settlement Development Plans existing or being born from an agricultural and water management point of view as well, together with the on-going construction licensing processes and modify wherever needed.
6. We have to assess the river basin possibilities on the territory of water associations and in possession of the data the Ministry of Agriculture and Rural Development should announce and coordinate a Programme of River-basin Building.
7. We have to revise 'The Water Policy of Hungary' in accordance with agricultural, rural and regional development.
8. We have to start educating experts on rural development in secondary and higher agrarian education.
9. The efficiency and number of water authority checks should be increased. We have to establish the legal possibility for water associations to have an authority status on their own area similarly to the system of the European Union.
10. It is necessary to have the legal and technical background for the execution of the tasks determined by the strategy, together with the whole referring legal body of text and the execution of the needed modifications.
11. Based on the results and products of the Hungarian Topography Programme a database of the agrarian, rural and regional development sources should be created.
12. We have to make a financial basis for the execution of the programme with the help of the Government, the support programmes and other sources of the EU (PHARE, ISPA, SAPARD etc.) and the domestic and international venture capital.

4. PUBLICATIONS AND LECTURES

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