Vegetated buffer zone project of the Vantaa River river basin

Helena Ahola

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The purpose of this project is to find methods of examining vegetated buffer zones and erosion of river banks, to test those methods in practise and give recommendations and instructions on how to construct various types of vegetated buffer zones. Special attention has been paid to the breadth of buffer zones, slope of surface, sensitivity to erosion, vegetation and cultivation methods. The methods were tested in the Vantaa River river basin in Southern Finland. The conclusions of this study can be applied in river basins where the percentage of field is considerably higher than the percentage of lake.

Keywords:
Vegetated buffer zone, erosion, Finland.

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The Water Protection Association of the Vantaa River and Helsinki District currently has a study project of vegetated buffer zones in progress. The purpose of the project is to find a method of examining the present-day situation of vegetated buffer zones and to develop new methods of constructing them.

This project is being carried out in cooperation with e.g. state water and environmental authorities, agricultural advisors, the cities of Helsinki and Vantaa, and the municipality of Tuusula.

Definitions

A vegetated buffer zone is an uncultivated area between a field and a watercourse.

The permanent vegetation of the zone protects the river bank from erosion and leaching. The best alternative is stratified vegetation which consists of trees, bushes and grass. The tallest trees must be placed near the river bed to shade fields as little as possible (fig. 1).

The breadth of the vegetated buffer zone depends on the size of the river bed, topography, soil, ecology and landscape. 1-2 meters would be enough by main ditches. The vegetated buffer zones can be 5-20 meters by stream and river banks which are steep and eroded (fig. 1.). According to Mander (1988) the absorption of nutrients is highest at 10 meters.

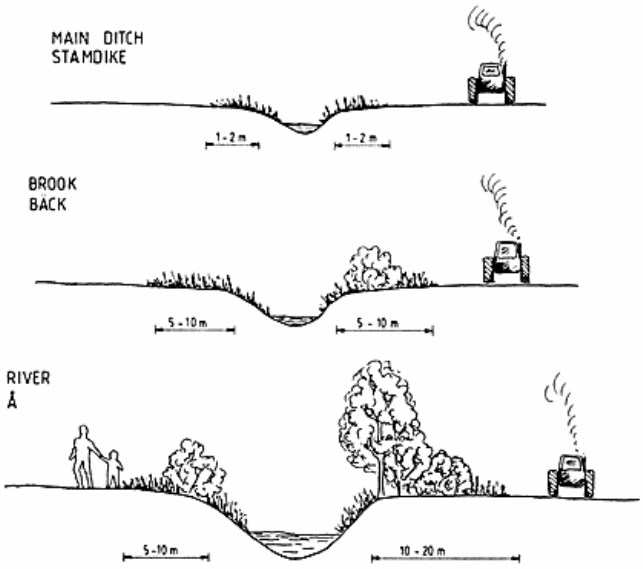

Fig. 1. Breadths of various vegetated buffer zones.

Fig. 1. Breder av olika skyddszoner.

The purposes of vegetated buffer zones

The essential reason for creating a vegetated buffer zone is to reduce surface erosion and nutrient load. Vegetated buffer zones are necessary on river banks which are sensitive to erosion especially in fine-grained soils. In clay the influence of surface erosion is greater than in sand and moraine which easily transfer water.

The amount of material washed out from level agricultural land is relatively small, some 900-1100 kg/hectare in a normal year and around 1500 kg/hectare in a rainy year. But even in a normal year undulating, sloping, arable lands will lose some 4000-4500 kg of material per hectare, and in rainy years as much as 6000-7000 kg/hectare (Mansikkaniemi, 1982). The percentage of field, the average sloping of fields, and the amount of ploughed and open ditched fields influence the total amount of leaching.

The deep roots of trees bind the soil and prevent nutrients from reaching the ground-water. Versatile tree and bush vegetation on the banks of watercourses is an excellent ecological choice, securing the preservation of vegetation and animal life.

Natural predators of cultivated plant eating noxious insects can live in vegetated buffer zones (Ruppert, 1987;

Welling et al., 1987). In an open area the trees of a vegetated buffer zone provide shelter from the wind (Åvall, 1981). Waterside vegetation shades the water, improving the living conditions of fish and other animals, and limiting the growth of water plants and algae.

Model of river bank examination

The examination of river banks made by this research project is divided into five parts. This is a common model which can also be applied to other circumstances.

1. First the boundaries of the examined area are defined in terms of the aims of the examination and available resources.
2. Then it is necessary to carefully and widely familiarize oneself with research area maps, and plans, other research and studies, statistics and land ownership. With the aid of maps possible areas of erosion and/or other problems can be determined.
3. The next stage is to perform preliminary field investigations based on the knowledge gained from stage 2.
4. By combining knowledge gained from stage 2 and stage 3, areas for in-depth examination can be chosen. To acquire a good overall impression of the river banks, several visits are necessary because the situation varies considerably during floods and growing season. Examination of river banks from the river bed as well as from both banks is recommended. There may be erosion which is difficult to notice from the river bank. Several things are worthy of consideration: e.g. slope of surface, sensitivity to erosion on river banks, possible erosion, soil, vegetation, ditching and subsurface drainage of the fields, cultivation methods, breadth of vegetated buffer zones, and appearance of the water.
5. A report is drawn up based on map and field investigations. Present conditions, recommendations and proposals for improvement are also represented in the report.

RESULTS OF FIELD INVESTIGATIONS

According to the examination in Helsinki (Ahola, 1988) the river banks of the Vantaa and Keravanjoki Rivers are generally in good condition. The areas between river banks and fields or buildings consist mainly of recreational routes. Viewed from water toward land the river banks proved to be eroded. The river banks were tufty, but there was no new erosion.

The river bed of the Vantaa River is difficult to reach, because there is thick vegetation consisting of willows (Salix sp.), meadowsweats (Filipendula ulmaria), wild chervils (Anthriscus silvestris) and nettles (Urtica dioica). Waterside vegetation would be stronger and more versatile, if there was more grass. If it is necessary to reach the river bank e.g. for fishing, the river bank has to be supported, and light stairs and docks built.

The field investigations of this project began in Helsinki

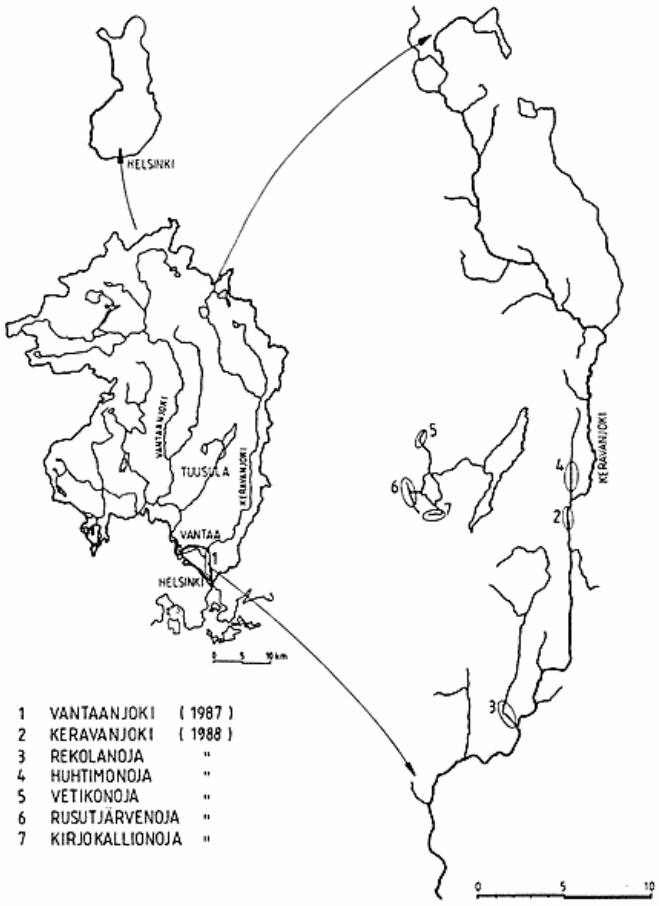

Fig. 2. The Vantaa River river basin and the examined river banks in 1987 and 1988.

Fig. 2. Vanda ås flodområde och strandinventeringens föremål i 1987 och 1988.

in 1987 (Fig. 2, point 1). Examination and examination method experimentation continued in 1988 with a study of the condition of brooks and ditches. A preliminary examination of small river beds was performed in spring 1988 in eleven brooks and ditches. Six of them were chosen for the detailed examination which is made only once (Fig. 2, points 2-7). These places were photographed four times.

These brooks and ditches flow through agricultural land. The breadth of vegetated buffer zones, surface of slopes and the shape of the river bed were measured every hundred meters on both banks of brooks and ditches. Cultivated plants, the condition of subsurface drainage, the general condition of the river bed, types of vegetation and the colour of the water were examined over the entire area (Fig. 3). No analyses were done at this stage.

Typical of the examined and problematic areas is a narrow buffer zone between field and river bed. The

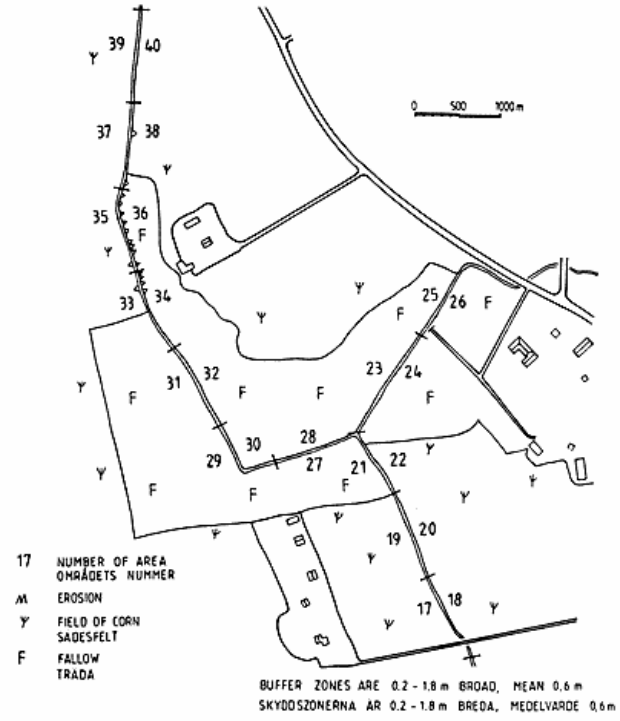

Fig. 3. Results of the field investigation in Rusutjärvenoja, Tuusula in 1988.

Fig. 3. Strandinventeringens resultater från Rusutjärvenoja, Tusby i 1988.

breadths of the vegetated buffer zones also varied considerably (Table 1). Vegetation has developed poorly especially on the slopes which have been cleared out.

The slopes of cleared ditches were very steep, barren and eroded. Depending on the type of soil, a vicious circle is created where the slopes cave in immediately after being cleared out and the river bed is blocked once again. The ditches are very steep because they have been cleared out several times thus adding to the erosion. In the examined areas some fields were ploughed right up to the river bed. Using pipes in ditches in this type of area would be a better idea.

Recommendations and instructions

One part of the vegetated buffer zone project is to draw up series of slides and transparencies. These series are used as teaching materials for farmers, decision-makers, officials, and students.

The experience gained as a result of this examination of river and ditch banks can be applied to river basins in Southern and Southwestern Finland, where the percentage of field is considerably higher than the percentage of lake.

The results can be used in planning other research projects and in giving general instructions on how to reduce the influence of agriculture. This project's model of exa-

object	number of areas	breadth of vegetated buffer zones m	mean m
Keravanjoki	60	0.5 - 20.0	6.2
Rekolanoja	60	1.5 - 100.0	8.5
Huhtimonoja	13	0.3 - 1.5	0.9
Vetikonoja	18	0.0 - 1.3	0.8
Rusutjärvenoja	38	0.2 - 1.8	0.7
Kirjokallionoja	14	0.4 - 1.6	1.0

Table 1. The breadth of vegetated buffer zones in 1988.

Tabel 1. Skyddszonernas bredd i 1988.

mining river banks can also be used, but with special attention paid to specific local circumstances.

In all planning concerning the use of river banks, close attention must be paid to vegetated buffer zones and the condition and use of that river bank. Planning has to be integrated.

The promotion of vegetated buffer zones and the reduction of the influence of nutrients and suspended material can be arranged by providing information through agricultural organizations.

Instructions on how to take care of vegetated buffer zones are important. Vegetated buffer zones are not meant to be waste land growing only weeds, but the vegetation has to be permanent and versatile.

Vegetated buffer zones alone are not sufficient. The nutrient load of the entire cultivated agricultural land has to be reduced. This can be accomplished by the use of proven cultivation methods. The steepest river banks, those with an inclination of more than 10 %, should be spared from cultivation.

State, cities and municipalities could exemplify how to arrange vegetated buffer zones. Agricultural schools could test various vegetated buffer zones. New farmers and other agricultural professionals could receive this information.

Cities and municipalities could also influence the arrangement of vegetated buffer zones with planning, especially in crowded areas. Roads for light traffic between fields and river beds could be built.

Vegetated buffer zone research in Finland

The Ministry of Agriculture and Forestry and the Ministry of Environment have a cooperative project in progress to intensify research aimed at studying and reducing the agricultural load to waters. The project started in 1988 and will continue into 1991.

The National Board of Waters and Environment began a project to research measures of reducing the agricultural pollution of lakes and rivers. The effects of cultivation techniques and plants on erosion and nutrient leaching are being researched on test fields by the Aurajoki River in Southwestern Finland.

Other research projects linked to agriculture's influence on water being carried out by the National Board of Waters and Environment are: Modelling of Nutrient and Pesticide Leaching of Agricultural Land, Activity of Agri-

cultural Phosphorus Load in the Aquatic Ecosystem and Effects of Agriculture on the Aquatic Ecosystem.

Research on the minimization of the effects of environmental problems caused by agriculture in the fields bordering rivers is being carried out in cooperation with the Agricultural Research Centre, the National Board of Waters and Environment, several universities and the Central Union of Agricultural Producers. The purpose of the research is to study the influence of various vegetated buffer zones on nutrient leaching from fields to water.

The necessity of research on vegetated buffer zones is great. The results of continental research projects cannot be directly applied to Finnish circumstances. The results of the Estonian research, however, (e.g. Mander, 1988) are similar to the preliminary experiences on the current Finnish research of vegetated buffer zones and are therefore easily applicable.

Resumé

Inom Vattenskyddsföreningen för Vanda å och Helsingforsregionen pågår ett skyddszonprojekt. Modellkommuner för projektet är Helsingfors, Vanda och Tusby. Arbetet har börjat på våren 1987 från Helsingfors och fortsatt 1988 på Kervo ås avrinningsområde, där har inventerats särskilt bäck- och dikstränder.

Målet med projektet är att utveckla och experimentera strandinventeringsmetoder. Avsikten med strandinventering är att utreda de nuvarande skyddszonernas läge, strändernas erosionkänslighet, de ras som har inträffat, karaktären hos växtlighet och odlingsmetoder. På grundval av kartorna och de preliminära terrängundersökningarna väljs de mest problematiska områdena ut för fortsatt granskning.

Skyddszonerna på Helsingforssidan av Vanda och Kervo å är i regel i gott skick. Annorstädes finns det bäckar och diken där strandvallarna är för branta, erosionkänsliga och det finns inte några skyddszoner. Det är klart, att utlakningens betydelse är störst på sådana områden.

Utgående från strandinventeringens resultat kan rekommendationer och direktiv ges för utredning i Södra och Egentliga Finland. Skyddszonerna bör beaktas i all planering som gäller strandområdena.

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Potentielle marginaljorder bestemt ud fra naturgivne faktorer

Henrik Breuning Madsen

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Initiated and funded by the Ministry of Environment a number of investigations were carried out in 1986 to elucidate different aspects about marginal land. One of these projects was a nation-wide mapping of soil conditions that might influence the marginalization of farmland. The mapping was based upon soil data bases covering the whole country, established by the Ministry of Agriculture, Bureau of Land Data.

Keywords:
Marginal arable land, soil mapping.

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I Danmark findes store områder, der igennem århundreder har været stabile landbrugsområder som fx de østdanske morænelerjorde. Dette skyldes, at man på disse jorde kan have en stor produktion år efter år på trods af varierende klimaforhold. I andre egne, som fx Midtjylland, har landbrugsområderne været langt mere ustabile. Her har anvendelsen af vådbundsområder og sandede strøg skiftet i takt med konjunkturerne og landbrugets teknologi. Som marginaljorder betegnes de områder, det ikke kan betale sig at dyrke, eller som ikke kan dyrkes rationelt på grund af forskellige båndlægninger og derfor udgår af den normale omdrift.

I første halvdel af 1980erne blev omkring 15.000 ha taget ud af omdriften og anvendt til andet formål. Jensen & Koch (1987) bestemte ud fra en interviewundersøgelse hos ca. 2500 landmænd, at 47 % af det opgivne areal var tilplantet og hovedsageligt med juletræer, 40 % benyttedes til afgræsning, 7 % lå brak, og 6 % benyttedes til andet formål. Årsagerne til marginaliseringen var mangeartede. I interviewundersøgelsen angav landmændene, at naturgivne faktorer spillede en stor rolle for, hvorvidt et areal ville gå ud af omdrift eller ej. Det drejede sig især om jorder, der var for tørre, for våde eller for stejle. Fordelingen af de anførte begrundelser var: 55 % naturgivne faktorer, 15 % arronderingsproblemer og 30 % andet, herunder økonomiske og fredningsmæssige årsager. Der forventes ikke store ændringer i grundene til marginaliseringer i sidste halvdel af 1980erne, hvilket fremgår af fig. 1.

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