VACCIA

Vulnerability assessment of ecosystem services

for climate change impacts and adaptation

ACTION 7: ASSESSMENT OF IMPACTS AND ADAPTATION MEASURES FOR AGRICULTURAL PRODUCTION

Deliverable: THEMATIC GIS MAPS

Date: 31 March 2011

Introduction

Action 7 aims, as its main deliverable, to publish an internet site at which four scenarios of adaptation in agriculture are demonstrated and illustrated in a user-friedly way. The audience for this dissemination of research are non-scientists who work in agriculture.

For the purpose, maps based on geographic (spatially explicit) information collected from or simulated to the demonstration area, are generated.

The thematic maps consist of independently collected biophysical data on climate, hydrology, soils, land use, and biodiversity, as well as socioeconomic data (structure of farming) on agriculture in Lepsämänjoki river basin. The Lepsämänjoki agricultural watershed is the demonstration area, which is used in VACCIA action 7 for the demonstration of impacts and adaptation to climate change in agriculture (see also Deliverable 3/Action 7). The maps are based on database (Deliverable 3), from which the actual data is derived for the maps, and many of the variables that will be used in the demonstration will be derived from grid data by interpolation.

The maps presented in this document are based on work done by project teams in MTT AgriFood Research Finland, and in SYKE Finnish Environment Institute.

Description of VACCIA/Action 7 and its earlier deliverables are available at:

http://www.environment.fi/default.asp?node=24075&lan=en

On behalf of the project group,

Helsinki 31 March 2011

Juha Helenius
ACTION 7

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1. Description of the Scenarios

Action 7 produces four illustrations of future situations of arable land use in two of the northern sub-areas of the Lepsämänjoki watershed (areas 21.046 ja 21.043, Thematic map 2a). The background assumptions for these illustrations include agricultural policy and market prices of agricultural commodities in driving farmer's decisions on crop choices.

The allocation of land to the various crop plant species is done by considering the opportunities brought by climate change to growing new species, and to introducing winter sown cultivars, as well as possibility to extend areas of present species. In addition, the allocation considers requirements for crop rotation and risks of crop failure, parcel properties such as drainage, soil type, parcel size and shape. Also, distance from the waterway is considered: species that are associated with high risk of erosion and nutrient leaching are, if possible, not placed next to a waterway.

PS Significant increase in Protein Self sufficiency in Finnish agriculture

WC Significant increase in use of Winter Cover crops

RS Significant decrease in diversity of production (Regional Specialization)

DP Significant increase in Diversity of Production

These scenarios are produced for two points of time in the future: year 2025, and year 2055. The illustrations are snapshots, so that crop rotations are neither apparent nor illustrated. The impacts of climate change have been estimated on the basis of IPCC SRES Scenario A2.

The four crop production scenario-maps will be overlaid with the maps illustrating the major environmental risk associated to changing agricultural land use in the Boreal agriculture, namely nutrient leaching and erosion to waterways.

This scenario work is based on research published as:

Peltonen-Sainio, P., Jauhiainen, L., Hakala, K. & Ojanen, H. 2009. Climate change and prolongation of growing season: changes in regional potential for field crop production in Finland. Agricultural and Food Science, special issue, 18: 171-190.

2. Material for the agricultural land use maps *(Hannu Ojanen)*

The material includes data on the parcels as in 2009, slope values from elevation maps, soil types, and waterways.

The slope values were in 25 meter grid in raster dataset, and they were converted to point features in ArcMap. The slope points were joined to parcels and the parcel got mean value of the slopes calculated within the parcel. Slope values were classified to ten classes and every parcel got the classified slope value as a slope class:

Slope classes

Slope class	Slope degrees
1	0-5
2	5-10
3	10-15
4	15-20
5	20-25
6	25-30
7	30-35
8	35-40
9	40-45
10	45-55

The vicinity of waterways was used to make a new variable, “water class”. The variable got three values depending on if the parcel is near big or little water or not. Narrow waterways are defined, for the purpose, as running waters less than 2 m wide, rivers as running waters 2-5 m wide.

Water classes

0 not next to a waterway
1 less than 5 m from a narrow waterway
2 less than 5 m from river or lake

These variables were used to select the plants to parcels. The plants and their proportion in different scenarios have been chosen by researchers of MTT, Pirjo Peltonen-Sainio and Kaija Hakala. They relied on following principles in the selection:

The parcels for conservation set-aside, reed canary grass and caraway should have small size, high slope class value, irregular shape and can have high water class value. Parcels for the plants, which are sowed in spring should have low slope class value and low water class value. If the parcel has higher slope class value, but is not situated near water it can be selected also. In this group small parcels are selected for oat. Parcels for the plants, which are sowed in autumn can have high slope class value and high water class value. After these conditions the bigger parcels are selected to the plants, which have bigger proportion in the scenario.

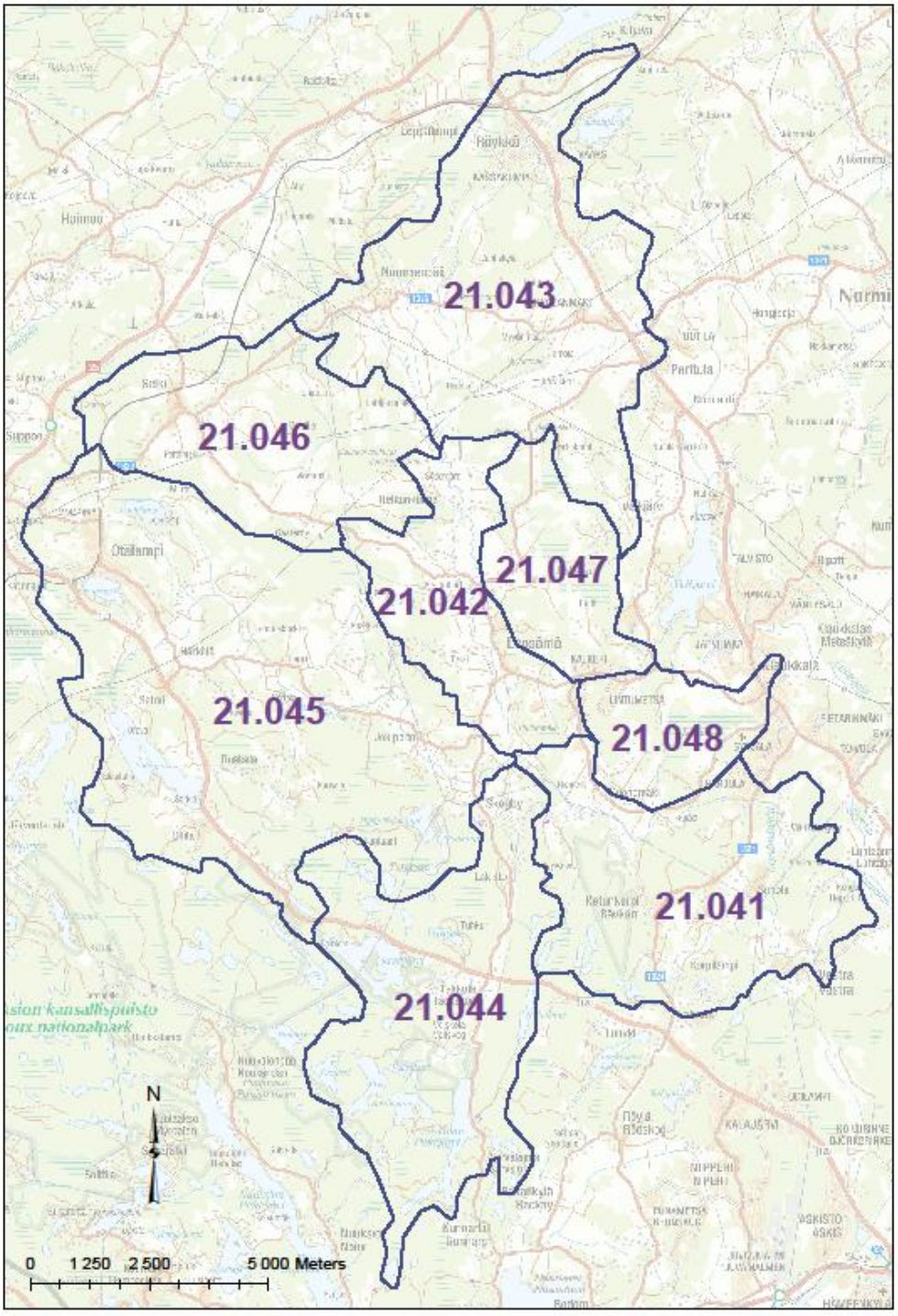
The allocation of crops resulting from this procedure is summarized in table 1.

Code	Crop	Scen PS		Scen WC		Scen RS		Scen DP	
		2025	2055	2025	2055	2025	2055	2025	2055
1	Oil seed rape	10	13	10	10	10	13	5	5
2	Turnip rape	5				5			
3	Horse bean	5	5		5	5	5		
4	Pea	5	5			5	5		
5	Lupine		2				2		
6	Winter rape				5				
10	Spring wheat	30	10					30	10
11	Barley	25	20	20		10	5	20	20
12	Oat	15	10			10	5	15	15
13	Triticale			5	30	10	10		5
14	Winter wheat		30	15	25	10	10	10	20
15	Winter barley				5				
16	Winter rye			40	15	10	10	20	25
20	Cons. set-aside	5	5						
21	Reed canary gras			10	5	10	10		
22	Sunflower					5	5		
23	Maize						5		
24	Caraway					10	10		
25	Hemp						5		

Table 1. Agricultural crops and their per cent proportions in different scenarios.

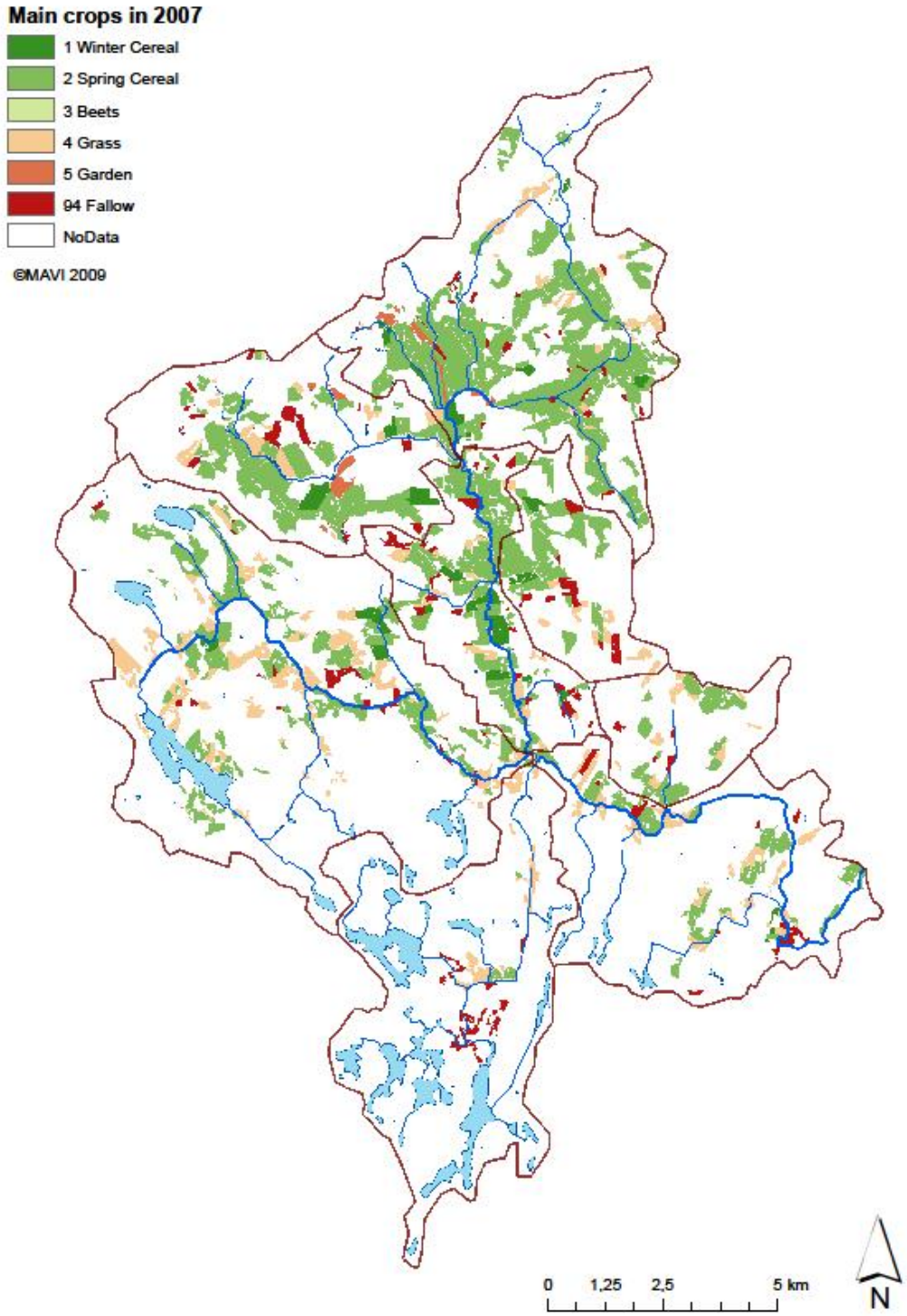
3. Thematic maps

a. Sub-areas of the Lepsämänjoki watershed



b. Agricultural land use

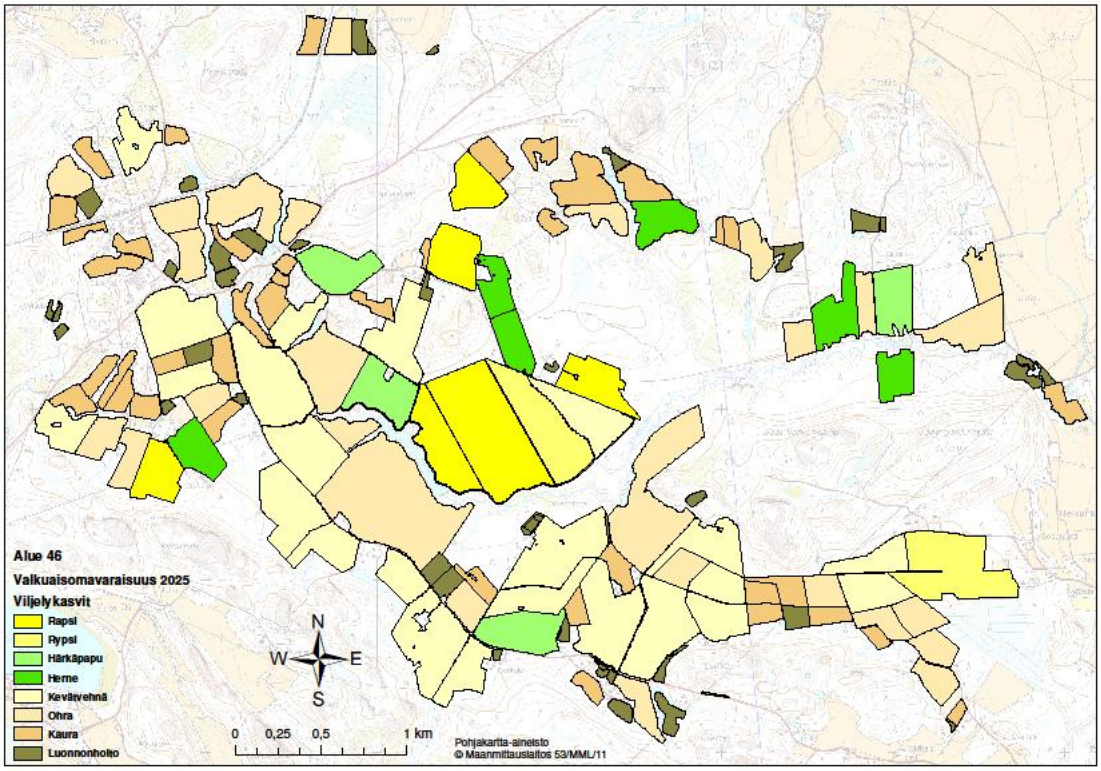
i. Present agricultural land use (crops, 2007 situation)



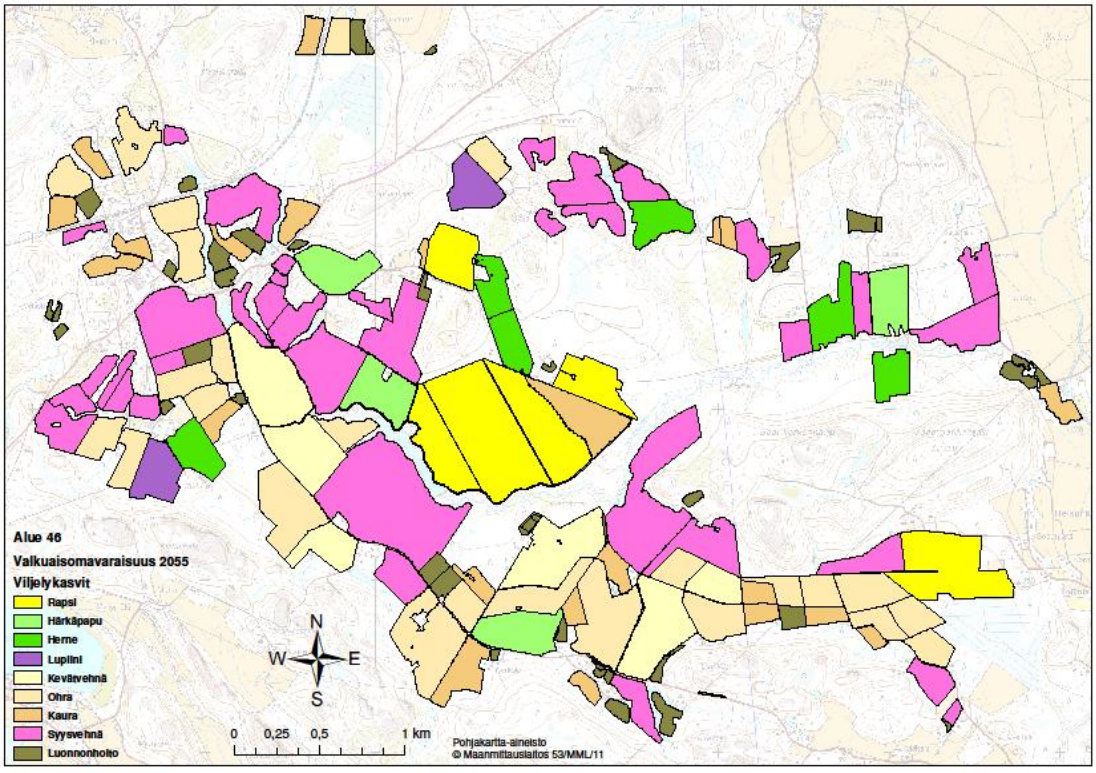
b. Agricultural land use

ii. Future agricultural land use, Scenario PS

2025:



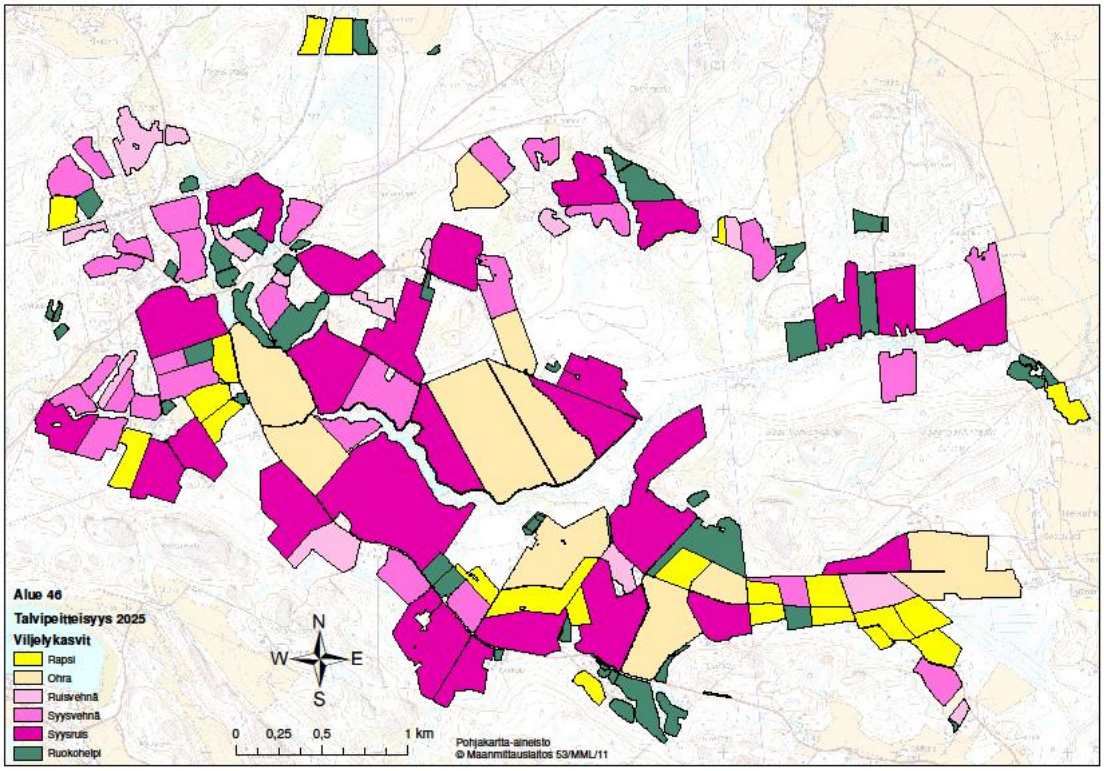
2055:



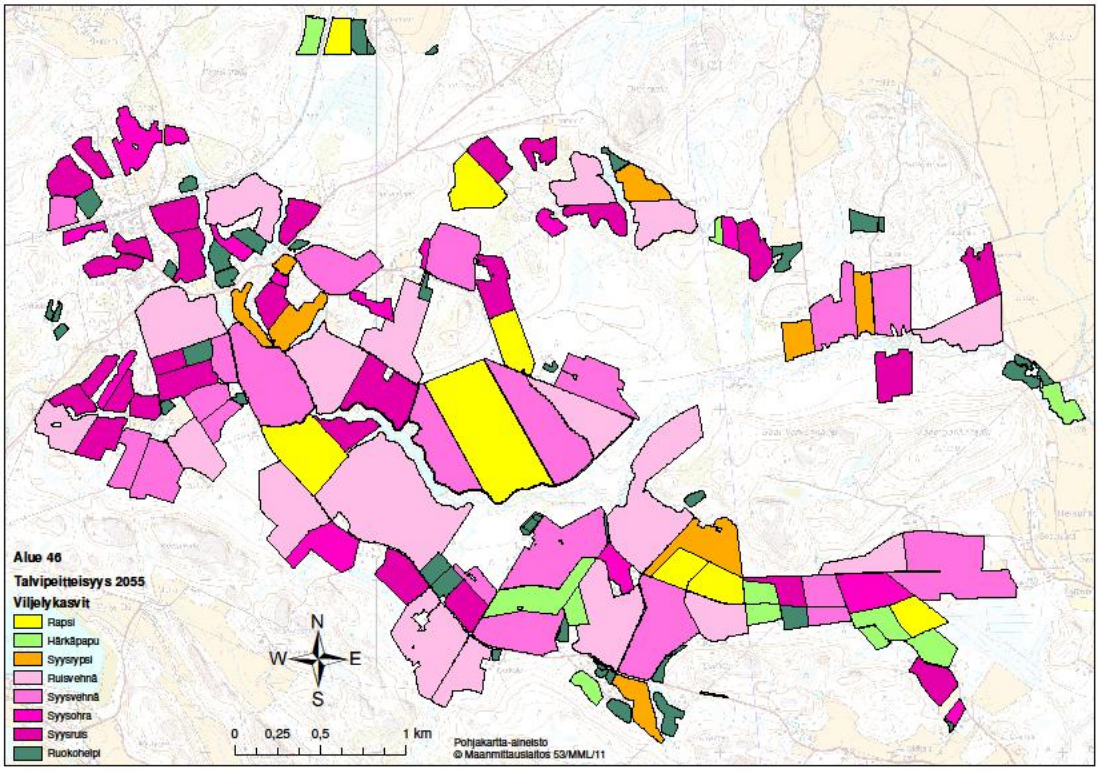
b. Agricultural land use

iii. Future agricultural land use, Scenario WC

2025:



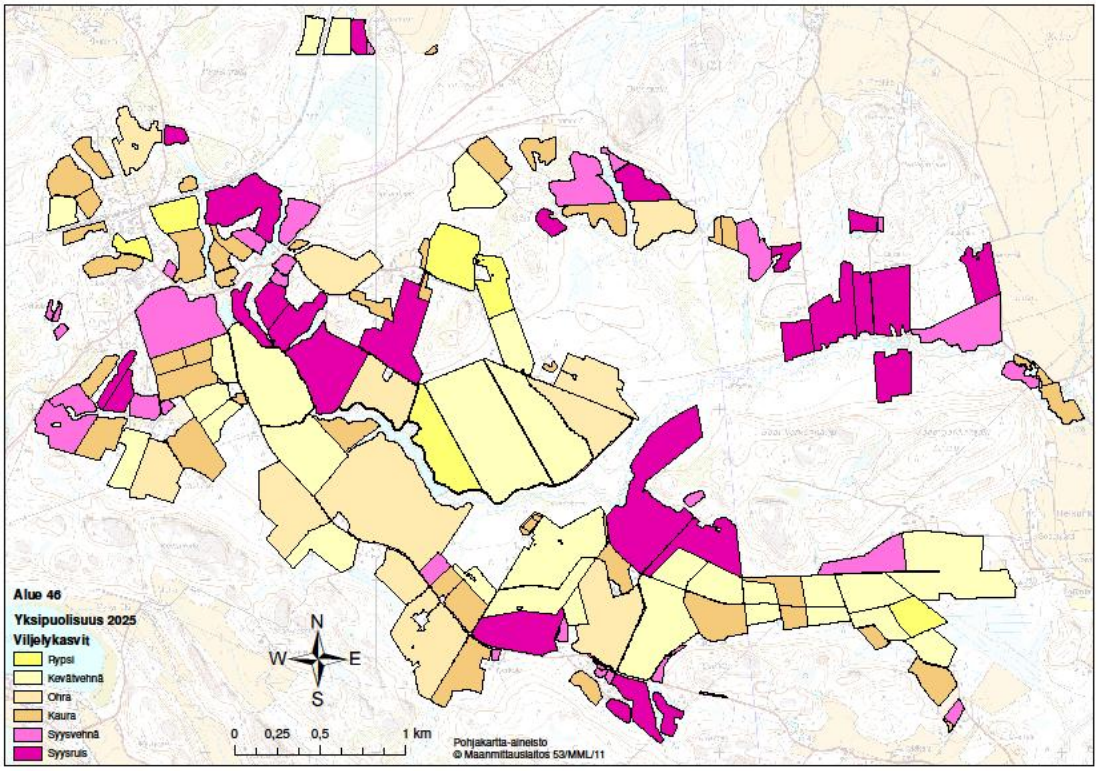
2055:



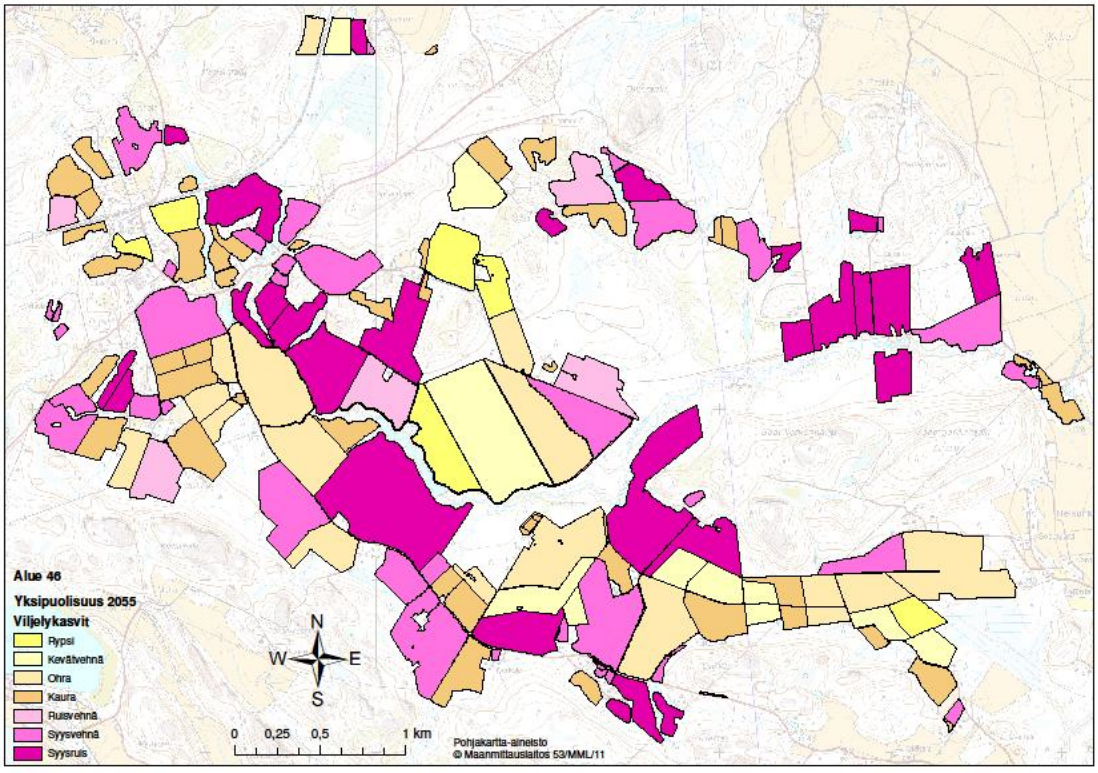
b. Agricultural land use

iv. Future agricultural land use, Scenario RS

2025:



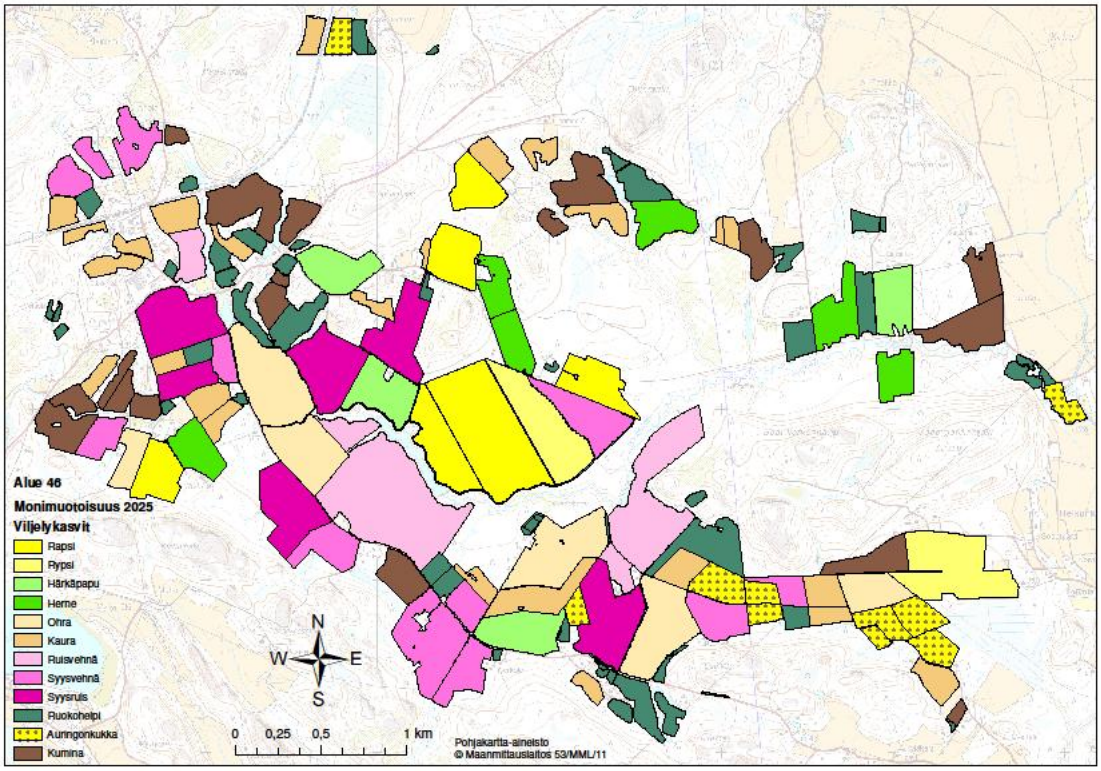
2055:



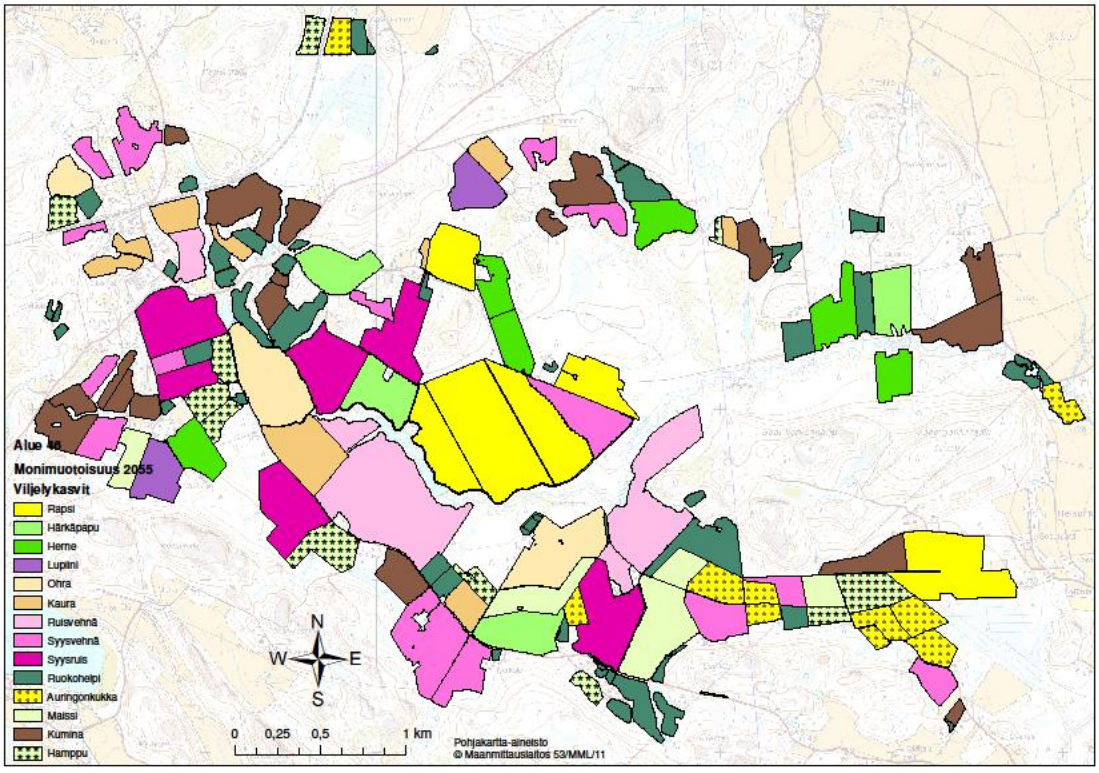
c. Agricultural land use

v. Future agricultural land use, Scenario DP

2025:



2055:



c. Vulnerability to Nitrogen leaching d. Vulnerability to Erosion

Source: *Mattila, P., Rankinen, K., Grönroos, J., Siimes, K., Karhu, E., Laitinen, P., Granlund, K., Ekholm, P. ja Antikainen, R. 2007. Viljelytoimenpiteet ja vesistökuormitus ympäristötukitiloilla vuosina 2003-2005. Suomen ympäristö 40.*