SECTION 2

The Effects on Agriculture and Environment in the Leningrad Region

2.1. Introduction

In this section we investigate the impacts on agriculture and the environment in the Leningrad region of possible climatic changes that might be induced by an increase of carbon dioxide and other "greenhouse" gas concentrations in the atmosphere.

While agriculture is one of the most sensitive areas of human activity to climatic changes, such changes could also have wider environmental implications in the region affecting, for example, water flow, groundwater level, soils, etc. Therefore it is extremely important to analyze, in an integrated fashion, the complex dynamic behavior of climate, agriculture and environment. The aim of this section is to investigate impacts of several scenarios of climatic change on crops at present cultivated in the region and on other aspects of the local environment.

In Subsection 2.2, the main climatic characteristics of the region are given along with some specific agroclimatic characteristics relating to winter rye cultivation. The scenarios of climatic changes, which have been used for analyzing impact are described in Subsection 2.3. The scenarios are built around the GISS general circulation model-derived $2 \times CO_2$ scenario and are constructed to simulate transient climatic changes. In Subsection 2.4, a short description is presented of the combined regression–dynamic modeling approach that has been used in the study. The validity of the model has been tested using climatic and winter rye yield data from the period 1951–1980.

In Subsection 2.5, some results are presented demonstrating the sensitivity of winter rye yields, ground water level, soil quality and surface water pollution to the specific climatic scenarios. Finally, possible adjustment measures for

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mitigating the impacts of climatic change are considered in Subsection 2.6, such as the increasing of drainage activity.

2.2. Agroclimatic Resources

The region can be divided into five main agroclimatic districts and one subdistrict bordering the Gulf of Finland (*Figure 2.1*). This classification is based on the thermal regime calculated as the effective temperature sum (ETS). The annual sum of effective air temperature above 5 °C varies, on average, from about 850 growing degree-days (GDD) in the east to 1250 GDD in the southwest (*Table 2.1*). The latter value resembles closely the values reported for the southern part of Finland (Part IV, this volume) and the northern part of Saskatchewan in Canada (Part II, this volume).

The annual accumulated sums of above-zero temperatures (effective accumulated temperatures) for the warm period (when mean daily temperature is

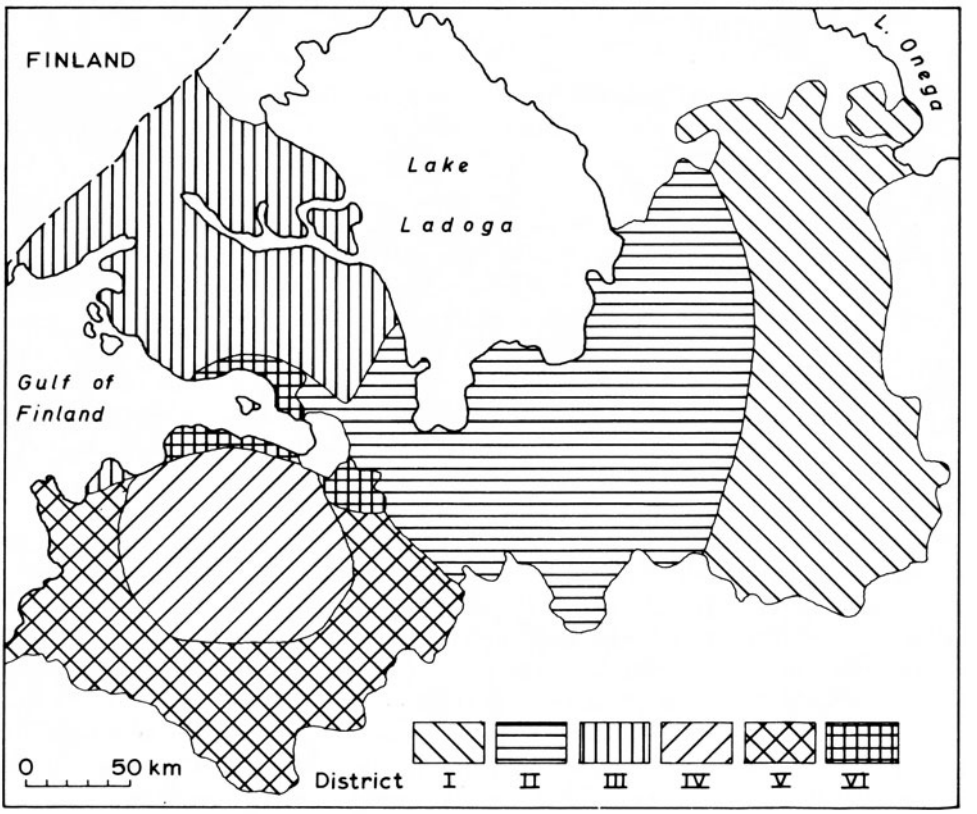

Figure 2.1. Agroclimatic districts of the Leningrad region. Climatic characteristics of each district are shown in *Tables 2.1* and *2.2*. (Source: Agroclimatic Resources, 1971.)