

SECTION 1

Introduction

1.1. The Purpose of the Study

Yields of crops vary in Finland from year to year owing to the variations in climate, particularly in temperature. Since the growing season is relatively short early sowing is important and this is sometimes delayed owing to late springs. Preparations of the seedbed cannot begin before the snow has melted and the soil has both thawed and dried sufficiently. Because of this, annual crops generally cannot benefit from the first 1–3 weeks of the growing period.

Drought in the early summer and frosts also lower the yields. Rains in the harvesting period are particularly damaging and have caused, perhaps, the greatest losses in yields. On the other hand, winter cereals and grasses also suffer from the length of the winter and sometimes from unpredictable thawing and refreezing of the soil in the early spring. Especially in areas with much snow in the east and the north of the country “low temperature” parasitic fungi are a problem. They are able to grow under the snow and to kill the overwintering plants.

Boundaries of cultivation have shifted from time to time. For example, above-average summer temperatures in the 1930s coincided with wheat and rye cultivation in the northern parts of Finland. But climate only provides a partial explanation for subsequent retreat of these crops. Economic considerations are also important (*see* Subsection 1.4.1).

While the general effect of climate on yields is well known there have, however, been few quantitative studies of the effects of climatic variations on Finnish agriculture (Keränen, 1931; Hustich, 1952). This case study estimates this effect by examining how variations in climate influence yields and by considering the economic consequences of these effects. Yield functions are estimated and are then applied to meteorological data from several warm and cool periods and, as a special case, to data describing the climate predicted for a doubled concentration of atmospheric carbon dioxide by the Goddard Institute for Space Studies (GISS) general circulation model (Hansen *et al.*, 1984).

1.2. Geography, Soil and Farm Structures

Finland is situated between the northern latitudes of 60 and 70 degrees. Biologically and geographically the country is in the boreal zone. This biome is sparsely populated (the average density 16 inhabitants/km²), and is dominated by coniferous taiga forests. The Gulf Stream, which skirts around the Scandinavian peninsula, has a warming effect on the Finnish climate. As a result, nowhere else is agriculture practiced extensively so far north (*Figure 1.1*). Climatic conditions at these same latitudes in Sweden and Norway are suitable for agriculture, but the topography and soils are not as favorable as in Finland.

Peat soils are characteristic of many areas (*Figure 1.2*), especially in the center and north (Ilvessalo, 1960). Tills are predominant in the central region, and most alluvial soils occur in the coastal areas of the south and southwest. Some degree of areal differentiation in the production capacity of the soils may be found in southern Finland between the coastal clays and the inland till areas, whereas a relatively high spatial homogeneity is typical of soil conditions in the north (Varjo, 1977).

Nearly two-thirds of the country is under forest, while less than a tenth is cultivated. Owing to rapid post-war urbanization and structural change the share of agriculture of the gross domestic product has decreased (from 16% in 1950 to 4.6% in 1982). Over the same period, partly as a result of mechanization, the population engaged in agriculture has decreased from 46% to 13%. In 1981 the typical farm averaged 11.2 ha of arable land and 35.1 ha of forest (*Farm Register*, 1984).

The country is divided into 18 agricultural districts, each served by a regional center (*Figure 1.3*). Farming in Finland is based essentially on three elements: field cultivation, animal husbandry and forestry. Animal production (especially milk production) has typically been the backbone of the farm economy and has succeeded in providing reasonably stable incomes which do not fluctuate greatly from year to year in response to climatic variations. Despite the shortness of the grazing period, dairy cows are raised even in Lapland, in some cases being kept indoors throughout the year. The short grazing period is unfavorable for beef cattle and the number of these is small. Sheep breeding has almost totally disappeared despite many attempts to promote it.

1.3. Agroclimatic Background

Finland is the northern-most country where agriculture is practiced comprehensively, although only a half of the year (in the north even less) is suitable for plant production. Climatic and natural conditions vary greatly from the south to the north. Permanent snow cover lasts from 100 days in the south to over 200 days in the north [*Figure 1.4(a)*]. It protects winter crops from frosts but causes damage in some years. Winter crops cover actually only about 3–5% of the total arable area, although milder winters would favor the expansion of their area.

The length of growing season (the period of time with long-term mean daily temperatures above 5°C) ranges from more than 175 days in the south to less