

## SECTION 1

# Introduction

### 1.1. Aims and Background

The purpose of this case study is to quantify the effects of specified climatic changes on crop yields in selected parts of the USSR and to consider the adjustments in land use and land management that represent the most appropriate responses to these effects. In common with other case studies of the IIASA/UNEP project a number of scenarios of both long-term and short-term climatic changes have been adopted. Different types of models have been used to examine both the potential impacts of these scenarios and some possible responses. The methods, results and implications are considered with respect to agricultural productivity in three regions of the northern European USSR.

During the post-war period, considerable attention has been paid in the Soviet Union to the intensification of agricultural production. This has led to increases in the amounts of mineral fertilizer applied, the numbers of tractors, combine harvesters and other machinery in use, and expenditures on energy. Due to these efforts, average agricultural output has been considerably increased (*Table 1.1*).

However, crop production has remained quite sensitive to variations in weather conditions, which is reflected by the variability in grain output from one year to another (*Table 1.2*).

There are at least three contrasting grain producing regions in the Soviet Union. Most grain is produced in the chernozem soil belt which includes the traditional grain growing areas (the Ukraine, Moldavia and part of Belorussia), and in the "new lands" developed during the 1950s in the cooler, drier eastern areas of Kazakhstan and Western Siberia. The third region, in the non-chernozem zone of the cool and moist northwest, has become increasingly important in recent years. The significance of these regional contrasts for total production is that poor conditions in one area are usually compensated by more favorable conditions in another – the so-called Regional Compensation Effect (Tarrant, 1985). This is considered in further detail below.

**Table 1.1.** Five-year averaged Soviet agricultural output, 1961–1980.

<i>Index</i>	<i>1961–1965</i>	<i>1966–1970</i>	<i>1971–1975</i>	<i>1976–1980</i>
1. Gross farm output (in comparable 1973 prices – 000 million roubles)	82.8	100.4	113.7	123.9
2. Grain (m tons)	130.3	167.6	181.6	205.0
3. Raw cotton (m tons)	5.0	6.1	7.7	8.9
4. Sugar beet (m tons)	59.2	81.1	76.0	88.7
5. Vegetables (m tons)	16.9	19.5	23.0	26.3
6. Meat slaughter weight (m tons)	9.3	11.6	14.0	14.8
7. Milk (m tons)	64.7	80.6	87.4	92.7
8. Eggs (000 m)	28.7	35.8	51.4	63.1

Source: *The USSR Economy for the Period 1922–1982*.

**Table 1.2.** Variability of Soviet grain production by five-year period, 1961–1980.

<i>Period</i>	<i>Grain output (m tons)</i>			<i>Variability (maximum–minimum)</i>	
	<i>Annual average</i>	<i>Maximum</i>	<i>Minimum</i>	<i>Million tons</i>	<i>Percentage of average</i>
1961–1965	130.3	152.1	107.5	44.6	34.2
1966–1970	167.6	186.8	147.9	38.9	23.2
1971–1975	181.6	222.5	140.1	82.4	45.4
1976–1980	205.0	237.4	179.3	58.1	28.3

Source: Yakunin (1982).

The most damaging effect of climate on total grain production in the USSR comes from drought during the growing season. The period 1951–80 was marked by severe droughts in 1954, 1955, 1972, 1975 and 1979 which affected large areas of the grain producing regions (Ulanova, 1984). In contrast, the most favorable agroclimatic conditions, in terms of total grain production, occurred in 1956, 1958, 1966, 1968, 1970, 1971, 1973, 1976 and 1978, when average grain yield was between 11% and 25% above the trend (Ulanova, 1984). These averages, however, mask considerable regional variations which can be identified by examining production data for individual oblasts (Tarrant, 1985). For example, in 1975 positive anomalies of spring and summer temperatures combined with low precipitation (*Figure 1.1*) led to severe drought over most of the grain growing regions, and Soviet grain production was only about 140 million metric tons, the lowest total for over ten years (*Table 1.2*). However, the positive anomalies of temperature contributed to above-average production in the northwestern region of the subarctic zone (*Figure 1.2*).

The reverse effect was evident in 1966 and 1968, when anomalously wet and cool summers led to above-average production in the southern and eastern grain growing areas, while in the western part of the subarctic zone (from the Leningrad region to the Ural mountains) grain production was well below trend [see *Figures 1.2(b)* and *1.2(c)* for grain production by oblast in 1966 and 1968, respectively, and *Figure 2.2* for winter rye yields in the Leningrad region].