Chapter 23 The Cool Temperate Continental (Siberian) Climate

Distribution

The Cool Temperate Continental (Siberian) Climate is experienced only in the northern hemisphere where the continents within the high latitudes have a broad east-west spread (Fig. 150). On its poleward side, it merges into the Arctic tundra of Canada and Eurasia at around the Arctic Circle. Southwards, the climate becomes less severe and fades into the temperate Steppe climate dealt with in Chapter 19.

The predominant vegetation of this Siberian or "sub-Arctic" type of climate is evergreen coniferous forest. It stretches in a great, continuous belt across North America, Europe and Asia. The greatest single band of the coniferous forest is the taiga (a Russian word for coniferous forest) in Siberia. In Europe the countries that have a similar type of climate and forest are mainly in northern Europe, Sweden and Finland. There are small amounts of natural coniferous forest, due to high altitude, in Germany, Poland, Switzerland, Austria and other parts of Europe. In North America, this sub-Arctic belt stretches from Alaska across Canada into Labrador, and is found on the high Rocky Mountains farther south.

The Siberian Climate is conspicuously absent in the southern hemisphere because of the narrowness of the southern continents in the high latitudes. The strong oceanic influence reduces the severity of the winter and coniferous forests are found only on the mountainous uplands of southern Chile, New Zealand, Tasmania and south-east Australia.

Climate

Temperature. The climate of the Siberian type is characterized by a bitterly cold winter of long duration, and a cool brief summer. Spring and autumn are merely brief transitional periods. The isotherm of 50°F. for the warmest month forms the poleward boundary of the Siberian climate and the winter months are always below freezing. The stations chosen to illustrate this type of climate are Moscow, in continental Europe and Churchill, in northern Canada, bordering Hudson Bay. The coldest month in Moscow is January with 12°F. (20° below freezing point). The warmest month (July) is as high as 66°F.; thus there is an annual range of 54°F., which is common in the Siberian type of

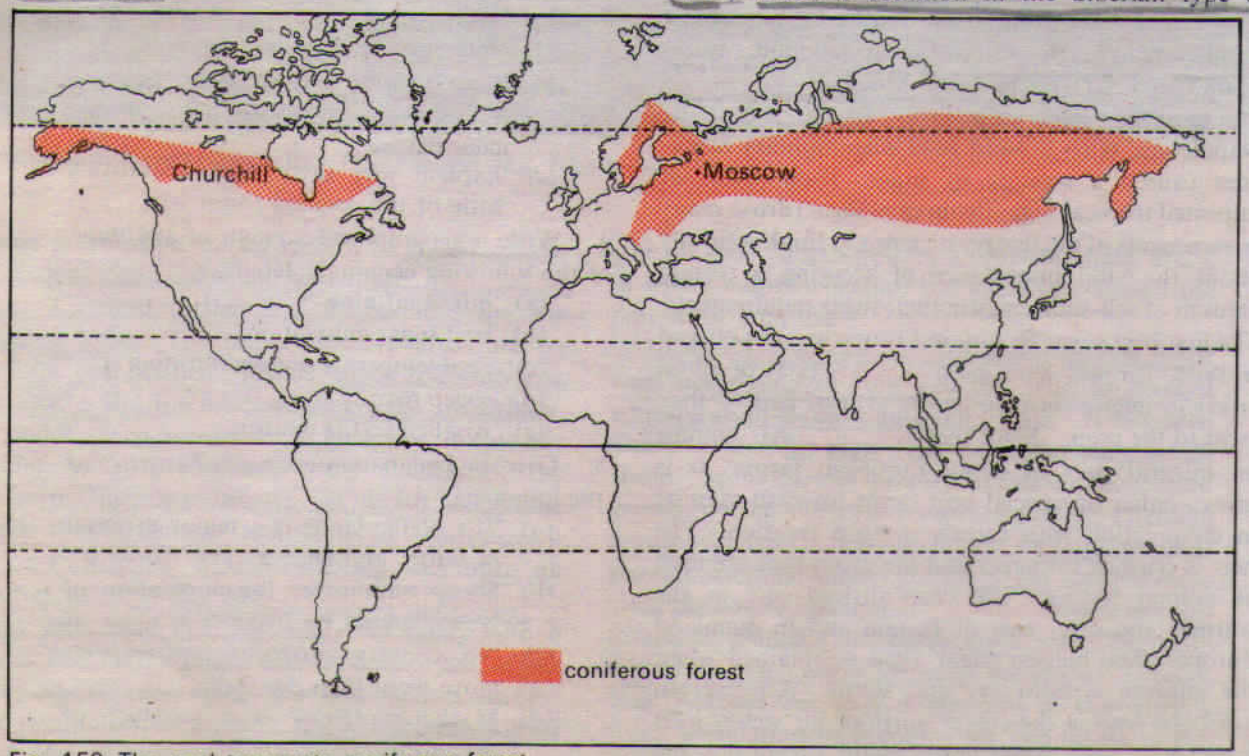


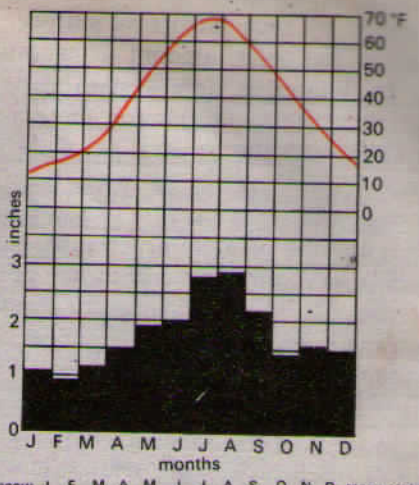
Fig. 150 The cool temperate coniferous forest

climate. In comparision, the annual temperature range for Churchill is even higher, reaching 73°F. (–19°F. in January and 54°F. in July). This is due to the more northerly position of Churchill. The extremes of temperature are so great in Siberia that it is often referred to as the 'cold pole of the earth'. Some of the lowest temperatures in the world are recorded in Verkhoyansk (68°N. 113°E. and only 330 feet in altitude) where –90°F. was once recorded. This is, in fact, 170°F. colder than Kuala Lumpur! It is almost unimaginable. In North America, the extremes are less severe, because of the continent's lesser east-west stretch. The lowest mid-winter means in the cold Mackenzie Valley are not lower than –70°F.

With such low temperatures in the cold season, heavy snowfall can be expected. Frosts occur as early as August and by September lakes and ponds are already ice-bound. All over Russia, nearly all the rivers are frozen. The number of days in which the rivers are frozen increases from south to north. In normal years, the Volga is ice-covered for about 150 days, while those further north (e.g. the lower courses of the Ob, Lena and Yenisey) are ice-covered for more than 210 days or 7 months! Occasionally cold, northerly polar winds such as the blizzards of Canada and buran of Eurasia blow violently at 50 m.p.h. or more and at a temperature of 50°F. below freezing-point. The powdery snow-flakes are blown around in the lower atmosphere and visibility is greatly reduced. Conditions are so unbearable that Siberia is very sparsely populated but it is gradually being developed.

Precipitation. The interiors of the Eurasian continent are so remote from maritime influence that annual precipitation cannot be high. Generally speaking, a total of 15 to 25 inches is typical of the annual precipitation of this sub-Arctic type of climate. It is quite well distributed throughout the year, with a summer maximum from convectional rain when the continental interiors are greatly heated (mid-summer temperatures of 60° to 75°F. are quite usual and the maximum recorded in Siberia is a real surprise—102°F.!) In winter the precipitation is in the form of snow, as mean temperatures are well below freezing all the time.

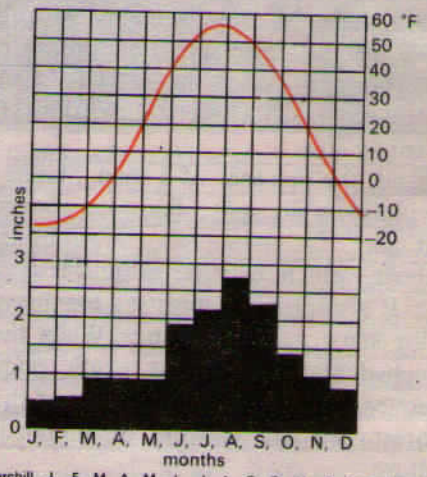
The precipitation rhythm can best be grasped from the two representative stations chosen, in Fig. 151 (a) and 151 (b). Moscow with an annual precipitation of 21 inches has most of the rainfall concentrated in the warmer months (June—September). There is no month without some form of moisture. In a region



Moscow	J	F	M	A	M	J	J	A	S	O	N	D	range / total
Temp.	12	15	24	38	53	62	66	63	52	40	28	17	54°F
Precip.	1.1	0.9	1.2	1.5	1.9	2.0	2.8	2.9	2.2	1.4	1.6	1.6	21"

Place: Moscow, U.S.S.R. (56°N., 37°E.)
Altitude: 480 feet
Annual precipitation: 21 inches
Annual temperature range: 54°F. (66°–12°F.)

Fig. 151 (a) Siberian Climate in Eurasia



Churchill	J	F	M	A	M	J	J	A	S	O	N	D	range/total
Temp.	-19	-17	-6	14	30	43	54	52	42	27	6	-11	73°F
Precip.	0.5	0.6	0.9	0.9	0.9	1.9	2.2	2.7	2.3	1.4	1.0	0.7	16"

Place: Churchill, Manitoba, Canada (58°N., 94°W.)
Altitude: 44 feet
Annual precipitation: 16 inches
Annual temperature range: 73°F. (54°–19°F.)

Fig. 151 (b) Siberian Climate in Canada.

where overall temperature is low, evaporation is not rapid and the relative humidity is high, this small amount of precipitation is adequate for tree growth. The conifers, which require little moisture, and transpire an equally small amount, are best suited to this type of sub-Arctic climate.

In Churchill, Fig. 151 (b), the annual precipitation is just 16 inches with a distinct summer maximum.

The total precipitation of the Siberian climate is determined by such factors as altitude, latitude, proximity to the poles, amount of exposure to influences by Westerlies, (on western parts of continents), temperate monsoons (on the eastern parts of continents) and the penetration of the cyclones. European U.S.S.R. usually has more than 20 inches of annual precipitation because of some on-coming Westerlies and the periodic penetration of cyclones. Eastern Siberia also has over 20 inches, being moistened by the S.E. Monsoon from the Pacific Ocean. Central Siberia and Canada have about 15 inches, due to their continentality and lack of sea influence. Polewards and southwards, the amount again decreases to only 12 inches or less. The cold, dry air of the north is incapable of holding moisture, and in the south are the semi-arid steppes.

Snow falls nearly everywhere in U.S.S.R. in the long, cold winter. The amount varies from place to place. It is heaviest in the northern tundra and in the Siberian taiga, where a thickness of several feet is common. Permanent snowfields like those of the Alps or the Himalayas are absent, because any accumulation of snow is melted with the return of spring and the warm summer. Frozen rivers are thawed, causing a rise in the water level and extensive floods occur. The lower courses of the Ob, Lena and Yenisey are marshy and ill-drained. On the other hand, the presence of a thick mantle of snow is not without its blessings. Snow is a poor conductor of heat and protects the ground from the severe cold above, which may be as much as 30°-50°F. colder! It also provides moisture for the vegetation when the snow melts in spring. When the ground is ploughed and the leached, acidic podzolic soil is improved, the continental interiors of the coniferous forest belt are capable of supporting some agriculture.

Natural Vegetation

No other trees are so well adapted as the conifers to withstand such an inhospitable environment as the Siberian type of climate. The coniferous forest belts of Eurasia and North America are the richest sources of softwood for use in building construction, furniture, matches, paper and pulp, rayon and other branches of the chemical industry. The world's greatest softwood producers are U.S.S.R., U.S.A., Canada and the Fenoscandian countries (Finland, Norway and Sweden). In the production of wood pulp (by both chemical and mechanical methods), the U.S.A. is the leader. But in the field of newsprint, Canada has outstripped all other producers, accounting for almost half of the world's total annual production. The more accessible coniferous forests have reached the limit of production but the relatively inaccessible taiga of Siberia will remain the richest reserve of temperate softwood.

There are four major *species* in the coniferous forests.

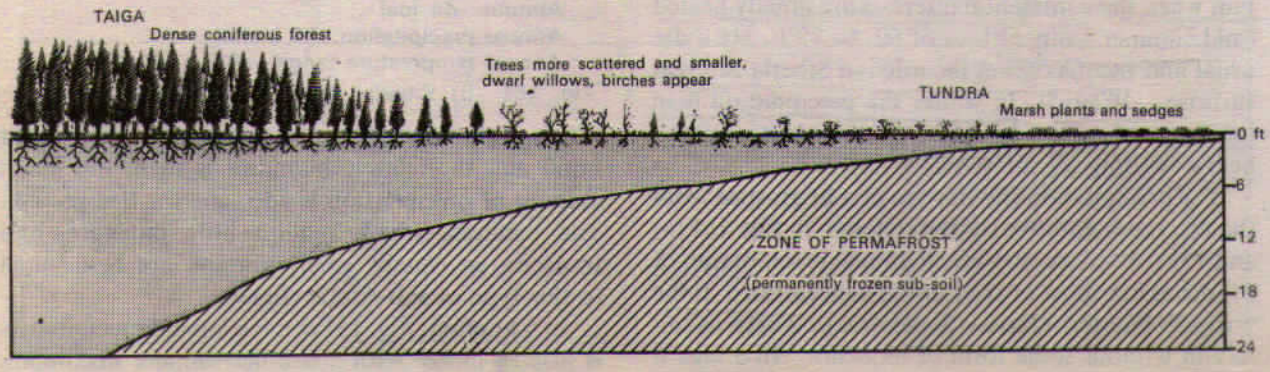
1. Pine, e.g. white pine, red pine, Scots pine, Jack pine, lodgepole pine.
2. Fir, e.g. Douglas fir and balsam fir.
3. Spruce.
4. Larch.

Their presence in pure stands and the existence of only a few species are a great advantage in commercial forest exploitation.

Coniferous forests

1. Coniferous forests are of moderate density. Unlike the equatorial rain forests which are luxuriant and contain trees of various heights, the coniferous forests are more uniform and grow straight and tall, up to a height of about 100 feet. Where the poleward limit of tree growth is approached the trees are widely spaced, and give way to tundra vegetation (Fig. 152).

Fig. 152 Diagram to show changes in vegetation in journey Polewards from the Taiga Zone



Coniferous forests on the eastern Rockies, Alberta, Canada *National Film Board of Canada*

2. Almost all conifers are evergreen. The low annual temperature with more than half the year below the growing-point temperature of 43°F., means that evergreens are at an advantage. Growth can begin as soon as growing-point is reached in spring. The conifer has a two-year fructification cycle. The seeds are pollinated in one year and dispersed in the following year. There is no annual replacement of new leaves as in deciduous trees. The same leaf remains on the tree for as long as five years. Food is stored in the *trunks*, and the bark is thick to protect the trunk from excessive cold.

3. Conifers are conical in shape. This is another adaption to survive the sub-Arctic climate. The sloping branches prevent snow accumulation which may snap the branches. It also offers little grip to the winds.

4. Leaves are small, thick, leathery and needle-shaped. This is to check excessive transpiration. The leaf surface is reduced to the minimum, as transpiration can be quite rapid in the warm summer due to intense continental heating.

5. There is little undergrowth. The podzolized soils of the coniferous forests are poor. They are excessively leached and very *acidic*. The evergreen leaves provide little leaf-fall for humus formation, and the rate of decomposition of the leathery 'needles' in a region of such low temperature is slow. All these factors are deterrents to the growth of much undergrowth. Absence of direct sunlight and the short duration of summer are other contributary factors to a sparse undergrowth, but where trees are widely spaced near the tree-line, heath and tundra plants cover the intervening ground.

Besides the continental interiors of the higher latitudes, coniferous forests are also found in other climatic regions wherever altitude reduces the temperature. The conifers are, in fact, the dominant trees of the mountainous districts in both the temperate and tropical countries. But on very steep slopes where soils are immature or non-existent, even the conifer cannot survive.

Economic Development

The coniferous forest regions of the northern hemisphere are comparatively little developed. In

Canada, eastern Europe and Asiatic Russia, large tracts of coniferous forests are still untouched. Only in the more accessible areas are the forests cleared for lumbering. The various species of pine, fir, larch and spruce are felled and transported to the saw-mills for the extraction of temperate soft-woods. There is little agriculture as few crops can survive in the sub-Arctic climate of these northerly lands. The long, cold winter, the frozen soils and the low mean annual temperature throughout the year exclude all but the hardiest crops. Only in the more sheltered valleys and the lands bordering the steppes are some cereals (barley, oats, rye) and root crops (potatoes) raised for local needs. Many of the Samoyeds and Yakuts of Siberia, and some Canadians are engaged in hunting, trapping and fishing. We shall deal with two of the major activities in greater detail.

1. Trapping. Many fur-bearing animals inhabit the northerly lands of Canada and Eurasia. Wherever the cold is keenest, the quality and thickness of the fur also increases. Consequently, the most severe winters produce the finest furs which fetch the highest prices. In Canada trappers and hunters, armed with modern automatic rifles, reside in *log cabins* in the midst of the coniferous forests to track down these animals. Their lives are hard and precarious at times, but the rewards are great if the 'harvests' are good. Muskrat, ermine, mink, and silver fox are the most important fur-bearing animals sought after in Canada. The Hudson Bay Company has many stations scattered in the northern regions to trade in furs with the Canadian trappers and hunters. To ensure a more regular supply of furs many fur farms have been established in Canada. Animals such as the silver fox and ermine are kept in captivity, and skinned when the furs reach a marketable stage. They fetch high prices in sophisticated cities like New York, London, Paris, Rome and Zurich, where the pelts are processed as attractive fur coats and women's handbags. In Siberia other fur-bearing animals are trapped. These are squirrels, otters, bears, sables, lynxes, martens, and foxes. As in Canada, fur-farming has now replaced hunting of wild animals in many parts of Siberia as the main source of furs.

2. Lumbering. This is probably the most important occupation of the Siberian type of climate. The vast reserves of coniferous forests provide the basis for the lumbering industry. The trees are felled for many purposes.

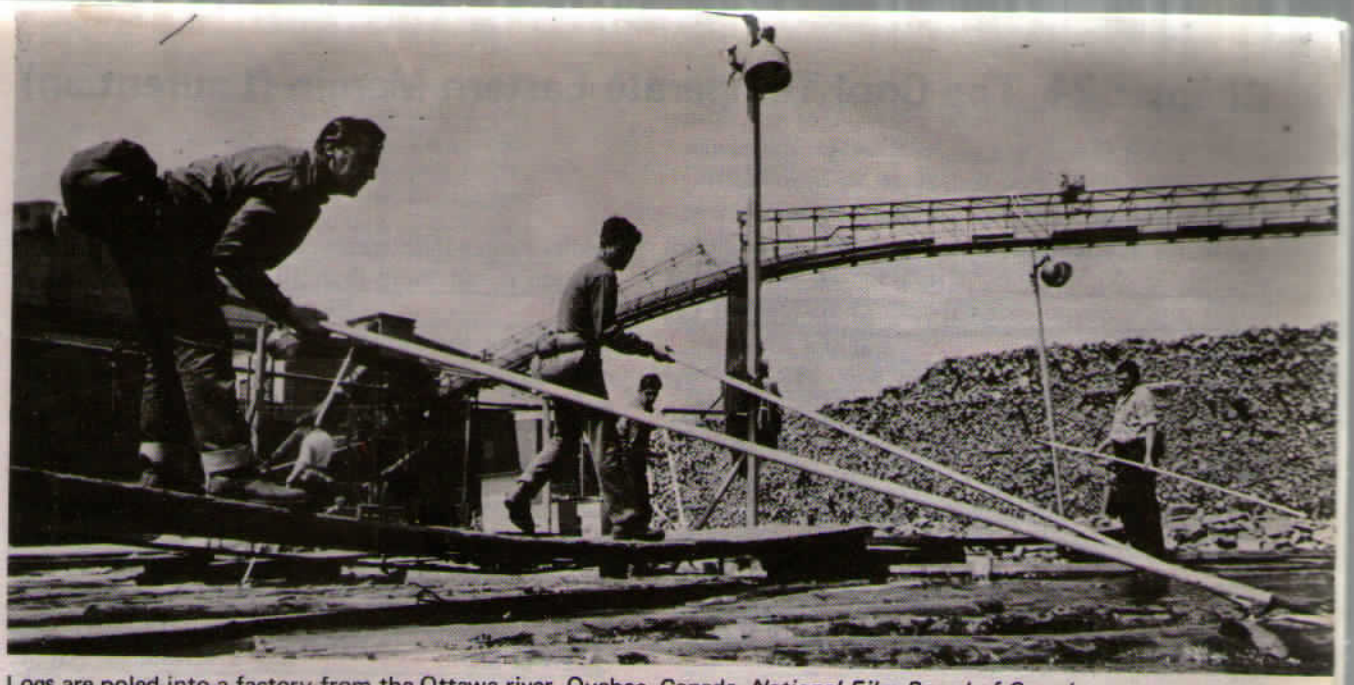
(a) Saw-milling. This processes the logs into sawn timber, plywood, planks, hardboard and other constructional woods.

(b) Paper and pulp industry. Timber is pulped by both chemical and mechanical means to make wood pulp the raw material for paper-making and newsprint. The development of the printing industry has made paper and pulp indispensable. Canada and U.S.A. are leading producers of the world's supplies of newsprint and wood pulp respectively.

A lumberjack uses a power-saw to cut up a fallen tree, Quebec, Canada *National Film Board of Canada*

(c) As a fuel. Less than a quarter of the world's softwood is burnt as fuel, because its industrial uses are far more significant. In contrast, almost three-quarters of the world's hardwoods are burnt as fuel, particularly tropical hardwoods where the trees occur in mixed stands.

(d) As an industrial raw material. Timber has a wide range of uses. In Sweden, matches form a major export item. From other temperate countries, timber is used for making furniture, wood-carvings, toys, crates and packing cases. From the by-products of the timber, many chemically processed articles are derived such as rayon turpentine, varnishes, paints, dyes, liquid resins, wood-alcohols, disinfectants and cosmetics.



Logs are poled into a factory from the Ottawa river, Quebec, Canada *National Film Board of Canada*

of the coniferous forests is characterized by the following features.

1. The conifers are limited in species. Pine, spruce and fir are the most important in the northern forests, while larch is more predominant in the warmer south. They occur in homogeneous groups and not mixed as in the tropical forests. This not only saves time and costs, but also enchances the commercial value of the felled timber.

2. In these northerly latitudes, agriculture is almost impossible and lumbering replaces farming in the continental interiors. Even where crops are cultivated, farmers are idle in the winter months and can supplement their income by doing part-time lumbering in the forests, as they do in most parts of Europe.

3. Lumbering is normally carried out in the *winter* when the sap ceases to flow. This makes felling much simpler. The snow-covered ground also makes logging and haulage a relatively easy job. The logs are dragged to the rivers and float to the saw-mills downstream when the rivers thaw in spring. This has greatly assisted the development of the lumbering industry in eastern Canada and Sweden. Unfortunately, over the greater part of Siberia, all the rivers drain polewards into the Arctic Ocean which is frozen for three-quarters of the year, and there are few saw-mills there. With the use of the Northern Sea Route, which links Murmansk and Vladivostok via the Arctic Ocean, development is increasing. Cheap hydro-electricity for driving the saw-mills is harnessed in the mountainous uplands of North America and Europe and has greatly assisted the lumbering industry.

QUESTIONS AND EXERCISES

1. Compare and contrast deciduous forests and coniferous forests in respect of the following.
   (a) distribution
   (b) vegetational characteristics
   (c) climatic influence
   (d) economic development

2. Distinguish between hardwoods and soft-woods. What industrial uses are made of them? Account for their large scale production for export in any one country.

3. Give a reasoned account of any *three* of the following.
   (a) The annual temperature range of Moscow is 54°F.
   (b) The annual precipitation of Leningrad is not more than 19 inches.
   (c) The lower courses of the Siberian rivers are frozen for as long as seven months.
   (d) One of the coldest spots on the globe, is Verkhoyansk with a record lowest temperature of –90°F.

4. What is meant by
   (a) the taiga
   (b) the veld
   (c) the selvas

Account for the distribution and characteristics of any *two* of them.

5. Describe the role played by forest products in the economy of *either* Canada *or* Sweden.