Distribution

The size and spatial distribution of the ecozones is shown in Fig. 1.1 and Table 1.1 and in the regional chapters.

Table 1.1. Areal extent of the ecozones

Ecozones – **Sub-ecozones**	**Area** million km^2	**Landmass** (%)
Polar subpolar	22.0	14.8
– *Ice deserts*	*16.0*	
– *Tundra and areas of rock and frost debris*	*6.0*	
Boreal	19.5	13.1
Temperate midlatitudes	14.5	9.7
Dry midlatitudes	16.5	11.1
– *Grass steppes*	*12.0*	
– *Deserts and semi-deserts*	*4.5*	
Subtropics with winter rain	2.5	1.7
Subtropics with year-round rain	6.0	4.0
Dry tropics and subtropics	31.0	20.8
– *Deserts and semi-deserts*	18.0	
– *Winter-wet grass and shrub steppes (subtropics)*	*3.5*	
– *Summer-wet thorn savanna (tropics) and thorn steppes (subtropics)*	*9.5*	
Tropics with summer rain	24.5	16.4
– *Dry savanna*	*10.5*	
– *Moist savanna*	*14.0*	
Tropics with year-round rain	12.5	8.4
Total area	149.0	100.0

The boundaries of the ecozones entered on the distribution maps adhere to the climatic zone structuring of the earth according to Troll and Paffen (1964), which do more justice to the earth zone's differentiation between vegetation and further natural characteristics than other effective climate classifications.

Nevertheless, their application for the drawing up of the ecozone remains makeshift, which in view of the fact that this book is primarily concerned

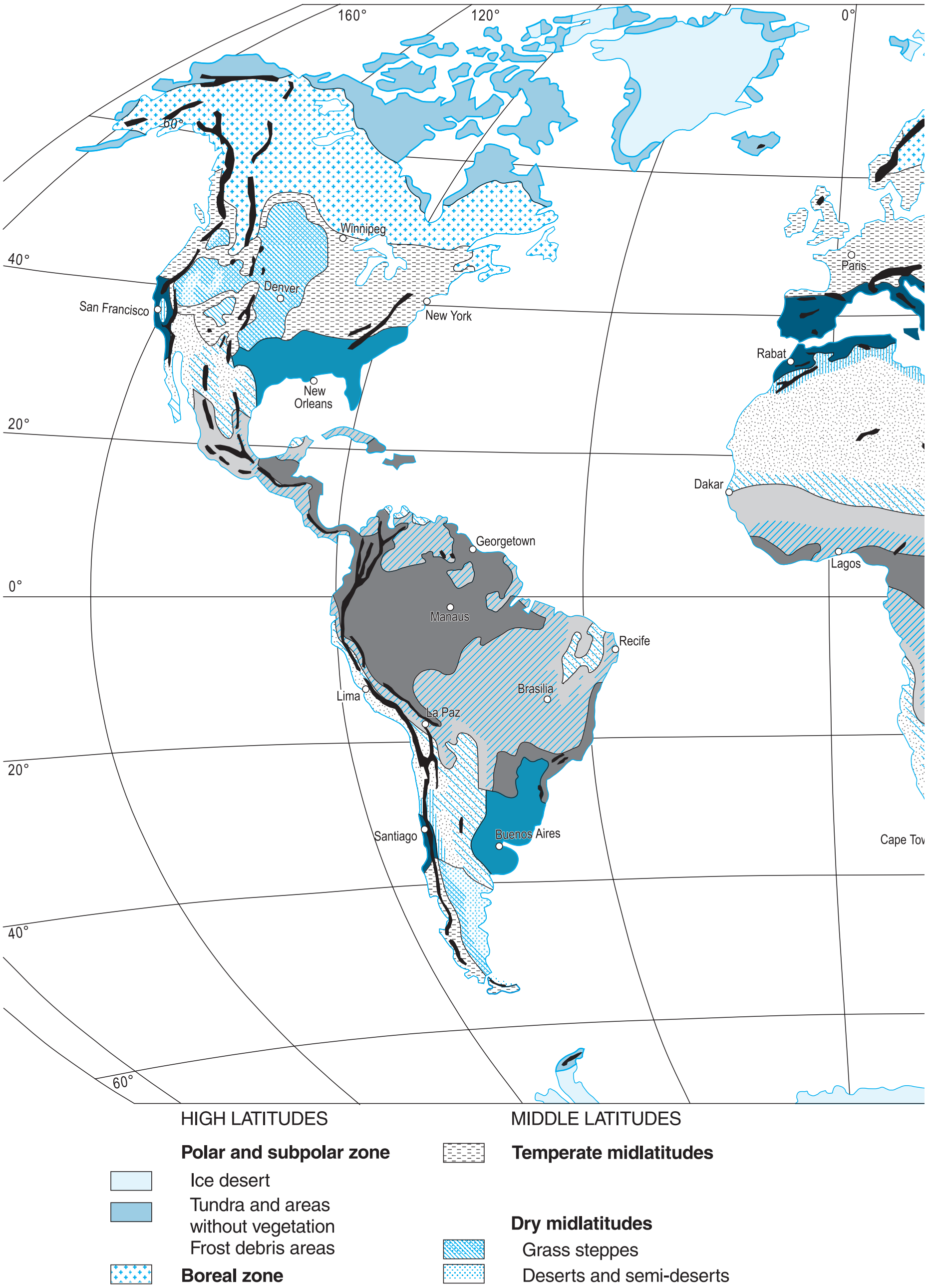
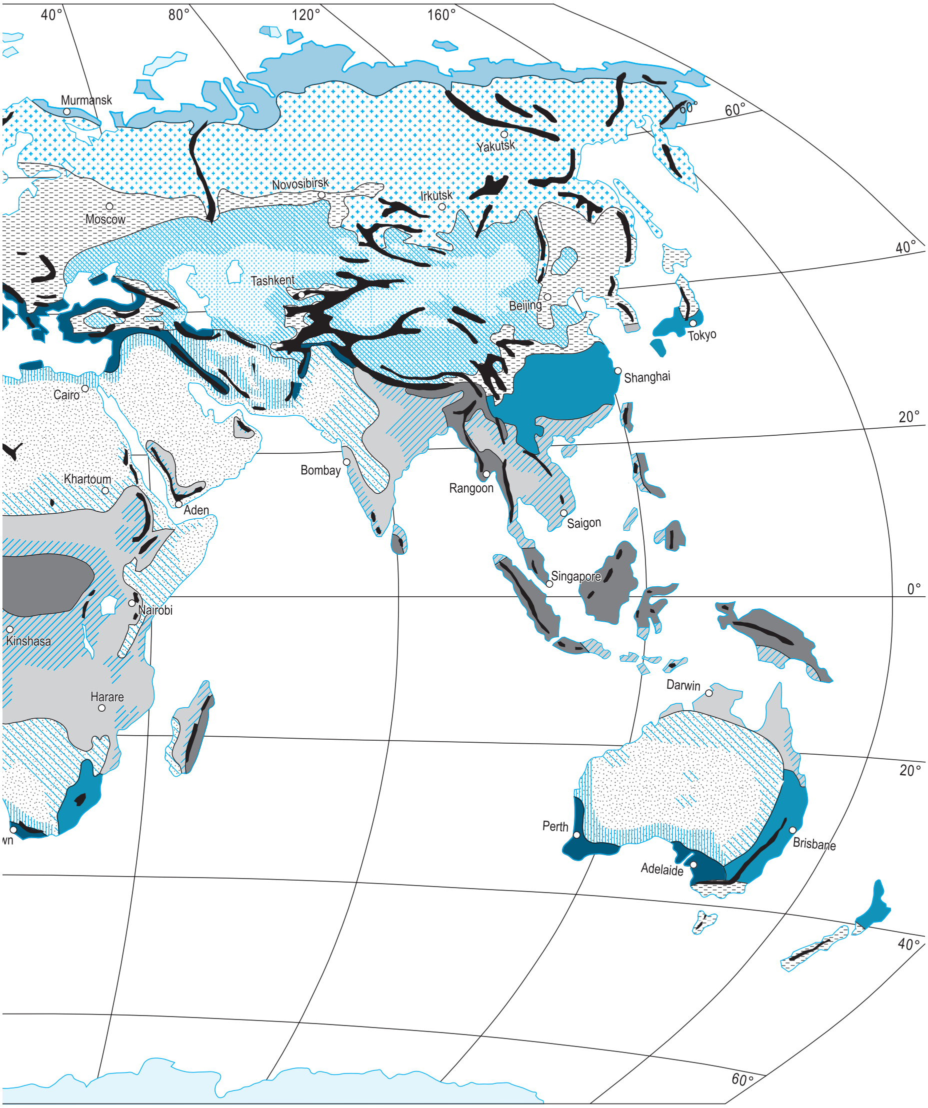


Fig. 1.1. Distribution of the ecozones of the world



SUBTROPICS AND OUTER TROPICS

Subtropics with winter rain

Subtropics with year-round rain

Dry tropics and subtropics

Deserts and semi-deserts

Grass and shrub steppes with winter rain

Thorn savanna and steppes with summer rain

TROPICS

Tropics with summer rain

Dry savanna

Moist savanna

Tropics with year-round rain

Uplands and mountains

with the mean qualities of the ecozones renders the external boundary of less consequence and has to be accepted for the interim. Larger areas which are difficult to classify (e.g. thorn savannas) are referred to as “transitional areas” (Fig. 13.1 and Fig. 14.1).

Climate

Climate provides the broad framework for the exogenic geomorphological processes, soil formation, plant growth and land use potential and is of fundamental importance in helping to define the character of an ecozone. Solar radiation and the length of the growing season are of particular importance for vegetation because radiation is the energy source for photosynthesis and determines the growing season length and therefore also the annual primary production of the vegetation.

The mean values of climatic data have only a limited usefulness for interpreting the effects of climate in an area. At least as important are the data on extreme events and their frequency, for example, data on precipitation intensities, the frequencies of extended periods of drought, strong winds, periods of intense cold and freeze thaw cycles. Also the micro climatic conditions within a small area and even within a plant cover may differ considerably from the climate for the ecozone as a whole.

2.1 Solar radiation

Global radiation is defined as the radiation with a shortwave range from about 290 to 3,000 nm that reaches the earth's surface as direct or diffused radiation (Fig. 2.1). The *photosynthetic active radiation (PAR)*, the radiation usable by plants, lies between 400 and 700 nm, the range for visible light. About half the energy from global radiation lies within these wave lengths.

The peak mean monthly radiation is similar in all ecozones (Fig. 2.2). Differences in annual growing season totals are caused by variations in the duration of the peak radiation and by variations in the time span within which plants can make use of the radiation energy they receive which, in turn, depends on their requirements for moisture and heat.

The *length of day* and its pattern of change throughout the year also affects the duration of the daily radiation. Ecozones in the middle and high latitudes are characterized by long hours of daylight and warmth in summer and by cold and darkness for long periods in winter. The low latitudes, by contrast, show little or no seasonal radiation and thermal differences. Energy transfers at the surface are shown in Box 1.

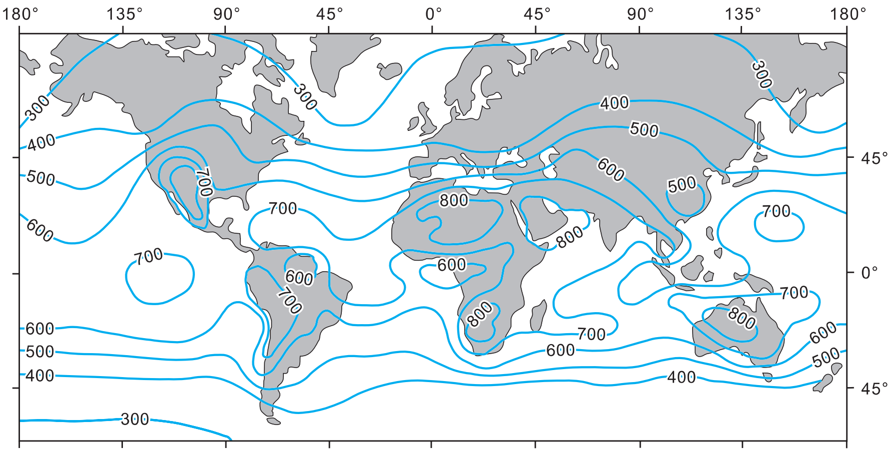


Fig. 2.1. Annual global radiation 10^8 kJ ha^{-1}. Source: De Jong 1973. Based on the uptake of this radiation it is possible to approximate primary production in the individual ecozones (Tab. 5.2)

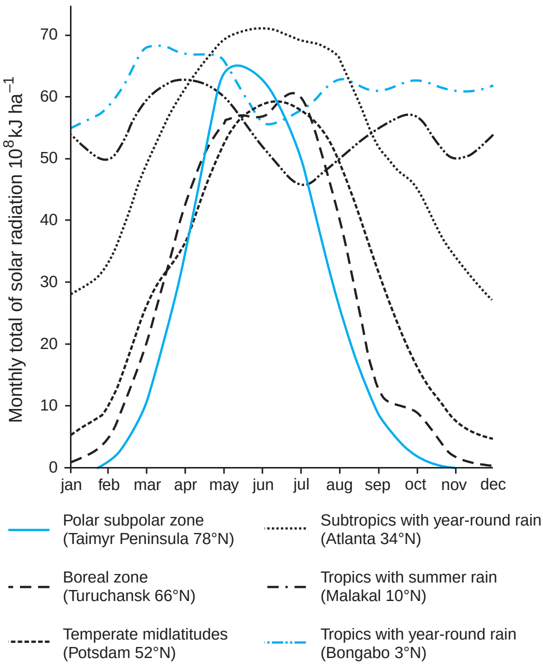


Fig. 2.2. Annual distribution of global radiation at weather stations in six ecozones

1

Simplified radiation (or energy) balance.[a]

$$(Q + q) \times (1 - \alpha) - A + G = LE + H$$

$(Q + q) \times (1 - \alpha)$ $-A + G$ = radiation balance (net radiation)	Q = direct solar radiation; q = diffuse radiation (downscatter)	$Q + q$ = global radiation of which < 50% in photosynthetically active radiation (PAR)	$(Q + q) \times (1 - \alpha)$ = absorbed short wave radiation (= net insolation)
	α = reflected radiation as % of global radiation	= albedo	
	A = outgoing radiation (longwave); G = counter radiation from within atmosphere (longwave)	= temperature or heat radiation	$A - G$ = effective longwave outgoing radiation (= net outgoing radiation)

LE = latent heat fluxes, LE is the transfer of heat energy connected with the state of water without changing the temperature, that is energy required for evaporation[b], melting[c], and/or release of heat by condensation and freezing (in immediate transition from solid to gaseous or solid state or vice versa: heat of sublimation)

H = sensible heat fluxes H is the temperature effective transfer of heat energy by molecular conduction at interfaces, includes heat transfers to and from the soil or snow cover to or from the atmosphere

[a] Lateral advective transport of energy, reflection of longwave counter radiation and photosynthetic energy fixed by plants are excluded. The latter ranges in terrestial areas from near zero in deserts to 0.8% in tropical rainforests of the global radiation.
[b] Energy required for evaporation or energy released by condensation of 1 g H_2O at 20 °C and normal pressure at sea level is 2.45 kJ
[c] Energy required to melt 1 g of ice or the energy released by freezing of 1 g H_2O is 0.17 kJ.