

By Robert G. Bailey, USDA Forest Service, Inventory & Monitoring Institute

Ecological Climate Classification

It's more than the mean monthly temperature of January or the mean annual precipitation

Information about climate is fundamental to an assessment of the land's capability and suitability for various kinds of use. Areas of uniform climate are also used to identify ecosystem units because climate acts as the primary input of energy and moisture into the system. As the climate changes, the kinds and patterns of dominant life forms of plants and animals change, as do the kinds of soils. Ecosystems of different climates differ significantly.

Large volumes of climatic data exist in databases or as data layers in geographic information systems. Such raw data has not been synthesized into ecological climate classes that are useful for ecological analysis. There are a number of concepts that must be understood to arrive at an ecological classification of climate. These include:

Weather refers to the condition of the atmosphere during a brief period of time

Climate generalized statement of the prevailing weather conditions at a given place, based on statistics of a long period of time.

Elements of climate e.g., solar energy, temperature, and precipitation-humidity

Climatic regime seasonality of temperature and moisture.

Ecological climate classification climate classes that correlate closely with the distribution of ecosystems. Many ecoclimatic classifications have boundaries that are primarily determined by vegetation. From a scrutiny of such attempts the following conclusions may be drawn.

- 1) The boundaries of ecoclimate zones may coincide with certain climatic elements. For example, the poleward limit of the boreal conifer zone corresponds roughly with the 10C (50F) isotherm for the warmest month. The 18C (64F) isotherm of the coolest month approximates the position of the boundary of the poleward limit of plants characteristic of the humid tropics, such as palms. *Generally speaking,*

however, it is a combination of factors rather than a single climatic factor that determines such boundaries and this is more in line with the concept of ecological climate.

- 2) The climatic factors, which delimit the main types of world vegetation, must be treated as complex. Temperature and precipitation must be treated together, for example, in order to define the concept of drought. Drought is not just a matter of precipitation. A given amount of rainfall may produce a humid climate under temperate conditions, whereas the same amount of rainfall may produce arid conditions in hot zones.
- 3) Certain major factors must be used to delimit the major ecoclimatic zones, for example, the continuous high temperatures of the tropical lowlands, the deficiency of heat in the cold zone, and the lack of precipitation in the arid zone.
- 4) Differences in climatic regime, defined as the diurnal and seasonal fluxes of energy and moisture, are used to define ecosystem boundaries. One can illustrate different climatic regimes by studying climate diagrams, or climographs. For example, tropical rainforest climates lack seasonal periodicity, whereas midlatitude steppe climates have pronounced seasons. Climate diagrams show temperature and precipitation values but also the duration and intensity of relatively humid and relatively arid seasons, the severity of a cold winter, and the possibility of late or early frosts. With this information, it is possible to judge the climate from an ecological standpoint.
- 5) Seasonality of precipitation affects the potential distribution of vegetation and should be considered in setting up ecoclimatic zone. Within the arid zone, for example, deserts that receive only winter rain (Sonoran Desert) can be distinguished from those that receive only summer rain (Chihuahuan Desert). Within the steppe zone, a semiarid steppe (short-grass prairie) climate that has a dry summer season and occasional drought can be distinguished from an arid semi desert (sagebrush) climate that has a very pronounced drought season plus a short humid season. The Great Plain grasslands are associated with the near absence of winter rains and the presence of spring rains.
- 6) The delimitation the ecological climates must also incorporate a consideration of the degree of dryness or cold as they also affects the distribution of vegetation. For example, the vegetation of the tropical savanna (wet-dry tropics) is highly differentiated relative to variation in length of the dry season. A southern (coniferous) forest climate and northern (forest-tundra) climate can be distinguished within the Subarctic Division of the Polar Domain on the basis of temperature differences.
- 7) Perhaps the most durable of the climatic classifications used in ecology is that proposed by Köppen (1931). Building on ideas of an earlier bioclimatologist, de Candolle (1874), Köppen made careful observations of the climatic conditions

required for the growth of various groups of plants, and the related variations in vegetation to temperature and precipitation.

- 8) Local variations in climate are reflected in landform and its ecological ties with vegetation. Local variation in landform (geology and topography) will cause small-scale variations in the amount of solar radiation received, create topoclimate, and affect the amount and distribution of soil moisture. These variations will subsequently be reflected in the *natural* pattern of vegetation across the landscape. In fact, the relationship between these natural patterns and climate can be used to extend data from climate stations to analogous sites within the same zone. This is a process climatologists use to extrapolate their point measurements.

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