

APARTADO 8-3870

TEL. 22-62-41

SAN JOSE, COSTA RICA

CABLE: SCIENCE

The life zone diagram or chart was constructed originally to show the relationship between the ecosystems in the southeastern mountains of Haiti and those of the surrounding regions. The chart is essentially an outgrowth or continuation of the excellent global classifications of Schimper and Warming. My major contributions were to change temperature readings to biotemperature, incorporate the pattern of logarithmic increases of factors and design the chart with its hexagonal pattern of life-zones.

The principal biotemperature guidelines and their values are shown as the horizontal lines which cross the diagram. The values in degrees Celsius are mean annual biotemperatures. These are the means of air temperatures between 0° and 30° C. Obviously, all vegetation is inactive at temperatures below freezing so that negative values should be eliminated for a valid classification.

The elimination of temperatures over 30° C is less obvious but readily comprehensible. As temperatures rise to approach 30°, respiration increases rapidly until it equals photosynthesis so that net photosynthesis or growth becomes zero. Different species probably have different cut-off values, but we have found that 30° C, based on the work of David Gates and observations in the tropical and subtropical regions, is a good approximate general value. Biotemperatures are occasionally somewhat awkward to calculate but meteorological stations could provide biotemperature values easily if so requested.

The logarithmic increases of the guide line values for mean annual precipitation as noted on the lines which run from lower left to upper right and those of

biotemperature were suggested by the Law of Liebig as applied to fertilizer applications. In the diagram the factors in short supply in the deserts and cold regions are water and heat, respectively. The uniform doubling across the chart in two directions provides the correct framework for the delineation of hexagons or life zones of equivalent climatic or ecological weight.

There are a few other characteristics of the diagram or first level of the life zone system which I wish to mention. One is that the third set of guide lines which delineate the humidity provinces have values which represent the ratio of potential evapotranspiration divided by precipitation. Mean annual values in mm of the former may be obtained by multiplying mean annual temperatures by 58.93. C.W. Thornthwaite's concept of potential evapotranspiration was found to be a real help in correctly incorporating humidity within the chart.

The altitudinal belts listed at the right between the same biotemperature guidelines which delineate latitudinal regions north or south of the equator indicate that the same diagram may be utilized, also, wholly or in part in the vertical sense so as to determine thereby the latitudinal region, altitudinal belt and specific life zone. Thus, both latitude and elevation are taken into account in classifying sites at the first level.

One of the more interesting features of the diagram is the horizontal line cutting right across a set of hexagons which is labeled the "Frost or Critical Temperature" line. Basically this implies that we have consolidated in one diagram, the two different sets of vegetation of the world, one above the line, which is hardy and can survive low temperatures and the other which is sensitive and eliminated from areas of low temperature.

Because man is primarily interested in specific crops or species, the upper and lower portions of the bisected hexagons have been classified as distinct latitudinal regions and altitudinal belts. However, from a physiognomic point of

view there is apparently no important difference between the vegetations on similar sites, as per climate and soils, of the premontane and lower montane elevational belts and of the subtropical and warm temperate latitudinal regions.

The second level of the life zone system incorporates other climatic or atmospheric variations and the edaphic factors, such as, for example, seasonal distribution of precipitation, mist condensation, salinity or drainage. We presented an outline of the various conditions which can all give rise to distinct ecosystems or associations within individual life zones at the VII FAO World Forestry Congress in 1972. When the same condition occurs in two separate life zones, the communities of vegetation are distinct anyway. As a result there are a multitude of ecosystems to differentiate or map if one starts on this level.

Because most vegetation mapping is carried out at this second level, a great number of different classifications or sets of names have been utilized by different workers and these are not readily intelligible to workers in other biogeographical regions or even in other countries within the same region.

The first level of the life zone system, being objective and of world-wide applicability, could serve as a framework for helping to identify regional ecosystems and thus facilitate communication between scientists around the world. In other words, the first level of the life zone system alone is not satisfactory for planning work, but the second or ecosystem level is composed of such a great number of natural vegetative covers in the world that if one tries to work on that level alone, he cannot really progress far for lack of an organizational framework.

When there is interest in land-use planning and management, there is a need for still another level, namely, the third level which can incorporate either the seral stage of the natural vegetative cover or the actual land use of the area such as the cultivation of grain, an improved pasture or urban development.

Costa Rica, for example, of approximately the size of West Virginia (50,000 km²) has over 1000 tree species alone in its natural vegetation. There are 12 life zones and a great number of ecosystems or associations, of which a high percentage actually consist of several stages of regrowth or a considerable variety of land-uses. The backdrop for land-use mapping is obviously very complex.

One method of preparing maps of potential or desirable land use is to start with the life zone mapping and then subdivide the life zones into ecosystems or associations or even in ~~the~~ some cases to groupings of associations. One is then left with the task of suggesting the proper land use, if not already in practice.

One of the major problems of the above system, which will become more serious with the passage of time is that more and more of the natural vegetation of the earth is being removed. Thus, from either the plant species approach to local vegetation associations or from the physiognomic point of view of classification into similar units the lack of natural cover is becoming an increasing problem.

Because of that problem Dr. J.A. Tosi, Jr., of our Center has developed a system which involves the division of the life zones of an area into landscape units. The latter are determined by two factors, the surface geology and geomorphology. The former is normally available from geological and soil surveys even though with different degrees of accuracy. The latter may be outlined from remote sensing photographs either from aerial or satellite levels.

As an example, a Darien project map of northwestern Colombia is shown. This is an area of 25,000 km² which was completed in 5 months by Tosi and a field crew of 2 field assistants. Five life zones and 3 transitional areas between zones were mapped. Those were divided into a number of landscape units--identified on the maps by letter symbols for 5 divisions of surface geology and 14 geomorphology units. The symbols are shown as a ratio with the life zone indication above and the landscape unit beneath.

Given a life zone chart and this map, scientific workers in other parts of the world should be able to understand the ecological situations outlined and if located in the tropics in either hemisphere should be able to compare the units with local areas in their own countries.

San Jose

Costa Rica

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L. R. Holdridge

Ecologist

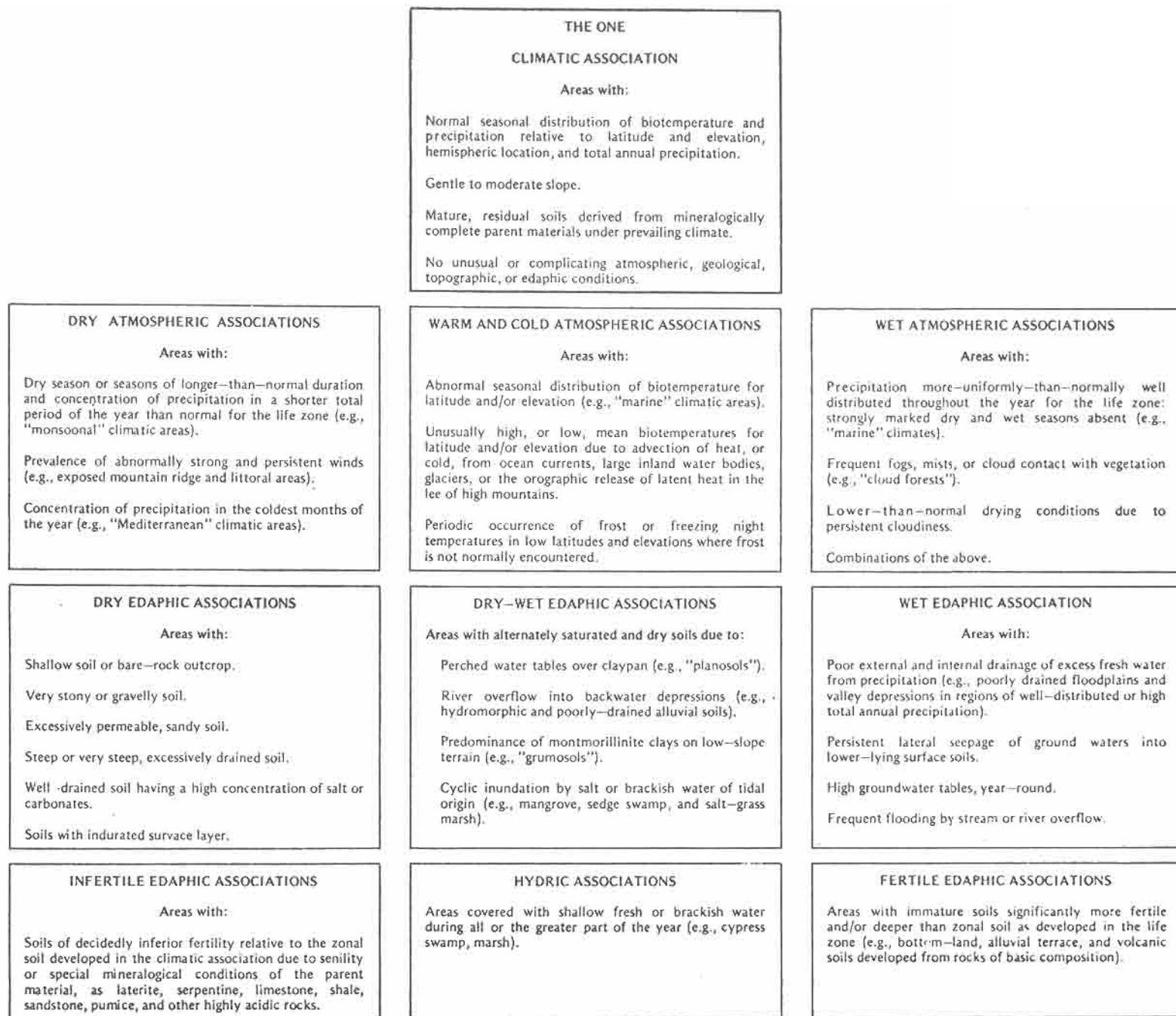


FIGURE 2 Diagram showing the relationship of the possible major categories of Associations to the One Climatic Association within a Life Zone.

DIAGRAM FOR THE CLASSIFICATION OF WORLD LIFE ZONES OR PLANT FORMATIONS

by L.R. Holdridge

