

LIFE-FORMS OF ILLINOIS PLANTS

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INTRODUCTION

General Concept

A plant, growing under natural outdoor conditions, is continually being acted upon by numerous and varying environmental stimuli. As a response to these surrounding influences the plant assumes a certain external appearance or form which has been termed the "life-form."

Historical

Miss Ennis [3], in her work upon the Connecticut flora, discusses fully the history of the life-form concept from the time of Theophrastus to the present day. Only a brief summary need be given here.

The *form* of the plant was first considered chiefly from the viewpoint of systematic classification. Although environmental relationships were recognized by the early botanists they were not thought to be important, and very little attention was devoted to them. In 1805, however, Humboldt pointed out the relationship of physiognomy to distribution, and showed that the vegetation of two regions with similar environment was similar in form.

Later, Warming noted certain characteristics of the individual plant which adapted it to its surroundings and which could be set apart from those characteristics of plainly taxonomic value. Thus the form of the plant as caused by the action of environmental factors was recognized, and the concept of the "life-form" elaborated.

Warming and other workers in the ecological field (Drude, Pound and Clements, Raunkiaer, and Gams) have developed systems for the classification of plants according to their life-form characteristics. The most widely used of these systems is that of the Danish botanist, Raunkiaer, presented in detail in 1905 (*Bull. Acad. Roy. d. Sci. de Denmark*, pp. 347-437).

Raunkiaer's Life-Form System

Raunkiaer's system for the classification of plants according to their life-forms has as its fundamental idea a representation of the climate of a region as evinced by the character of the plant life of that region. The varying degree of protection afforded to the perennating or dormant bud is considered as the adaptive feature, and with this as a basis the following five classes of plants are recognized:

1. Phanerophytes (Ph). Trees and shrubs, the perennating buds are freely exposed; characteristic of tropical and sub-tropical regions.
 - a. Megaphanerophytes (Mg). 30 m. or more in height.
 - b. Mesophanerophytes (Ms). 8 m. to 30 m. in height.
 - c. Microphanerophytes (M). 2 m. to 8 m. in height.
 - d. Nanophanerophytes (N). Less than 2 m. in height.
2. Chamaephytes (Ch). Plants with the perennating buds either at the ground level or not more than 25 centimeters above it; characteristic of regions with a long winter period.
3. Hemicytrophytes (H). Plants with the perennating buds in the upper layer of the soil; characteristic of temperate climates.
4. Cryptophytes (C). Plants with the perennating buds in the deeper soil layers or protected by water; characteristic of regions with a season of drought or cold.
 - a. Geophytes (G). Land plants whose perennating buds are buried in the soil.
 - b. Helophytes. Marsh or water plants whose perennating buds are in soil or water.
 - c. Hydrophytes. Submersed aquatics, the perennating buds covered by water. Helophytes and hydrophytes (HH) are usually considered together.
5. Therophytes (T). Annual plants, characteristic of regions of intense heat and also of cultivated areas.

The Life-Form Spectrum

To obtain what is known as the life-form spectrum for a specific region, the flora of that region is classified into the above life-form groups and the percentage of each group is determined. This results in a series of percentages known as the "spectrum." Since the degree of protection offered the perennating bud varies according to the climate of the region under consideration, the percentages of the life-form classes will also vary, and the dominance of a particular life-form class will serve as an index to the general environmental conditions.

Raunkiaer, as summarized by Smith [12], recognizes three climatic zones:

1. Tropical regions with uniform high temperature and varying humidity; dominated by phanerophytes.

2. Regions of decreasing warmth correlated with differences between summer and winter, but where the precipitation is usually favorable for plant growth; dominated by hemicryptophytes.
3. Regions of further decreasing warmth and less precipitation; dominated by chamaephytes.

The Normal Spectrum

In order to have some standard as a basis for comparison, Raunkiaer has devised what he calls the "normal spectrum." This is best summarized in the words of Smith [12] as follows:

"The normal spectrum is the base-line, and the outstanding features of the other spectra are deduced by comparison, not by the highest percentages in their own curves, but by the amount of variation from the normal spectrum. The latter is, ideally, the phyto-climatic spectrum of the whole earth; actually it is obtained by computation and at present is given only as approximate. It was arrived at by first selecting one thousand representative species, and then taking four hundred of these which were carefully analyzed." (See Table II and fig. 2.)

Methods of Investigation

In working out a complete life-form spectrum for a given region it becomes necessary to consider the entire flora of that region from the standpoint of its classification into the various life-form groups. The first phase of the work, therefore, consists in the compilation of a list of plants native to the area under consideration. Such a list of the plants of Illinois was derived from the catalogs and manuals available [1, 4, 5, 7, 8, 10], and although doubtless incomplete, it is probably representative. As Miss Ennis has found that the inclusion of naturalized species "does not materially alter the spectrum," they may be left out of consideration.

In order to make life-form studies of the floras of various portions of the State, Illinois has been somewhat arbitrarily divided into four regions termed respectively: north, central, mid-south, and south, as shown on the accompanying map, figure 1. The division lines have not all been made horizontally across the State, but for the south and mid-south regions have been determined by the last killing frosts of spring and the first killing frosts of autumn [11].

The distribution of the plants in each of these four regions was determined as far as possible from the lists and floras consulted. Where the distribution was doubtful or could not be determined from these sources further data were obtained from examination of material in the herbarium of the University of Illinois.

In the determinations of the life-forms of the various species, free use has been made of previous work upon the subject, of the manuals, and also of the herbarium material. Some determinations are doubtless



FIG. 1. Map of Illinois showing the north, central, mid-south and south regions.

inaccurate, for there was no opportunity to do extensive field work, but as Miss Ennis points out, "a considerable difference in the determination of the life-forms of a region does not materially alter the deduction as to the outstanding features of climate."

In preparing the spectra the following total numbers of native species have been used: total Illinois flora, 1,734 species; north flora, 1,370 species; central flora, 1,227 species; mid-south flora, 891 species; south flora, 905 species; and a combination of the mid-south and south

