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**1. What Is Ecophysiology?**

Ecophysiology is an ecological science that seeks to describe the physiological mechanisms underlying ecological observations. In other words, ecophysiologicalists, or physiological ecologists, address ecological questions about the controls over the growth, reproduction, survival, abundance, and geographical distribution of plants, as these processes are affected by interactions of plants with their physical, chemical, and biotic environment. These ecophysiological patterns and mechanisms can help us understand the functional significance of specific plant traits and their evolutionary settings.

The questions addressed by ecophysiologicalists are derived from a higher level of integration, i.e., from "ecology" in its broadest sense, including questions originating from agriculture, horticulture, forestry, and environmental sciences. However, the ecophysiological explanations often require mechanistic understanding at a lower level of integration (physiology, biochemistry, biophysics, molecular biology). It is, therefore, quintessential for an ecophysiologicalist to have an appreciation of both ecological questions and biophysical, biochemical, and molecular methods and processes. In addition, many societal issues, often pertaining to agriculture, environmental change, or nature conservation, benefit from an ecophysiological perspective. A modern ecophysiologicalist thus requires a good understanding of both the molecular aspects of plant processes and

the functioning of the intact plant in its environmental context.

## 2. The Roots of Ecophysiology

Plant ecophysiology aims to provide causal, mechanistic explanations for ecological questions relating to survival, distribution, abundance, and interactions of plants with other organisms. Why does a particular species live where it does? How does it manage to grow there successfully, and why is it absent from other environments? These questions were initially asked by geographers who described the global distributions of plants (Schimper 1897, Walter 1974). They observed consistent patterns of morphology associated with different environments and concluded that these differences in morphology must be important in explaining plant distributions. Geographers, who knew climatic patterns, could therefore predict the predominant life forms of plants (Holdridge 1947). For example, many desert plants have small, thick leaves that minimize the heat load and danger of overheating in hot environments, whereas shade plants often have large, thin leaves that maximize light interception. These observations of morphology provided the impetus to investigate the physiological traits of plants from contrasting physical environments (Blackman 1919, Fensholt 1958, Ellenberg 1953, Larcher 1976).