**SUCCESSION, CLIMAX, AND ECOSYSTEMS**

**演替、顶级群落与生态系统**

In the late nineteenth century, ecology began to grow into an independent science from its roots in natural history and plant geography. The emphasis of this new "community ecology" was on the composition and structure of communities consisting of different species. In the early twentieth century, the American ecologist Frederic Clements pointed out that a succession of plant communities would develop after a disturbance such as a volcanic eruption, heavy flood, or forest fire. An abandoned field, for instance, will be invaded successively by herbaceous plants (plants with little or no woody tissue), shrubs, and trees, eventually becoming a forest. Light-loving species are always among the first invaders, while shade-tolerant species appear later in the succession.

在19世纪末期，生态学开始从它的源头——自然历史学和植物地理学中脱离出来成为一门独立的学科。这种新的概念“群落生态”强调的是不同物种构成的群落中的组成和结构。在20世纪早期，美国生态学家弗雷德里克•克莱门茨指出植物群落会在一个大变动(比如火山爆发、泥石流或者森林大火)之后发生演变。比如一块废弃的土地，就会接连受到草类植物(那些没有或只有很少木质结构的植物)、灌木和树木的入侵，最终形成一片森林。喜阳植物总是第一批入侵者，而那些喜阴植物随后出现。

Clements and other early ecologists saw almost lawlike regularity in the order of succession, but that has not been substantiated. A general trend can be recognized, but the details are usually unpredictable. Succession is influenced by many factors: the nature of the soil, exposure to sun and wind, regularity of precipitation, chance colonizations, and many other random processes.

克莱门茨和其他早期的生态学家从演变的顺序中看到了类似定律的规律性，但这个规律性还没有得到证实。我们可以看出大概的趋势，但是细节通常无法预见。演变受很多因素影响：土壤状况，曝光和曝风，降水规律，意外殖民和其他随机过程。

The final stage of a succession, called the climax by Clements and early ecologists, is likewise not predictable or of uniform composition. There is usually a good deal of turnover in species composition, even in a mature community. The nature of the climax is influenced by the same factors that influenced succession. Nevertheless, mature natural environments are usually in equilibrium. They change relatively little through time unless the environment itself changes.

演变的最后阶段被克莱门茨和早期生态学家称为顶级群落，它同样不可预测，组成也不单一。通常会发生大量的物种组成的更替，即使是在成熟的群落也同样如此。顶级群落本质上同样受到那些影响演变的因素的影响。尽管如此，成熟的自然环境通常处于平衡状态。它们随时间改变相对较少，除非环境本身发生变化。

For Clements, the climax was a “superorganism”, an organic entity. Even some authors who accepted the climax concept rejected Clements' characterization of it as a superorganism, and it is indeed a misleading metaphor. An ant colony may be legitimately called a superorganism because its communication system is so highly organized that the colony always works as a whole and appropriately according to the circumstances. But there is no evidence for such an interacting communicative network in a climax plant formation. Many authors prefer the term "association" to the term "community" in order to stress the looseness of the interaction.

对于克莱门茨来讲，顶级群落是一个“超级有机体”，一个有机的个体。即使那些接受顶级群落概念的作者也拒绝接受克莱门茨关于超级有机体的描述，它的确是一个误导人的隐喻。一个蚁群被称作超级有机体还比较合理，因为它的通信系统组织非常严密，在某些情形下这些群落能够像一个整体一样巧妙运作。但是没有证据表明在顶级群落植物系统中有这样一种相互影响的交流系统。相比“群落”，很多作者更喜欢用“联系”用以强调交互的松散性。

Even less fortunate was the extension of this type of thinking to include animals as well as plants. This resulted in the "biome," a combination of coexisting flora and fauna. Though it is true that many animals are strictly associated with certain plants, it is misleading to speak of a "spruce-moose biome," for example, because there is no internal cohesion to their association as in an organism. The spruce community is not substantially affected by either the presence or absence of moose. Indeed, there are vast areas of spruce forest without moose. The opposition to the Clementsian concept of plant ecology was initiated by Herbert Gleason, soon joined by various other ecologists. Their major point was that the distribution of a given species was controlled by the habitat requirements of that species and that therefore the vegetation types were a simple consequence of the ecologies of individual plant species.

更不幸的是这种思考方式从植物扩展到了动物。于是就产生了生物群落的概念——一种动物群落和植物群落共存的结合体。尽管很多动物确实和一些植物紧密联系，但诸如“云杉麋鹿生态系统”的说法仍然具有误导性，因为云杉和麋鹿之间并没有像一个有机体那样有内在联系。云杉群落并没有极大地受到麋鹿存在或者不存在的影响。实际上有很多云杉林并没有麋鹿。对克莱门茨关于植物群落概念的反对意见最早是由赫伯特•格里森提出来的，并且获得了很多其他生态学家的支持。他们的主要观点是给定物种的分布是由栖息地物种需求决定的，因此植被类型是简单的单个植物类型生态的结果。

With "climax," "biome," "superorganism," and various other technical terms for the association of animals and plants at a given locality being criticized, the term "ecosystem" was more and more widely adopted for the whole system of associated organisms together with the physical factors of their environment. Eventually, the energy-transforming role of such a system was emphasized. Ecosystems thus involve the circulation, transformation, and accumulation of energy and matter through the medium of living things and their activities. The ecologist is concerned primarily with the quantities of matter and energy that pass through a given ecosystem, and with the rates at which they do so.

尽管顶级群落，生态群落，超级有机体和许多对给定区域动植物联系描述的专业术语都被批评，但“生态系统”越来越被广泛接受，它用以描述相互联系的有机体以及生态环境物理因素的系统。最终，这个系统强调的是能量转变模式。因此生态系统包括通过生物媒介和活动而产生的循环、转换和能量及物质的积累。生态学家主要关注的是在给定系统下流过系统的物质和能量的量以及它们流过的速率。

Although the ecosystem concept was very popular in the 1950s and 1960s, it is no longer the dominant paradigm. Gleason's arguments against climax and biome are largely valid against ecosystems as well. Furthermore, the number of interactions is so great that they are difficult to analyze, even with the help of large computers. Finally, younger ecologists have found ecological problems involving behavior and life-history adaptations more attractive than measuring physical constants. Nevertheless, one still speaks of the ecosystem when referring to a local association of animals and plants, usually without paying much attention to the energy aspects.

尽管生态系统的概念在二十世纪五六十年代特别流行，但它也不是最权威的范例。格里森反对顶级群落和生物群系的论点用来反驳生态系统同样很有效。进一步讲，交互的数量如此之大以至于即使借助计算机也很难去分析它们。最后，年轻一代的生态学家发现关于行为和生命历史进化的问题比测试物理常量更有趣。尽管如此，当谈到某地的动植物联系的时候还是会使用生态系统，通常也就不关注能量的方面了。