communication techniques to increase collaboration among scientists and educators. By providing access to multimedia tools that otherwise would require massive computing power, COSEE-OS has increased access to high-quality resources while offering insight into how scientists view ocean-climate connections. COSEE-OS currently is refocusing its efforts toward building the next generation of tools that will allow participants to communicate synergistically with each other regardless of geographic location.

Building this community resource could increase participant engagement, thereby empowering scientists to more efficiently infuse their scientific research into the K-16 realm.

For more information, visit http://cosee.umaine.edu.

References


**HISTORICAL NOTE**

Origins of the Word “Phenology”

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Observing and documenting life cycle stages of plants and animals have been tradition and necessity for humans throughout history. Phenological observations—as called by their modern scientific name—were key to successful hunting and farming because the precise knowledge of animal behavior and plant growth, as well as their timing with changing seasons, was critical for survival.

In today’s context of environmental awareness and climate change research, phenological observations have become prime indicators of documenting altered life cycles due to environmental change in disciplines from biology to climatology, geography, and environmental history. Observations on the ground, from space, and from models of different complexity describe intra-annual and interannual changes of life cycles at individual, pixel, or grid box scale.

As a result, the science of phenology has become widely used though it is a relatively young discipline. The term “phenology,” derived from the ancient Greek word “phainesthai,” with the English meaning “to appear,” made its debut in European scientific literature around 1850. At the time, the Belgian botanist Charles Morren (1807–1858) was working extensively on the history of plant phenomena using terms like “periodical phenomena” and “anthochronology.” In a public lecture at the Academy of Brussels on 16 December 1849, Morren elaborated on this particular science and became the first to use the term “phenology” (see Figure S1 in the online supplement to this Eos issue (http://www.agu.org/eos_elec/)). Other important disciplines at the time such as meteorology, botany, zoology, physiology, and anthropology all comprised phenological aspects. But phenology specifically addresses successive appearances of phenomena and puts its focus on their timing and their relationship with the Earth’s environment. In consequence, phenology merits being a scientific discipline itself, Morren argued.

In 1853, the term “phenology” was used for the first time in a title of a scientific paper. In “Souvenirs phénologiques de l’hiver 1852–1853” (Phenological memories of the winter 1852–1853, Figure S2 in the online supplement), Morren reported phenological observations that followed that season’s extraordinarily warm winter, such as second flowerings. Observations of this kind should be noted in meteorological yearbooks, Morren stated, but even better would be inclusion in phenological yearbooks, as phenology is the “real” science for these sorts of observations.

A precise definition of what phenology should encompass and how definitions in guidebooks should be formulated was heavily discussed at the time. For example, Adolphe Quetelet (1796–1874), director of the Royal Observatory of Belgium and permanent secretary of Belgium’s Royal Academy, promoted phenological observations to document all biological and physical periodical phenomena in nature, whereas Morren’s work only focused on plant physiology. Morren’s terminology was taken up at the meteorological institute in Vienna in 1858, and soon after, the term “phenology” started to be used by several scientists and agencies in Latvia and Italy.

In today’s age of global satellite observations and sophisticated modeling of phenology, knowing the etymology of this widely used term underscores the fact that its roots are in hands-on observations. The timing of appearances in the living world will be crucial data for understanding the impact of climate change just as observations of seasons and life cycles have been throughout human history. References and suggestions for further reading are given in the online supplement.

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