Clarity in Ecology: Terminological Prescription Is the Wrong Route

Improving the clarity of writing in ecology is a worthy goal, both among scientists and in communicating with policymakers and the public. Herrando-Pérez and colleagues (2014) propose a convention on ecological nomenclature (CEN) that would attempt to regulate ecological terminology. Any such attempt at terminological prescription will fail, because of fundamental properties of language and meaning.

Attempts at language prescription are common and have a uniform history of failure (Hodges 2008). These failures are inevitable, as philosophers of science and language have shown. Many scientific terms simply cannot be defined with the prescriptive boundaries Herrando-Pérez and colleagues propose. Even a term such as *forest* illustrates the point: Although we all "know" what a forest is, we immediately run into trouble bounding its meaning: How much land is required? What tree density demarcates woodland from forest? Does a large thicket of baby trees count? Any fixed definition necessarily excludes cases, forcing one of two solutions: Either the definition must expand to accommodate excluded cases, thus obviating the prescribed definition, or new terms are required for excluded cases, leading to terminological proliferation. Since ecologists regularly apply old concepts to new systems, this problem is perennial. The CEN proposal fails to address this key philosophical issue.

The examples that Herrando-Pérez and colleagues offer for CEN are dangerously misleading. All three focus on naming, but CEN does not; CEN addresses conceptual terms (e.g., *density dependence*, *ecosystem*). The task of naming planetary features, chemical compounds, and nucleotides focuses on discrete objects: It is possible to agree on object names. But even naming species, ecologists' closest analogue to objects, has substantive philosophical issues in drawing boundaries between entities in time and space. Definitional problems are far worse for concepts.

Herrando-Pérez and colleagues also neglect the leading cause of miscommunication: poor writing. Clarity improves when people learn to write well; good writing is much more than using technical vocabulary consistently. Writing clarity is critical when ecologists interact with nonecologists: Journalists and advertisers understand that conveying ideas requires understanding the audience and using words and images that resonate with that group. Leading ecological groups, including the Ecological Society of America, the Society for Conservation Biology, and the Aldo Leopold Leadership Program, have focused on helping ecologists to use language in ways pertinent to nonecological audiences. In stark contrast, the CEN proposal suggests ecologists should build a repository of prescriptively defined terms to use for all audiences, but since audiences outside of ecology will not know these terms, the CEN proposal increases rather than reduces barriers to communication.

The CEN proposal is based on faulty philosophical premises, draws analogies to nonanalogous entities, and fails to identify poor writing as the leading cause for miscommunication. Effort put into CEN will be wasted. Such effort will also damage the ecological community. The panel they propose, by its very nature controversial because it decides which definitional arguments are "sound" in terminological reviews and chooses definitions that favor one side over another in conceptually disputed areas, will lead to division and disagreement without improved clarity.

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Clarity and Precision of Language Are a Necessary Route in Ecology

The main proposal of our recent *BioScience* paper (Herrando-Pérez et al. 2014) is to establish a convention of ecological nomenclature (CEN). The main points Hodges makes in her letter are already countered in our original paper. This situation reinforces the idea that *quality writing* (Hodges's argument) and *quality reading*, including correct semantic interpretation and citation of published research (Todd and Ladle 2008), are not alternative approaches. Rather, they act as a joint complement to the regulation of scientific language (our argument), in support of excellence in science.

Contrary to Hodges's assertion, long-standing nomenclature-oriented conventions in astronomy, chemistry, genetics, and medicine are based on constrained vocabularies of both concepts and terms. For instance, the *Gold Book* (chemistry) does not focus on discrete objects but on concepts (e.g., isomerism, volatilization), and the majority of the discrete objects it names (e.g., flagpole, leucotrienes) are concepts all the same, since they represent abstractions of the complex molecular and atomic structure of matter (which is analogous to the description of complex ecological "objects" such as ecosystems, niches, and populations). Along those lines, species are abstractions based on combinations of (mostly) morphological and genetic characters and, by and large, might be the closest analogue to objects for taxonomists. Ecologists, however, are typically much more concerned about evolutionary processes over all levels of biological organization. Ecologists

deal with objects such as water bodies and trees, but it gives little credit to our discipline to contend that we cannot define what *forest* means (in fact, there are several internationally accepted definitions in current use, depending on the application), let alone journals and conservation biologists addressing the ecology and management of forests.

We are unable to find in Hodges (2008, contested in Jax and Hodges 2008) an account for the commonality and uniform history of failure of nomenclature conventions, beyond a few general, one-sentence references to the Royal Society (seventeenth century), the movement of Authoritarian English (eighteenth century), and the Ecological Society of America (ESA; twentieth century). To be a fair benchmark of likely success, the topic would deserve a full dissertation in itself, precisely defining the meaning of *success* and then finely scrutinizing the nature of both *successful* and *unsuccessful* enterprises of terminological standardization across scientific disciplines in past and modern times. We indeed devote in our paper two paragraphs of body text, box 3, and one file of supplemental material, to explaining some of the history and problems encountered by the ESA's Committee on Ecological Nomenclature. In short, Hodges (2008) argues that there is no evidence that polysemy and synonymy block scientific progress, yet she provides no backing or reference to the contrary. To our knowledge, no metrics of scientific progress (e.g., papers not published, funding not obtained, policy not developed because of terminological problems) have been correlated with terminological style in the primary literature. This represents an important area of investigation pending exploration.

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