WRITING WITH PRECISION, CLARITY, AND ECONOMY
by Richard N. Mack

To be good is noble; but to show others how to be
good is nobler and no trouble.
Mark Twain (1899)

The instructions to Authors for Ecology and
Ecological Monographs include the statement:
“Write with precision, clarity, and economy.” This
wonderfully self-illustrative sentence contains some
of the most important instructions given to
prospective authors, yet it is probably the most
overlooked. Based on my experience as a subject
editor for the past three years, I contend that
verbiage, obscurity, and imprecision in manuscripts
slow the editorial process and ultimately hamper
communication. Many of my comments and
solutions will sound familiar. They should. Our
familiarity with them does not, however, make them
less important.

Writing with economy- Inclusion of extraneous
material and redundancy between sections of a
manuscript are two big enemies of economical
writing. Whole paragraphs often appear in
Introductions and Discussions that are only
tangentially related to Results. An Introduction
should clearly state the manuscript’s subject and
place it in broad context (the “Big Picture”), then
swiftly focus on the specific question(s) that the
manuscript addresses. Because of the current
emphasis on testing hypotheses in ecology, editors
now commonly see each alternative hypothesis
erected and discussed at length in a manuscript’s
Introduction, Discussion, or both. Taken to an
extreme, such treatment wastes a lot of print.

Redundancy between Results and Discussion is also
common. One way to avoid this duplication is to
compare drafts of the Results and Discussion line by
line, eliminating sentences in the Discussion that
merely paraphrase results. Although the reasons
vary, the Discussion is certainly the section most
likely to contain rambling prose. A Discussion
longer than one-third of the manuscript should alert
the author to check for over-interpretations of the
data and irrelevant musings.

Consecutive paragraphs in a poorly written
manuscript can often be collapsed into one by
eliminating unnecessary sentences. Some authors
seem reluctant to eliminate any sentence once inserted into
the text; for whatever reason, the result is a series of loose
sentences, each of which says little. And still others try to
salvage an awkward sentence instead of scrapping it and
starting over (e.g., “Survivorship among later other cohorts
that were studied followed similar patterns”). Sentences
beginning with the hackneyed construction: “There is
(are) . . .” are common in Ecology.

Bad syntax makes sentences long, convoluted, and
incomprehensible. Compound sentences, used correctly,
can link closely related ideas clearly and concisely. Take
this run-on sentence, for example: “Evaluation of dating
methods, including identification of historically
documented cultural horizons in profiles of regional
pollen, a 20th century increase in sediment concentrations
of grassland-produced opal phytoliths, 210Pb, and 14C
prompted recommendations that 14C dating be restricted to
deposits older than 500 yr because confidence intervals
approach the radiocarbon age in younger samples and
because pollen and 210Pb can provide precise chronologies
for sediments deposited since human settlement.” A
semicolon (plus elimination of verbiage) clears the fog:
“Deposits older than 500 yr were dated with 14C; younger
deposits were dated with 210Pb or by identifying cultural
horizons with diagnostic pollen or opal phytoliths.” A
paragraph in which each sentence is followed by an
excessively long string of citations frustrates
comprehension, particularly when the sentences are the
interconnecting pieces of an argument. (I once
encountered a simple declarative sentence followed by 26
citations.) So-called freight train strings of adjectives
(e.g., “the now actively growing, adult caespitose alien
grasses”) are a similar though more commonly recognized
problem.

Superfluous words also slow down comprehension. We
often write with the same verbosity permissible in
conversational English. Consequently, I suspect that some
manuscripts are transcripts from dictation. A
conscientious author can easily eliminate these crutches
from his manuscripts: Hart (1976), Day (1983), and
Strunk and White (1979) in their excellent The Elements of
Style all illustrate superfluous expressions. I have
assembled expressions that are among those most
annoying to me, along with more succinct alternatives, in
Table 1. My list was compiled from just six manuscripts
submitted to Ecology; the potential list of phrases and
words to be avoided is, of course, much longer.

Although my intent is not to poke fun at any class of
authors, manuscripts prepared from dissertations are the
high-grade ore of the problems I discuss here. Theses are
rarely in a form suitable for publication. Often the syntax is ponderous and stilted (i.e., passive voice, non-descriptive verbs, and excessive use of negative clauses). Furthermore, the conversion from dissertation to manuscript often seems to have been made in great haste. For example, the statement “(see Chapter III)” was inadvertently left in the text of one manuscript I edited. The marching orders for those preparing manuscripts from theses should be to prune words ruthlessly. All who supervise graduate students should ensure that their students gain a lot of experience in writing concisely and clearly. A primer such as The Elements of Style should be issued to each beginning graduate student, and the student should master its contents.

I am not advocating that our journals be reduced to collections of papers with staccato phrases, like the documentation for computer programs. I also do not favor changing our journals to the style of reports in Science or letters in Nature. But a recent comment by Leslie Real, another editor for Ecology, deserves careful assessment. He reports that some ecologists consider Ecology and Ecological Monographs to be “archival” compared to more “communicative” ecological journals. Perhaps they have gained this impression because some papers are unnecessarily long. If progress is directly related to communication, Real’s observation bodes ill for the future of our journals.

Table 1. Common expressions with superfluous words (left column) and suggested substitutes (right column)

<table>
<thead>
<tr>
<th>The purpose of this study</th>
<th>I (or We) hypothesized</th>
</tr>
</thead>
<tbody>
<tr>
<td>was to test the hypothesis</td>
<td>We assessed</td>
</tr>
<tr>
<td>In this study we assessed</td>
<td>We demonstrated a direct</td>
</tr>
<tr>
<td>We demonstrated that there was a direct</td>
<td>were</td>
</tr>
<tr>
<td>were responsible for</td>
<td>caused</td>
</tr>
<tr>
<td>played the role of</td>
<td>Consequently</td>
</tr>
<tr>
<td>On the basis of evidence available to date</td>
<td>to compare</td>
</tr>
<tr>
<td>in order to provide a basis for comparing</td>
<td>through; by</td>
</tr>
<tr>
<td>as a result of</td>
<td>because</td>
</tr>
<tr>
<td>for the following reasons</td>
<td>during the experiment</td>
</tr>
<tr>
<td>during the course of this experiment</td>
<td>during</td>
</tr>
<tr>
<td>during the process of</td>
<td>when</td>
</tr>
<tr>
<td>during periods when</td>
<td>during the study</td>
</tr>
<tr>
<td>for the duration of the study</td>
<td>(eliminate by rearrangement)</td>
</tr>
<tr>
<td>the nature of</td>
<td>many (or few)</td>
</tr>
<tr>
<td>a large (or small or limited) number of</td>
<td>conspicuous number of</td>
</tr>
<tr>
<td>a small (or limited) number of</td>
<td>many</td>
</tr>
<tr>
<td>conspicuous number of</td>
<td></td>
</tr>
</tbody>
</table>

substantial quantities | much |
| a majority | most |
| a single | one |
| an individual taxon | a taxon |
| seedlings, irrespective of species | all seedlings |
| all of the species | all species |
| various lines of evidence | evidence |
| they do not themselves possess | they lack |
| were still present | persisted; survived |
| the analysis presented in this paper | indicating |
| indicating the presence of | despite |
| despite the presence of | checked for |
| checked for the presence of | without |
| in the absence of | observations |
| a series of observations | may have caused |
| may be the mechanism responsible for | With light not limiting |
| It is reasonable to assume that where light is not limiting | in a single period of a few hours |
| in a single period of a few hours | occur in areas of North America |
| occur in areas of North America | the current population; the population |
| adjacent transects were separated by at least 20 m | adjacent transects were at least 20 m apart |
| in the vicinity | nearby |
| separated by a maximum distance of 10 m and a minimum distance of 3 m | 3-10 m apart |
| The present day population | the current population; the population |
| their subsequent fate | their fate |
| whether or not | whether |
| summer months | summer |
| are not uncommon | may be |
| due to the fact that | (eliminate by rearrangement) |
| showed a tendency toward higher survival | had higher survival |
| devastated with drought-induced desiccation | killed by drought |

Journals avoid becoming merely archives in part by stressing that all accepted manuscripts convey justification, results, and tightly reasoned arguments in crisp, clear sentences and a logical sequence of coherent paragraphs. As William Strunk said, “Vigorous writing is concise.” Through careful editing, the purpose of each paragraph, each sentence, and each word in a manuscript should be apparent and defendable. That position may strike many authors as extreme, but I think it is nevertheless a useful goal. The excuses for not taking such care have largely evaporated with the widespread...
availability of word processors, which make successive revisions convenient and quick.

Editing sometimes yields unexpected results. Most societal journals are budgeted for a maximum number of pages that may be printed each year; the current budget for *Ecology* and *Ecological Monographs* allows 2725 pages. The advice from reviewers and editors may help an author trim so many unnecessary pages that in effect another author’s whole manuscript can be published. The obvious benefits of that effort are shared by all prospective authors.

A deluge of publications is a permanent part of our professional lives. To an increasing degree, manuscripts not written with economy of expression will receive the Churchillian judgment: “This paper, by its very length, defends itself against the risk of being read.” (as cited in Manchester 1983).

*Writing with clarity and precision.*-Dictionary definitions of clarity are: “clearness or lucidity as to perception or understanding: freedom from indistinctness or ambiguity” (*Random House Dictionary of the English Language* 1971). In practice, clarity may simply mean comprehensibility upon first reading (J.R. King, *personal communication*). Despite the obligation to be clear in reporting our methods and results and the results and interpretations of others, problems commonly arise in manuscripts. Yet solutions sometimes appear from unexpected sources. For example, conversational English is often verbose, but it is usually clear. And some of its clarity can be effectively incorporated into manuscripts. Use of the first person avoids ambiguity in the description of experiments (“I divided the population into three equal groups.”) and the presentation of opposing positions (“We believe Smith’s (1983) contention is supported by his results, although Jones (1985) disagrees.”).

Hurlbert (1984) urges editors to insist that the experimental design be described in sufficient detail to permit repetition by the reader. This straightforward practice can reveal ambiguities or missing pieces in the description of a design, and should always be employed by the author before submitting the manuscript. The practice might also reduce cases in which an editor inadvertently changes the meaning of a sentence (a common complaint of authors) because he or she guessed incorrectly about the sentence’s murky meaning. Much misinterpretation also arises through reference to an indefinite antecedent, as in: “The radiocarbon dates define isochrones along the transect that establish a series of stratigraphic profiles. These provided the geomorphic basic for all subsequent analyses.” Does “These” refer to the radiocarbon dates, the isochrones, or the profiles?

Improper word choice also creates ambiguities. The incorrect use of “which” and “that” continues to plague manuscripts. As the *CBE Style Manual* (1983) points out, “which” should only be used for nondefining, nonrestrictive clauses or phrases; i.e., those beginning with “which” add some nonessential information about the subject of the sentence. “That” introduced restrictive clauses or phrases in which the information answers the question “which one?-that one.” Use “while” to mean “during the time of” and not as a substitute for “although,” “whereas,” “as,” “but,” or “and” (Hart 1976). Neologisms will always be necessary in science, but jargon obscures clarity (e.g., “die-off,” “root-wad,” “feedforward”). An author using a phrase with no single, fixed meaning, such as “spatial and temporal pattern” should define it clearly.

By definition *precision* is intertwined with clarity. Precise means “definitely or strictly stated; being exactly that and neither more nor less; being just that and not other; carefully distinct” (*Random House Dictionary of the English Language* 1971). Nonetheless many common pitfalls occur through imprecise language alone. Instead of stating that “many” (or “few”) organisms live in the area, state the number (even if in parentheses). Do the same for distances. Were the plants “in the vicinity of” each other (a phrase I consider verbose), “near” each other, or were they “adjacent to” each other, i.e., “juxtaposed”? The prepositions “to” and “with” are often used imprecisely. One compares something “to” something that is dissimilar (“of a different order,” Strunk and White 1979), but compares something “with” something that is related (or at least not of a different order). As the editors for the British Ecological Society point out: “Your reputation will not be enhanced by a permanent record of woolly thinking.” (British Ecological Society 1978).

Precision can also be foiled by a word with multiple definitions. For example, a factor may “decimate” or “devastate” a population. “Decimate” can mean to reduce by one-tenth (as well as to reduce by a great number or proportion), although “devastate” always means lay waste, i.e., cause great destruction (*Webster’s Third New International Dictionary* 1963). Frequent use of an unabridged dictionary is the obvious and probably the unavoidable solution.

*Conclusion.*-Good writing will not make bad science good (the proverbial sow’s ear into silk purse), but poor writing can prevent good science from receiving the recognition it deserves. We all can list examples of similar points made in contemporaneous papers: one paper is often cited, the other languishes in obscurity. Not only do manuscripts vie for journal space; they ultimately vie for recollection by readers. Memorable papers are clear, brief, and forceful. No one would willingly consign his work to obscurity, but
we do so with imprecise, ambiguous, and verbose manuscripts.

Acknowledgments

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Richard N. Mack  
Department of Botany  
Washington State University  
Pullman, WA 99163

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