

# **Principles of Good Technical Writing for Proposals, Theses and Dissertations**

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## **The Proposal**

### **Structure of a Proposal**

The overall format of a proposal emphasizes 5 distinct sections: rationale, central question and statement of objectives, methods, timeline and literature cited. Length is generally 5 to 15 pages.

### **Rationale**

This is where you must persuade the reader that there is an issue of such importance that investment of precious time and money is warranted. The organization is general to specific and the persuasive argument begins with a statement that is likely to win ready agreement from almost everyone. From that premise, a series of logical steps takes the reader to the point that he or she is almost forming your question in their own mind. All of this should be done in about 2 pages. Most proposals fail because they lack a crisp and compelling argument, or lack a clear question.

### **Statement of Objectives**

The question lays the foundation for the statement of objective. This may be one or several statements that provide a clear direction for the study. These statements are generally *not* operational objectives but conceptual steps to answering the question. An ideal format for statement of objectives is casting them as hypotheses (generally not the null).

### **Methods**

In thesis proposals, the statement of objectives is often followed by a section entitled “Background” which elaborates on what is known about the question. However, the important next step is a description of methods. Here the key is to ensure that the reader sees the link between each objective and the methods that will be employed to address it. The focus of methods should be on the “what” with minimal justification. However, some justification is acceptable for proposals, in contrast to manuscripts.

### **Timeline**

Finally, thesis proposals should include a timeline that describes milestones in the research process. These should be specific enough that all readers will be persuaded that the project is do-able.

### **It's Expected to Evolve**

Proposals are plans, not blueprints. The central question is not likely to change, but refinements to objectives, and certainly to methods, are expected. The intent of the proposal is to persuade the reader that you are knowledgeable of past efforts and have a reasonably good sense of how to proceed.

## **The Manuscript**

Overall structure follows manuscript format as described in the most common outlets for research. For us that is generally the Journal of Wildlife Management (JWM). Basic elements include 9 distinct sections: abstract, introduction, study area, methods, results, discussion, management implications, literature cited, and tables and figures. An acknowledgments section is added last. Overall length is generally about 35 pages including all sections. Headings and subheadings follow the JWM hierarchy with respect to margin justification, case and use of bold and italics. Use of scientific names, units of measure and literature cited follows JWM guidelines.

### **Abstract**

The abstract needs to include a single sentence of rationale, a sentence of objectives, several sentences of methods, several sentences of results (including key quantitative findings), several sentences of discussion and one sentence of management implications. Guideline for length of the abstract is 1 line per page. Note that academic guidelines prescribe 150 words for MS thesis and 250 words for PhD dissertation.

### **Introduction**

Introductions should be short (2 pages) and focused exclusively on the rationale for the study. The introduction should address two questions: what's the problem and why is it important? They should lead logically to the statement of objectives. Statement of objectives should be simple declarative statements. They should begin with the phrase, "My objectives were to..."

Ecological Applications: "We encourage authors to clearly state the scientific and practical challenge and then describe the contribution that their paper makes toward understanding or resolving the issue. This requires a clear, simple, and direct opening paragraph. It is not enough to indicate that, for example, species with complex management dynamics require innovative management approaches. What are the

implications for the species studied, and what generalities can be drawn? If the results indicate a problem, but not a solution, what steps are required to implement the new ideas as management techniques? If the study addresses a technique or concept that may be applied by other researchers, under what circumstances can the new method be employed?"

Sequencing of the argument is important in the Introduction and later in the Discussion. The argument should proceed from general to specific, and form a logical series of points that leads inextricably to the need for your objectives. The test for this strength of the sequencing is to read just the topic sentences (the first sentence in a paragraph). Doing so should provide the reader with a clear idea of where the study is headed and why it is important.

Paragraph structure is important. Material within each paragraph should be limited to the point being made in the topic sentence. It should serve to support and expand upon the point. Subject-object-subject construction for sentence sequencing is a good model. To illustrate

In April, deer migrate to summer range. The most important characteristic of summer range is the mixture of open and forest land. The optimal mixture is about 30% forest and 70% open.

Note how the first sentence talks of deer and summer range. The next sentence picks up "summer range" and develops it to describe a mixture. The next sentence picks up the "mixture" and develops it to describe the optimal composition. This format produces a flow to the idea that is easily read and assimilated by the reader.

## **Study Area**

Study Area needs to include a general description of land-form and weather conditions of the area, as well as location (lat/lon). Then, it needs more detailed information on facets that are particularly relevant to the specific study described in the manuscript. If the study assesses the impact of snow depths, then the Study Area description needs to include information on snowfall patterns that are typical. Study Area is generally written in present tense.

## **Methods**

Methods are a description of *what* was done, and *how*, but follows the journalist's rule: *who*, *where* and *when*, as well as *what* and *how*. Note that *why* is generally limited. The organization should follow the same sequence of the statement of objectives and should refer back to the objectives. For instance, we might have a statement of objective in Introduction: "I sought to estimate mortality rates in deer resulting from automobile collisions." Restatement in Methods: "To estimate mortality rates for deer-vehicle

accidents, I used data obtained from the Department of Motor Vehicles.” Note the somewhat different form.

There is a tendency to include rationale in Methods and while some is helpful, in general doing so should be avoided. Limit it to a parenthetical phrase (set off by a comma) or a single sentence. Do not include the evolutionary steps to your methods. We tend to want the reader to understand all the blood, sweat and innovation we contributed, but that’s for memoirs. Technical articles focus exclusively on what worked to produce the data that will be presented in Results.

## **Results**

Parallel structure is important and Results should follow the same sequence of presentation at Methods. The Results section should focus exclusively on what you found. Interpretation should be limited to factual statements or assessments based on a priori criteria (that are stated in Methods!). Text should *summarize* findings and use tables and figures to support and expand those findings. A reader should be able to get the message without reading the tables and figures, just as the tables and figures should contain enough information to be understood without reading the text.

“Figure” and “Table” should never be the subject of a sentence. They should always be references and so placed in parentheses.

There are differing philosophies, but I ascribe to the school of thought that says statistical inferences are black and white. It is either significantly different, or not different. There are no trends unless the tests show significant trends. Science is not a game of horse shoes and “almost” does not apply. Remember too that statistical differences are not necessarily biological differences. This distinction is grist for the Discussion.

## **Discussion**

Discussions are written around a few key points. Think about what you want the reader to remember most from your work. If you were forced to capture the essence of your work in not more than 5 key bullet points, what would they be? If you had 90 seconds to tell someone what you found in your research, what would you say? Readers will not remember more than about 3 messages, so limit and sharpen the focus! The Discussion is built around those key points and uses the information in Results to support and illustrate those points. Similarly, The Discussion must make the case that the study merits attention of a national or international scientific community, so think about how you answer the following question: what are the implications to the broader scientific or natural resource management community? The incorporation of literature is intended not

only to support the points of the argument but to expand their application beyond the locale of the study.

Logical sequencing of the argument is crucial to the Discussion, so use of the topic sentence assessment is vital. Ultimately, the Discussion must answer the central question posed in the Introduction, so look back at the Introduction and polish the two sections until that are in accord.

Once the Discussion and Introduction are in accord, then look back to Results to make sure these two sections are in accord. What is in the Discussion determines what merits being in the Results. Editors remove all portions that are not represented in the Discussion, so look at the Results with that in mind. Then go back to Methods and remove all portions for which no results are provided. Conversely, editors remove portions of the Discussion that have no support in Results, so make sure the Results and Methods necessary to support the Discussion are there.

### **Management Implications**

The focus here is how the findings can be applied, and how they are relevant beyond the boundaries of the study area. Here is where the debate over the value of publishing the study can be won or lost. An editor of a journal intended for a national or international audience who sees little relevance to your findings beyond the Adirondacks, or New York, or the Northeast may decline to publish the article. Management implications need to help editors, as well as readers, see the application of the findings to issues of broad importance to society or managers.

### **Figures and Tables**

Remember that JWM rules apply to Figure captions and table headings. What, where, and when are crucial elements. Captions and headings should allow the reader to grasp the information without referring to the text of the document.

### **Common Mistakes That I Would Prefer Not to Have to Correct**

*Since* and *because* are not synonyms. *Since* conveys a sense of time. *Because* conveys a sense of cause and effect. Sentences can begin with *since*, but should not begin with *because*.

The word *data*, when used as a noun, is always plural.

Avoid strings of nouns. “Estimating white-tailed deer non-hunting early-winter mortality parameters was....” This makes for difficult reading. Break it up: “Estimating parameters for non-hunting mortality in white-tailed deer during early winter...”

Avoid run-on sentences. “I used yearling antler-beam diameter, winter weather, and a seasonal net primary productivity function to calibrate a seasonal range index within the framework of a bio-energetic model (Moen 1968) that predicts the annual weight cycle of male fawns (Moen and Severinghaus 1981).”