

## WRITING A SCIENTIFIC PAPER FOR PUBLICATION

J.K. VANCLAY

*Department of Economics and Natural Resources,  
Royal Veterinary and Agricultural University, Frederiksberg, Denmark*

### ABSTRACT

Help your readers, referees, editor and yourself by careful attention to detail. The summary should be an informative precis of facts and conclusions, not merely a description of the paper. Make the paper easy to read, don't use jargon and have a colleague check it before you submit it to a journal. Use figures rather than tables, and keep the whole paper, including tables and figures, clear, simple and to the point. Consult the journal's "Instructions to contributors" before submitting.

### Introduction

Many manuscripts contain good ideas hidden by careless preparation. That not only makes it hard for the referee, but also creates extra work for the author when it gets returned for revision. Or you may not get a second chance; your paper may simply be rejected. So it's best to do it right the first time, and I hope these few suggestions may help.

Writing a good paper isn't easy, but it is worth the effort to do it well, otherwise nobody will read it (or it might not get published) and your efforts will have been wasted. So how do you make your paper a good one? Several books offer advice on this topic, and I'll offer a few brief suggestions to supplement the textbook advice.

### Choosing your Subject and Audience

Before you put pen to paper (or fingers to keyboard), you should know *what* and for *whom* you want to write. You don't have to be a research scientist to publish papers; other people have valuable things to say too. If you've been in forest management or planning, you could indicate areas where information is lacking and thus stimulate new research, you may have some innovative ideas on the process of planning, or you may be able to relate some interesting experiences. If you know something that you

would like to share with others, then you are ready to start with your paper.

Once you've decided on a subject, you need to identify a target audience - whom do you want to tell? This decision influences the way you write your manuscript, and the journal to which you submit it. Choose a journal that reaches the right audience (e.g. national or international; ecology, silviculture, management, utilization or multi-disciplinary?), then get hold of a recent issue and check the style and length of some contributions. Can you compile your ideas into a similar format? Read the publisher's "Instructions to Contributors"; this is usually inside the journal covers, or may be in the first issue for the year (if not, write to the editor and ask for a copy).

### Writing the first draft

Now you're ready to get started, so grab your pen and go. Everyone has their own approach, and different things work for different people. Some people just write from start to finish. I can't; I don't write fast enough and seem to lose track of my ideas. So I scribble out a rough outline and gradually expand on it and rearrange it in a logical order. Before I had my word processor, I liked to write in pencil on large sheets of paper, leaving wide margins for later additions. The important thing at this stage is to get your ideas in writing, and the hardest

part for most of us is starting with a blank sheet of paper.

Once you've got the main ideas outlined, you need to develop a logical argument that flows well. Don't be afraid to cut-and-paste, either with scissors and glue, or on your word processor. Try to develop a logical flow of ideas without digressions. "Flashbacks" may be good in novels and movies, but they rarely help in scientific papers.

If you're reporting an experiment, you may find it useful to follow the standard formula "Introduction, Literature, Materials, Method, Results, Discussion, Conclusion". If this structure doesn't suit your needs (e.g. this paper), try something different. Most journals are flexible enough to accept different presentations, provided that your paper is logical and easy to read.

### Tables, Figures and Equations

Tables are sometimes a necessary evil, and may be the best way of reporting data such as analyses of variance. But too often they are inappropriate; they may be easy for the author to compile, but are rarely an efficient way of conveying information to the reader. The information in most tables can be conveyed better in figures. Figures can better portray the trends in the data, and if necessary, the original data can be provided to interested readers on request. So have a second look at all your tables, and see if you can deliver the message more effectively with figures. Avoid the temptation offered by some computer packages to add lots of "special effects" to your figures. Instead try to keep it simple and clearly labelled. A good objective is to convey the greatest amount of information with the smallest amount of ink.

If you must have tables, make sure that they are easy to follow, and that all columns are clearly labelled. Figures and tables should be labelled sufficiently well that they make sense without referring to the text of the article. Notwithstanding this, you should refer briefly to all figures and tables in the text. And don't forget to indicate to the editor where you want the figures and tables to appear.

The same goes for equations. They're the best way to describe complex mathematical relationships, and to summarize big sets of data,

but they're rarely easy for the reader to follow. So draw a figure to accompany your equations, and make life easy for the reader. Use the standard IUFRO symbols (Soest *et al.* 1959), and explain clearly what all the symbols in the equations mean.

The presentation of statistical analyses also requires care. Make sure that your analyses are appropriate, and explain the analysis and the implications clearly. If you're not strong in statistics, consult a statistician for advice and assistance (You should do this before starting your experiment; don't leave it until you are writing your report). And read Warren's (1986) advice on the presentation of statistical analyses.

### Title and Summary

The title and summary or abstract are the most important parts of your paper. These are the only parts that most people read, so they are especially important. In just a few words, your title must convince potential readers to read your paper. So choose your title carefully, start with a key word, and make sure that the title indicates what the paper is about. Some journals have a short title at the top of each page. If you submit to such a journal, you can suggest a suitable short title, especially if your full title is long or complicated.

Most journals perpetuate your abstract in *Forestry Abstracts* and computer databases, so it too is important. It should not merely describe what the paper is about, but should summarize the main results and conclusions. Try not to use verbs such as "discuss" and "report" in your summary; rather try to convey more content in fewer words. For example, instead of saying "The response to fertilizing is discussed", say "The optimal fertilizer application is ... kg/ha and produces a ..% increase in yield".

Some journals ask you to supply key words. These may also be used for computerized retrieval, so choose them carefully. It is not necessary to repeat words used in the title, but synonyms may be appropriate. If the journal does not support key words, make sure that all the important key words are included in the abstract or summary.

### Revising the draft

We've made a start, and that's important, but now the work begins. You may have heard that science is 1% inspiration and 99% perspiration. We've had the inspiration, and now we have to perspire. You should check your draft several times: for omissions, for errors of fact, for structure and flow, for typographic and grammatical errors, and again just to be sure. Your paper has to pass the test of time, so it's best if you don't attempt all these checks in a single day. Instead, leave it for a few days between checks, so that you approach it fresh each time, and so your ideas have time to mature.

When you are fresh and not distracted, read your manuscript again. Try to read it as an outsider would, and see if there is anything that you have omitted. Are you sure that you are taking nothing for granted? When you are happy that your manuscript is complete, then make sure that it is correct. Go through your manuscript again, and make sure that you've got it right, and that there are no factual errors and no contradictions.

Next you need to read your entire manuscript again, with your eye on the way in which ideas and arguments unfold. Is it easy for an outsider to read, and to follow your ideas? Try to avoid technical jargon, but if you must use it, follow the conventions in Ford-Robertson (1971). Finally, check it all again for spelling and grammatical errors. If your computer has a spelling and/or a grammar checker, you should use them, but you still have to do it manually as these checkers cannot detect all errors. Unless you're a professional proof reader, read every word, aloud. And then check tables, numbers, equations and references again. This sounds like a lot of work, but it is better that you do it now rather than later at the editor's insistence. And it is better that you do a little extra work to make it easier for your readers. If you write a good article, you may have a thousand readers, and the efforts you make will pay dividends a thousand-fold!

### Peer Review

Your paper is intended for others to read, so you should get some of your friends and colleagues to read it first. Get a fellow expert in your field to check for errors of fact. And get a friend typical of your target audience to check that it is easy to understand, and without assumptions and jargon. Listen carefully to their comments; it's easier for them than for you to see weaknesses in your manuscript. Try to incorporate their suggestions, and if they made a lot of suggestions ask them to have another look after you revise the paper. And don't forget to acknowledge their assistance.

If English is not your mother tongue, get a native English speaker, or the best English speaker you know to read your manuscript. It's easier for them than for you to spot a grammatical error. Don't be embarrassed by such a request; few people are perfect in their second language, and it is better for one person to spot the mistake, than for a thousand.

The editor will refer your manuscript for anonymous refereeing, but you should arrange your own peer review. Journal referees are busy with their own work, and they are not paid for their efforts. Their job is to check the technical content of your paper, and they should not have to correct your English or re-structure your paper - that's your own responsibility.

### Submitting your paper

Before you submit your paper, read the journal's instructions again, and check your paper one more time. Keep a legible copy of your manuscript yourself (accidents happen in the post and in the editorial office), and ensure that you send the editor sufficient copies. Make sure that you include your affiliation and return address. The editor should acknowledge receipt of your manuscript; keep this letter, and use the reference number in all further correspondence.

The editor will have your manuscript refereed, and you will probably have to make some revisions in response to the referee's comments. Do this promptly, and return the revised manuscript as soon as you can. Keep a copy of the referees comments and your

revision. Write a covering letter to accompany your revised manuscript, explaining how you accommodated the referees comments, especially if you disagreed with the referee.

Many journals now accept manuscripts on floppy disk, and this can save time and avoid typesetting errors. If your journal accepts disks, provide the revised manuscript on paper and on disk, and check that you have the correct format (disk size and density, word processor or ascii files).

In due course, you will receive the galley proof for correction. You should attend to these immediately and return them promptly, as any delays may upset the publication schedule for the journal. Check the entire proof carefully, cross-checking with your copy of the revised manuscript. Read it aloud, and double check all tables, numbers and equations. If you have big tables, get a friend to help. This is your last chance to avoid making a fool of yourself.

Check that the paper carries your current address, and update any references you may have shown as "in press".

### **Publication**

After publication, you should receive reprints from the publisher. Send copies to your co-authors, to any colleagues who reviewed your manuscript, and to any authors whose work you cited frequently. You may receive requests for reprints from people interested in your work, and it is courteous to respond promptly. In responding, you may also wish to provide copies of some of your other work (especially if you cited papers not readily available elsewhere) and any additional data (e.g. detailed source data for figures).

Now all you have to do is start writing.  
Good luck!

### **References**

- Ford-Robertson, F.C., 1971. Terminology of Forest Science Technology Practice and Products. Society of American Foresters, Washington D.C. 349 p.
- Soest, J.van, Ayrar, P., Schober, R. and Hummel, F.C., 1959. The standardization of symbols in forest mensuration. (reprinted 1965) Maine Agricultural Experiment Station, University of Maine, Technical Bulletin 15. 32 p.
- Warren, W.G., 1986. On the presentation of statistical analysis: reason or ritual. *Can. J. For. Res.* 16:1185-1191.