

Writing and Publishing Scientific Papers in English-language Peer-reviewed Journals

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Purpose of Scientific Papers

A scientific study is not really complete until results have been published and understood by the appropriate audience

Who are you writing for?

- Scientists in your field
- Students
- Scientists in other fields
- Managers
- Others?

Thinking about your writing

State your facts as simply as possible...
No one wants flowers of eloquence or
literary ornaments in a research article.

R.B. McKerrow

Clarity is critical

- Clear thought
- Clearly stated problem
- Clearly presented results
- Clearly stated conclusions

The best English is that which says what is needed with the fewest and simplest words.

Example from results:

Based on analysis of the data, we found that the understory vegetation structure and composition were similar on all plots before treatment.

Better: The structure and composition of understory vegetation before treatment were similar on all plots.

What is a scientific paper?

- First full publication of completed research
- Peer-reviewed
- Includes information so that readers can:
 - Assess observations
 - Repeat experiments and methods
 - Evaluate logic and conclusions
- Appears in a readily available source (ideally—some do not)

Typical Structure of Scientific Paper

- Title (authors)
- Abstract (key words)
 - Summary of entire paper
- Introduction
 - What is the question being addressed?
 - Why is it important?
 - Preview of approach and potential results
- Methods
 - How was the study conducted?
- Results
 - What did you learn?
- Discussion
 - What is the meaning or importance of results?
- Conclusions
- References

A note on title and key words

Think carefully about your title and key words!

- The most important words for identifying and classifying your paper
- Attract potential readers
- Used by indexing programs
- Makes papers easier to find in online searches
- What search terms would you use to locate a paper on your topic?

Structure can be adapted

- Basic elements remain
- May be combined in different ways depending on the type of research being reported
- For example—combine Results and Discussion
- Specific structures allowed depend on journal

Organization is key to a successful presentation

Some repetition is good

- Most people will only read the abstract.
- *If the abstract does not tell them why they should be interested, they will not read the paper.*
- Even interested readers may read only the introduction, and maybe the summary or conclusions.
- Many people will never read the entire paper, but will look at tables and figures.
 - They should clearly show most important results
- *Major conclusions and importance of results* should be:
 - *highlighted* in the abstract,
 - *outlined* in the introduction,
 - *described fully* in the discussion, and
 - *summarized* at the end (conclusions or summary).

Other Types of Papers

- Review paper
- Research note
- Conference report
- Abstract

Review papers and Research Notes generally peer-reviewed

Most conference reports are either syntheses or reports of preliminary results; often not peer-reviewed and therefore not primary publications.

Except for review papers, the basic structure of the report is the same.

Getting Started

- Think carefully about the goals of the paper, hypotheses you are testing, etc.
- Review your methods (including data analysis)
- Decide what are your most important results
- Why are they important?
- Who is your major audience?
- What journals might be appropriate outlets?
- Determine preferred journal; backups?

Structuring your paper

- Read Instructions to Authors for your target journal
- Look at recently-published papers for that journal
- Structure your paper appropriately for that journal
 - Does abstract have distinct sections or not?
 - Are Headings and Sub-heads numbered or not? If so, what is the method of numbering?
 - Can you combine Results and Discussion? Etc.
 - Restrictions on length, number of figures or tables, etc.
 - How are references formatted (both in text and in bibliography).
 - What types of sources are allowable citations?
- Do an outline before you start writing.

A note on abbreviations

- Abbreviations of frequently-used terms, treatments, etc. can be useful.
- Define abbreviations the first time you use them in the text in each major section of the paper
- Avoid in title or abstract
- Define abbreviations in figure captions and table headings
- IF you use too many abbreviations, the text becomes VERY difficult to read. Don't abbreviate common terms (e.g. WF for wildfire; FB for fire behavior)
- If you have a lot of variables that are abbreviated, consider adding a table of abbreviations.

Title

- Fewest possible words that adequately describe the contents
- Be as specific as possible
- Should be appropriate for indexing and attracting readers

Example:

“Fire effects in Siberia” (too general, except for a book!)

“Effects of experimental fires of various severities on *Pinus silvestris* forests in central Siberia” (more specific)

Authors

- Discuss in advance: highly sensitive issue!
- Authors - contributions to overall design, execution, intellectual content
- List in order of importance to the research and development of the paper
- If equal, list alphabetically
- Use first names and middle initials where possible (depends on journal)

Abstract

- A brief summary of the paper
 - Problem and scope (background)
 - Methods (general approach)
 - Results and Conclusions
- Usually a single paragraph
- 200 words or less (depends on journal)
- No references or abbreviations
- Written in past tense
- Specific format and length depend on journal
- **Write the paper first!**

Introduction

- Consider purpose of paper and audience
- Background and rationale sufficient for reader to understand what paper is about and why it is important
- Mostly present tense
- You may want to do a rough draft, but not actually finish the Introduction/Background until after writing methods and results

Introduction (continued)

- Nature and scope of problem
 - Provide background and context
- Review of relevant literature (include citations)
- Briefly describe any theories involved
- General methods and reasons for using them
- Objectives, goals, hypotheses or theories to be tested
- Expected value of work
 - One or two sentences!

Methods

- Describe study sites (location, vegetation, etc.)
 - Consider a map!
- Describe design and methods so work can be reproduced
- Think of this section as a cookbook; be precise
- Describe statistical analysis only if specialized or unusual
- Provide references for previously published methods, BUT
 - Describe in more detail if published in Russian or not accessible
 - Many “traditional” Russian methods not known elsewhere
- Describe related methods together
- Structure methods and results sections the same if possible
- Write methods before results
- NO RESULTS IN METHODS SECTION
- Past tense

Results

- Present data and results of analyses
- If you want to discuss as you present, consider a combined Results and Discussion section.
 - Often more efficient—and paper may be less repetitive
- Start with general description of research and approach
- Describe new knowledge being presented
- Include selected, representative, or synthesized results—not every data point!
- NO METHODS IN RESULTS SECTION

“The compulsion to include everything does not prove that one has unlimited information, it proves that one lacks discrimination.”

Aaronson 1977

Results (continued)

- State both positive and negative results
- Focus tables and graphs on the positive
- Do NOT repeat data from tables and figures in text
 - But DO summarize it
- Use tables and figures only when necessary; for a few data points, describe in text
- Include statistics/statistical significance of results in text, tables, figures
- Past tense!

Results (continued)

- Describing differences among treatments or sites
- Terminology “x times less than” or “decreased x times”
 - Not understood outside of Russia
- “Increased x times” is understood
- Often better to use a percent when talking about increases or decreases or comparing values:
 - e.g. for increases: x was 150% of y; x was 50% higher than y
 - These mean the same thing!
 - e.g. for decreases: x was 25% of y
 - In Russian terminology this would be “decreased 4 times”

Tables and Figures

- Should be understandable without referring to the text.
- Avoid displaying same data in both tables and graphs
- Decide what is the most effective display
 - Graphs show broad differences; tables show precise quantitative results
 - Graphs generally easier to interpret
 - Keep graphics as simple as possible for appropriate display of data
 - Purpose is to communicate your results, not impress with your fancy graphics!
- If information can be easily put in words rather than in a figure or table, do it
- Format tables and figures according to guidelines of journal

Tables and Figures (cont.)

- Indicate suggested location of figure or table in body of manuscript (optional)
 - e.g. [Figure 3 about here]
 - Centered on its own line
- In paper for review, generally put tables and figures at end of manuscript
 - This will depend on the journal
- For most journals, figure captions should be typed on a separate page, but it helps reviewers to add them to the figure in the review drafts, if the journal allows this
- Table captions often can be included with table
- See Instructions for Authors for individual journal requirements

Preparing Tables

- Format tables according to guidelines of journal
- Organize tables so columns contain similar types of information
 - More compact, easier to read and understand
 - Do not include columns for constants or that contain large numbers of zeroes
 - Give only significant figures for data
- Include information on statistical significance of results

Sample Table 1a - bad example

Table 1. General characteristics of study sites

Site	1	2	3	4
Location	Montana	Arizona	California	Oregon
Vegetation type	Douglas-fir	Ponderosa pine	Mixed conifer	Sitka spruce
Soil type	Clay loam	Sandy clay loam	Silty clay loam	Loamy clay
Elevation (m)	2,000	1,100	2,500	300

Sample Table 1b - rearranged

Table 1. General characteristics of study sites

Site	Location	Vegetation type	Soil type	Elevation (m)
1	Montana	Douglas-fir	Clay loam	2,000
2	Arizona	Ponderosa pine	Sandy clay loam	1,100
3	California	Mixed conifer	Silty clay loam	2,500
4	Oregon	Sitka spruce	Loamy clay	300

Sample Table 2

Table 2. Chemical components of smoke aerosols. Standard error shown in parentheses.

Fire	Date	Chemical concentrations		
		C	K	Fe
		(mg/g)	(mg/g)	(mg/g)
1	20 June 2000	900 (50)	45 (20)	0
2	21 June 2000	850 (38)	20 (7)	0
3	20 July 2001	790 (65)	60 (17)	10
4	24 July 2001	875 (90)	100 (15)	0
5	15 July 2002	950 (60)	25 (7)	0
6	20 July 2001	920 (70)	35 (5)	0
Mean		881 (23)	48 (12)	1.7

Sample Table 3

Table 3. General characteristics of study sites

Site	Location	Vegetation type	Soil type	Elevation (m)
1	California	Ponderosa pine	Clay loam	2,000
2	California	Ponderosa pine	Sandy clay loam	1,100
3	California	Ponderosa pine	Silty clay loam	2,500
4	California	Ponderosa pine	Loamy clay	300

Figures

Common types of figures include:

- Maps of study location
- Photographs (experimental set-up, field sites, etc.)
- Graphs
- Spatial data (maps of burned areas, vegetation, etc.)
- Flow charts and other diagrams (e.g. model structure)

Graphs

- Make lettering, lines, etc. large enough for reduction
- Simple types (e.g. Arial) are easier to read
- Do not extend axes far beyond extent of data
- Use either different line types or different symbols—not both
- Combine into composite graphs where possible It is better for final manuscript layout to display composite graphs vertically
- For displays of similar data, try to use the same axis scales

Graphs

- Do not include title on graph. Information belongs in figure caption
- Axis labels should start with a capital letter
- Include axis units in parentheses
- Space axis numbers so they are easy to read; include intermediate tick marks for clarity
- Boxed graphs often easier to interpret
- Place legend inside graph box if possible
- Define any abbreviations for legend, axes, etc. in figure caption.

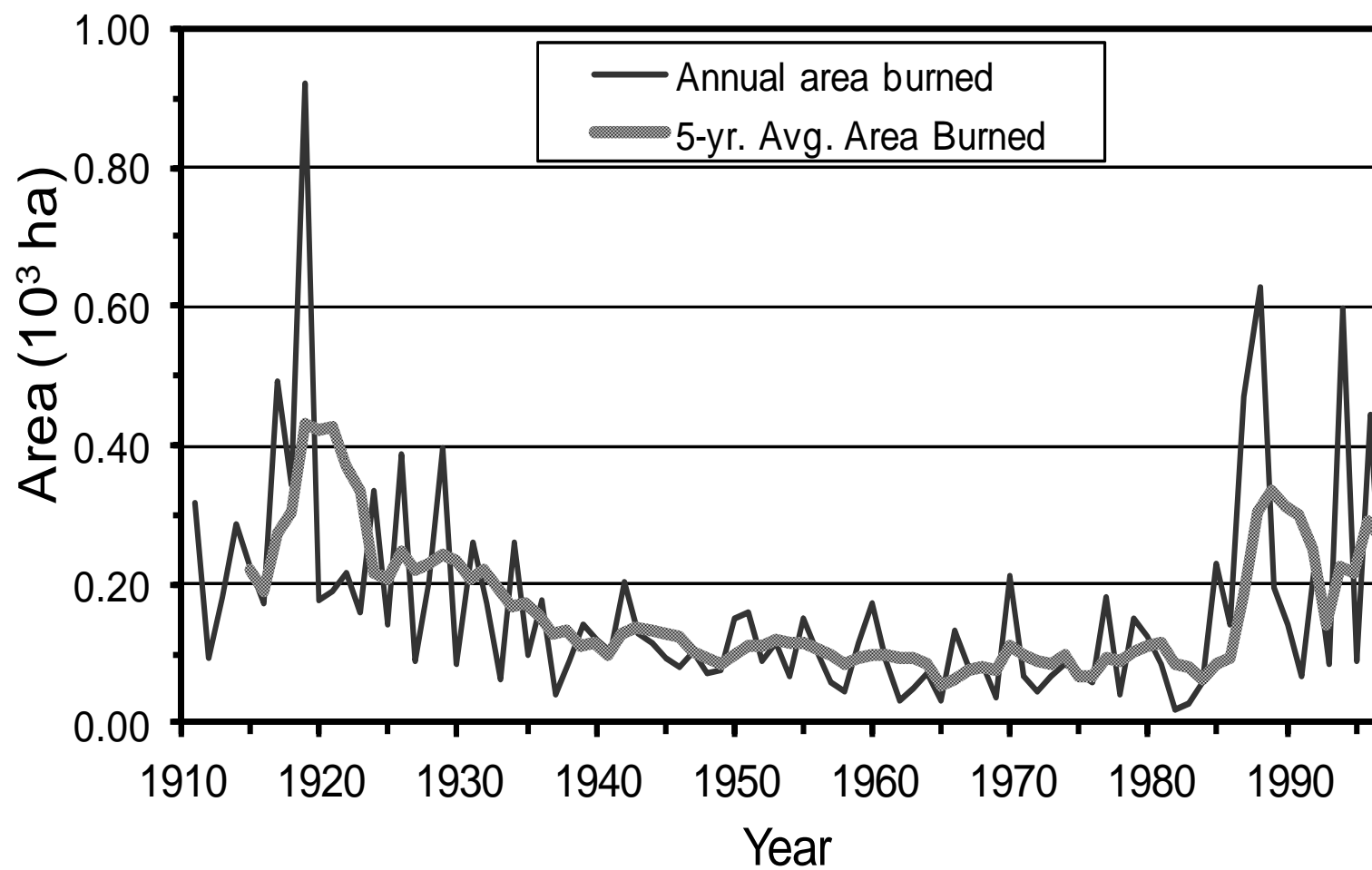


Figure 1. Annual area burned in wildfires on US Forest Service land from 1911 through 1997. The dotted line represents a five-year running average. Data on file at USDA Forest Service, Washington, DC.

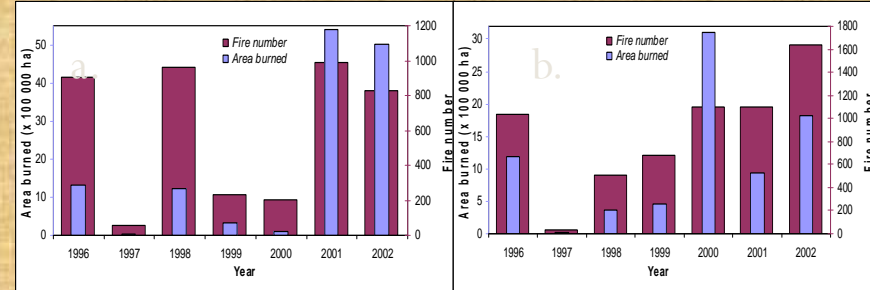
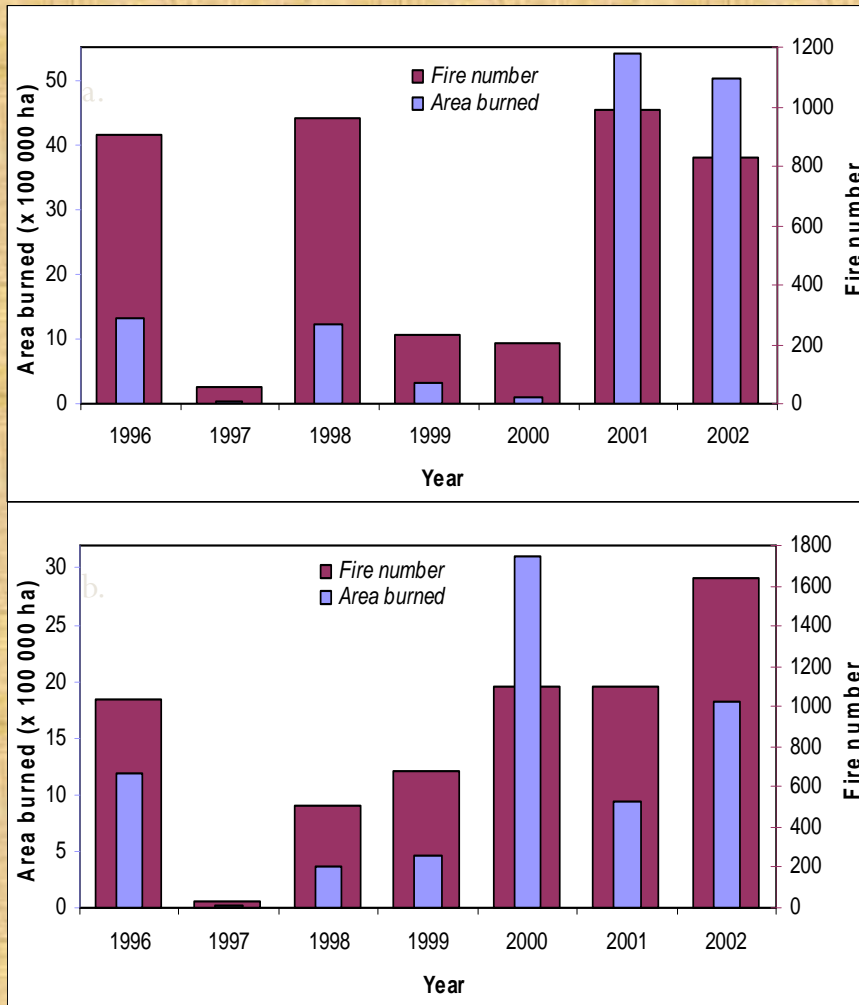


Figure x. Fire activity diagram for 1996-2002 in: a) the Sakha Republic (Yakutia) and, b) the Amur Region in the Russian Far East.

Vertical grouping allows more flexibility in sizing and is less likely to lead to excessive reduction of figures

Figure x. Fire activity for 1996-2002 in: a) the Sakha Republic (Yakutia) and, b) the Amur Region in the Russian Far East.

Discussion

- Present principles, relationships or generalizations from results
- Point out exceptions, lack of correlation, limits of data or inference
- Discuss your results in relation to those of others
- Address theoretical implications
- Describe relationships among observations
- Discuss the significance of results
 - So what? Why should the reader care?
 - Practical or theoretical applicability of results

Conclusions

- What are the main things you have learned and why are they important?
- Do not extrapolate more than justified by data
- State conclusions clearly
 - Summarize evidence for each conclusion
- Keep it simple!

End with a bang, not a whimper

Acknowledgements

- Thank people who have made a physical rather than an intellectual input
- Thank those who may have contributed in substantive way to ideas for work but not participated in the research or writing the paper—check with them first!!
- Thank previous known reviewers—check with them!
- Recognize funding sources (e.g. any grants)
- Do not just add names to impress—it can backfire
- Include in your original submitted paper. May affect choice of appropriate reviewers.

References/Literature Cited

- Always provide references for information from other sources
- Be selective
 - Use primary references where possible
 - In general do not cite abstracts
- Cite only published papers unless absolutely necessary
 - See Instructions for Authors for how (or whether) to cite unpublished data, theses, personal communications, abstracts, etc.
- Place citations immediately after the information they refer to—not at end of sentence or end of paragraph.
- Double-check that:
 - All citations are accurate and complete: date, authors' names, title, source, publisher, location, page #s, etc.
 - All references cited in text are in Literature Cited section
 - All references in Literature Cited are referred to in the text

References (examples)

There are numerous ways of formatting references. Be sure you have followed the guidelines for the specific journal you are submitting to

A few examples of possible citations in IJWF format:

- *Journal paper*

Hess JC, Scott CA, Hufford GL, Fleming MD (2001) El Niño and its impact on fire weather conditions in Alaska. *International Journal of Wildland Fire* **10**, 1-13.

- *Book*

Cary G, Lindenmayer D, Dovers S (Eds) (2003) 'Australia burning: Fire ecology, policy and management issues.' (CSIRO Publishing: Melbourne)

- *Book chapter*

Gill AM, Bradstock R (2003) Fire regimes and biodiversity: a set of postulates. In 'Australia burning: Fire ecology, policy and management issues'. (Eds G Cary, D Lindenmayer, S Dovers) pp. 15-25. (CSIRO Publishing: Melbourne)

- *Report*

Finney MA (1998) FARSITE: Fire Area Simulator-Model development and evaluation. USDA Forest Service, Rocky Mountain Research Station Research Paper RMRS-RP-4. (Ogden, UT)

Manuscripts containing innumerable references are more likely a sign of insecurity than a mark of scholarship.

William C. Roberts

However:

Manuscripts containing unsupported statements are more likely a sign of weak science or lack of knowledge of pertinent literature than of the stature of the investigators.

Susan G. Conard

Submitting papers for publication

- Choose journal carefully
 - Audience
 - Topic
 - Quality and level of respect in field
- Follow Instructions to Authors carefully
 - Be sure references are in proper format
- Include cover letter
- Most journals use electronic submission (if not send air mail or express mail)
- Do not be afraid to inquire about status, if you hear nothing for 6 weeks or so—manuscripts DO get lost and delayed!

Manuscript Reviews

- In top journals very few manuscripts are accepted as submitted; 50% or more may be rejected!!
 - Be pleased rather than insulted if revisions are requested!
- Both “revision” and “rejection” letters come in several forms
- Read letter and review comments carefully, and think about them, before deciding how to respond
- Possible responses:
 - Make requested changes and resubmit
 - Make selected changes, but not those that you disagree with
 - **Provide an explanation if you disagree with review recommendations**
 - Revise and send to different journal
 - Do more research or analysis before revising and submitting to this or other journal
 - Decide that your paper is not worth publishing

Responding to Reviews

- Usually the editor and reviewers are on your side.
- Most papers are greatly improved by attention to reviewers questions and comments
- Take comments seriously.
 - If more than one reviewer questions or does not understand, almost certainly other readers would have the same problem
- Do not be afraid to ask the editor questions.
- Include cover letter with revised paper, explaining changes made (or not made).

“I expect [editors] to accept all my papers...as submitted, and publish them promptly. I also expect them to scrutinize all other papers...with utmost care.”

Earl Wood

Responsibilities of reviewers

- Do your best to meet deadlines; contact editor if you will be late
- Maintain confidentiality
- Disclose potential conflicts of interest
- Read the paper carefully
- Make comments as constructive and tactful as possible:
 - **Not:** This is a terrible paper (although maybe it is!)
 - **But:** The authors present interesting data, but the methods section needs more detail and the paper needs careful editing, etc.
 - **Not:** The graphs are impossible to interpret.
 - **But:** The results would be much easier to understand if the graphics were simplified, with fewer variables per graph. Numbers, letters, lines, and symbols should be larger so that they are clear and easy to read after reduction.
- Even the paper is rejected, the work may well be resubmitted elsewhere—so constructive comments will be useful.

After your paper is accepted

CONGRATULATIONS—Your paper will be published!

Respond as quickly as possible to requests from production staff—e.g. need for higher-quality graphics

Dealing with Page Proofs:

This is the last chance for quality control

- Always check proofs carefully and return by the deadline
- Contact the managing editor if you will be late
- Read your paper carefully for meaning
- Check all numbers and axes on graphs
- Check spelling of authors' names, references
- Have someone not familiar with the paper read it
- Mark changes in text and in margin
- Make all necessary changes, but *only* necessary changes

Publication ethics and permissions

- Give all authors a chance to review the paper *before* submission for publication
- Acknowledge people who contributed to paper in other ways
 - *e.g.*, ideas, equipment, funding, data collection.
 - Allow people in acknowledgements to review
- Send them copies when published
- Published material has copyrights
 - Ask permission from the publisher *in writing* for republication of figures, tables, or entire paper
 - This applies even if:
 - You wrote the earlier paper
 - You wish to publish it in another language

Writing style and use of English

- Keep writing simple
 - Short words
 - Simple sentences
 - As few words as possible
- Ask a native English-speaker to review if possible
- Take care that subjects and verbs match
- Place modifiers immediately before or after the word they modify

Writing style and use of English

- Proper use of past and present tense
 - Refer to published work in the present tense, as it is assumed to be established knowledge (*e.g. In many cases, trees **grow** more slowly after a fire.*)
 - Refer to your current work in past tense (*e.g. Scotch pine on our study sites **grew** faster after the fire.*)
 - However: Clements (1888) **observed** that lightning **causes** fires.
- Use active voice where possible
 - “*We (I) found...*”, rather than “*It was found that...*”
 - “*The trees **produced** defense chemicals in response to insect attack.*” versus “*Defense chemicals **were produced by** the trees in response to insect attack.*”

Use of articles: “the” and “a” (“an”)

- One of the most difficult things for non-native English speakers is knowing
 - When is an article necessary?
 - Which one should I use?
- Use “the” for a specific item, region, etc.
 - Give me the book. I am going to the Ural Mountains, or the Moscow Region. What is the correct answer?
- Use “a” or “an” if you are talking about a category of items.
 - Can I borrow a pencil (any pencil)? I am looking for a grocery store. Can you give me an answer?
- In general, no article is used when referring to specific named locations (cities, countries, streets, stores, parks, etc.)
 - I am going to Krasnoyarsk; Do you live in Russia?
 - Is the store in Akademgorodok? Where is Stolby?
 - But, then, I live in the United States of America!

Use of Jargon

- Jargon:
 - Specialized language that is particular to a scientific field;
 - Unnecessarily complicated language.
 - In the worst cases, jargon is characterized by the almost complete omission of one-syllable words.
- If terms are not readily understood by any part of your intended audience:
 - Define them, or
 - Use simpler, less specialized words
- Avoid the temptation to transliterate rather than translate
 - Try to figure out what terms are used in English
 - If not possible, describe or define

Write to communicate and not to impress

Jargon by example...

- Slumbering canines are best left in a recumbent position.
 - Let sleeping dogs lie.
- The capacity to perform novel feats cannot be instilled in a superannuated canine.
 - You can't teach an old dog new tricks.
- A strong desire to investigate the situation led to the untimely death of this particular *Felis catus*.
 - Curiosity killed the cat.
- At that point in time, our research team ignited the ultimate combustion exercise for the year 2002 as described in the experimental protocol.
 - Then we lit the final prescribed burn of 2002.

(Thanks and apologies to Robert Day)

A final anecdote:

Two men were flying in a balloon and got lost. They saw a man walking on the ground and asked him if he could tell them where they were.

The man thought a bit and replied, "You are in a hot-air balloon."

One balloonist said to the other, "I'll bet that man is a scientist."

His friend said, "Why do you think that?"

The balloonist answered, "Because his answer was completely accurate, and absolutely useless."

For further information:

- Robert A. Day (1998) How to Write and Publish a Scientific Paper, 5th Edition. Oryx Press.
<http://www.coltech.vnu.edu.vn/~hanv/graduate/howtowrite.pdf>
- David Lindsay (2011) Scientific Writing = Thinking in Words, CSIRO PUBLISHING
- Online courses and websites: :
 - Bates College Biology Department, How to write a scientific paper:
<http://abacus.bates.edu/~ganderso/biology/resources/writing/HTWtoc.html>;
 - International Forestry Review Guide:
<http://www.cfa-international.org/ONGSWintro.html>;
 - ACS Publishing 101 videos have good tips from Editors (see Episodes 1 and 6 on writing from an editor's perspective and the review process): <http://pubs.acs.org/page/publish-research/index.html>
- English language help:
 - Purdue University (<http://owl.english.purdue.edu/owl/>)
<http://writing.engr.psu.edu/exercises/index.html>
 - Pennsylvania State University--Michael Alley's *Craft of Scientific Writing* has practice exercises:
<http://writing.engr.psu.edu/exercises/index.html>



Thank You