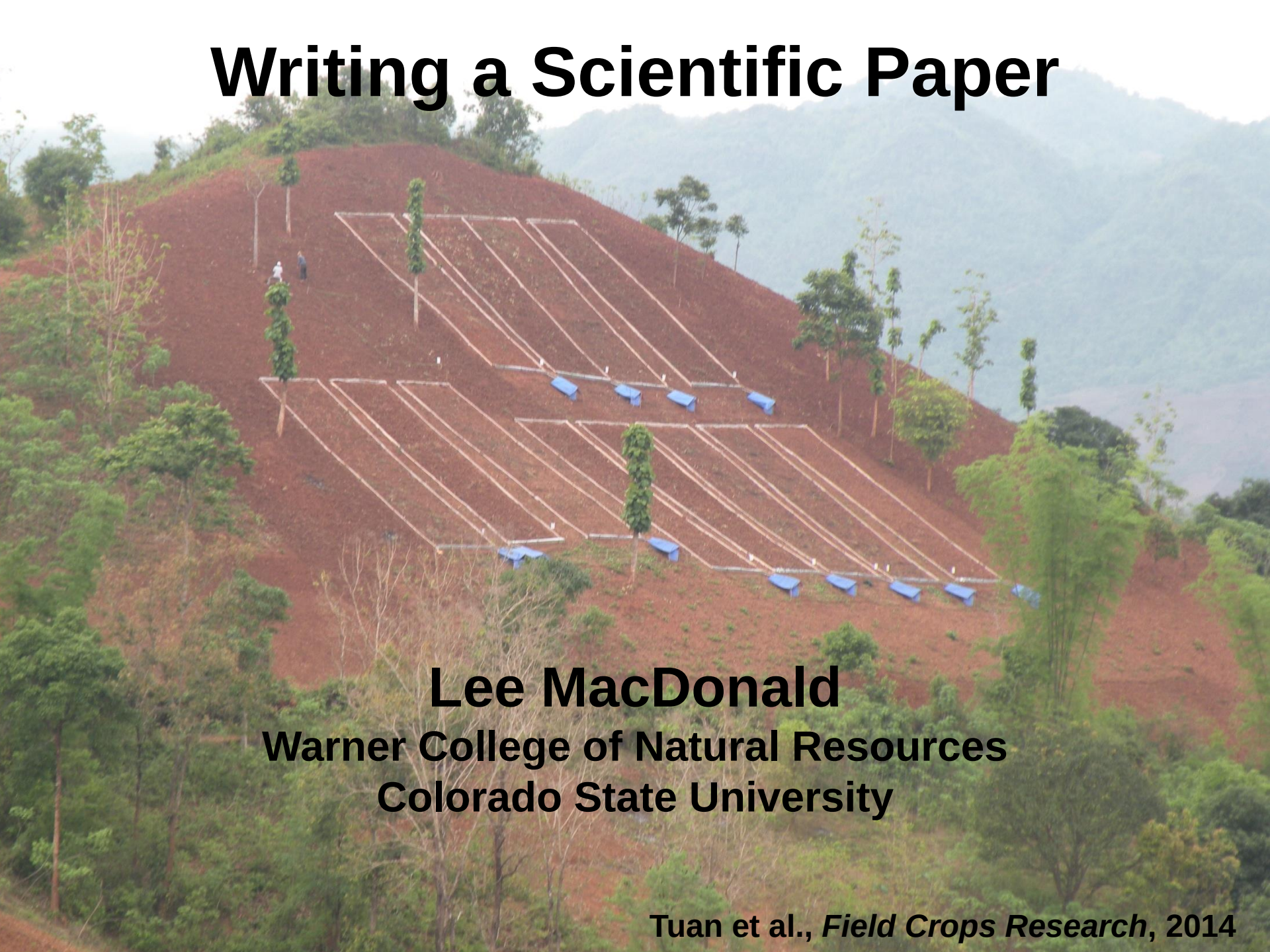
Writing a Scientific Paper



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Tuan et al., *Field Crops Research*, 2014

My background

- Professor of land use hydrology since 1990;
- Published:
  - 6 books or monographs;
  - About 45 papers in peer-reviewed journals;
  - About 15 peer-reviewed book chapters and proceedings papers;
  - Around 3000 citations;
- Rejection rate of less than 5%;
- Generally regarded as good writer and editor.

Still working….

- Retired from teaching in 2012, but still have projects and graduate students;
- Still publishing:
  - Three papers published in 2016;
  - Two papers in revision following reviews;
  - Two papers in review;
  - Two more nearly ready to submit;
  - Others in the pipeline….

Getting an F in retirement!

Should not compare U.S. and VNUF faculty

1. Teaching loads in U.S. much less;
   - Typically 3-4 classes per year;
2. Graduate students are full-time, with 1.5-2 years for M.S. and 4-5 years for Ph.D.;
3. Promotion based primarily on peer-reviewed publications;
4. Expectations of funding agencies and universities are to produce peer-reviewed publications;
5. More opportunities for interactions and staying up to date;
   - Fall Meeting of American Geophysical Union ~25,000 geoscientists!
6. U.S. faculty are mostly native English speakers;
7. More extended training in conducting research and publishing.

Publishing is not easy!

1. Develop idea → Specific objectives;
2. Figure out methods;
3. Get funding and collect the data;
4. Analyse data;
5. Write report → Draft paper;
6. Get comments from colleagues and revise;
7. Submit to journal;
8. Get reviews and revise;
9. Publication!

Entire process takes at least 2-3 years!

What are your questions and concerns?

- How to structure a paper?
- Help with writing skills?
- Defining your objectives and story?
- Selecting a journal?
- Finding money for projects?
- Methodology for research?
- Finding time to do research?
- Limited statistical analysis skills?
- Lack of confidence?

What makes a good paper?

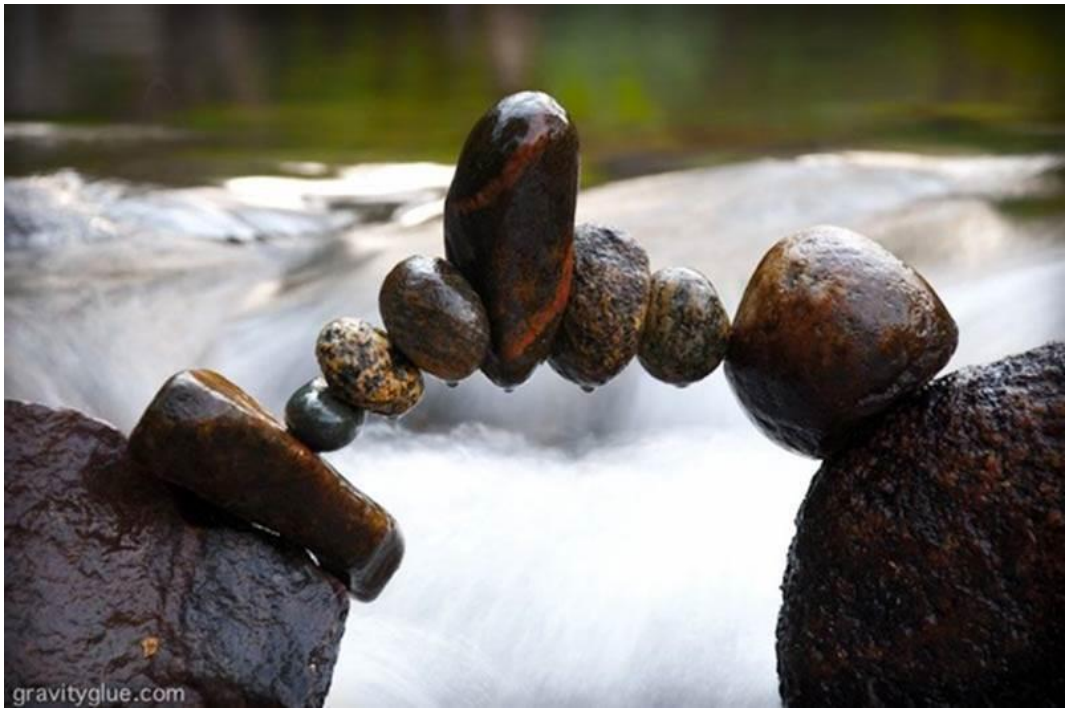
A good story that is well told!

- Well told means:
  - Clear;
  - Logical;
  - Concise;
  - Precise;
  - Explicit.

YOU have to know what YOU want to say!

Writing

- The best writer is a good editor:
  - Need to constantly and critically review your own writing;
  - My papers take 5-10 drafts, my proposals only 3-5;
- Writing is a skill and an art that improves with and needs practice;

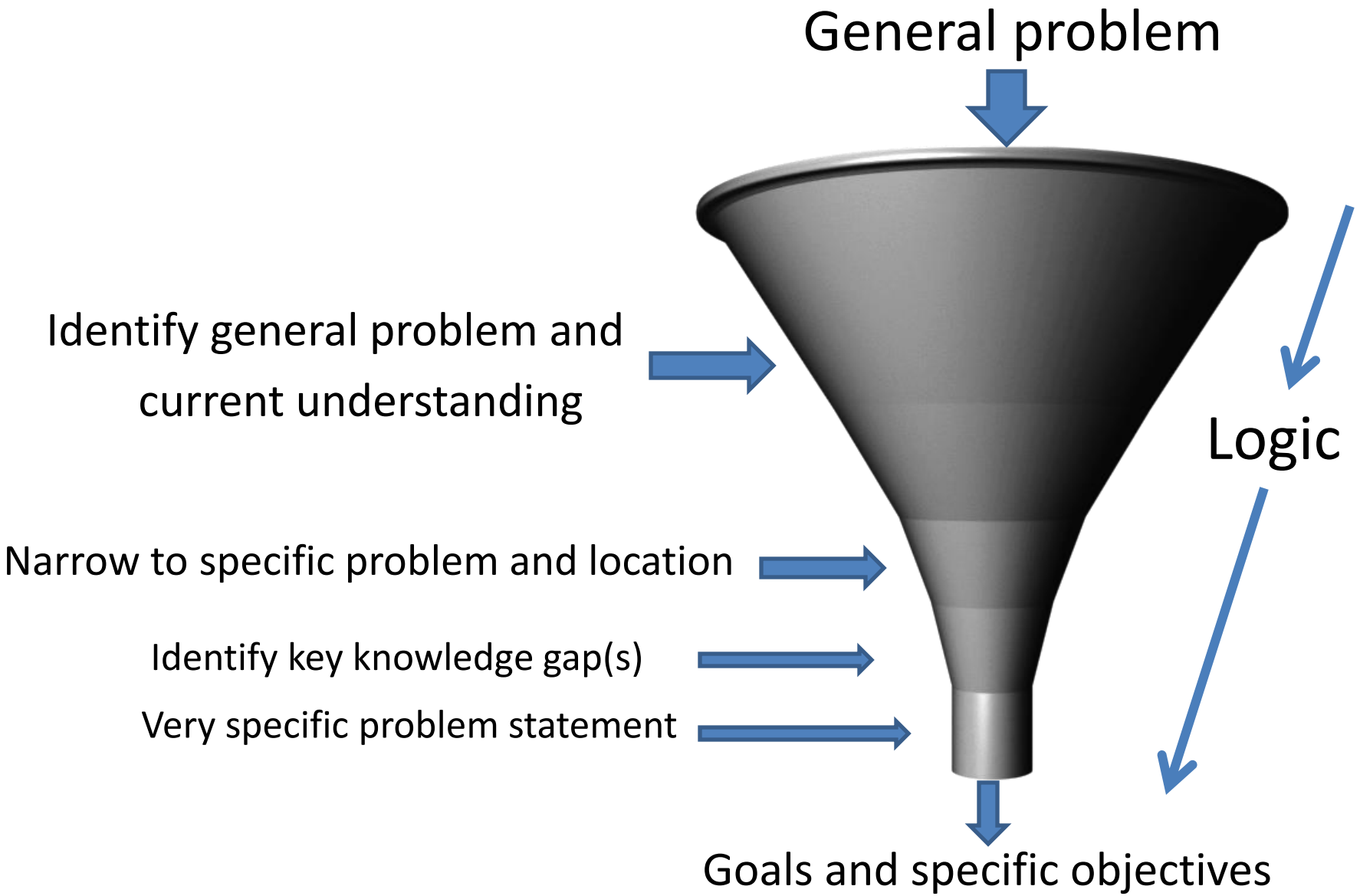


How to structure your paper: Use international scientific format!

1. Introduction;
2. Goal and (specific) objectives;
3. Methods;
4. Results;
5. Discussion;
6. Conclusions;
7. Acknowledgements;
8. References or Literature Cited.

No “Inherited methods”, no “Inherited data”, no “Research Content”.

Introduction: Structure and Format



Introduction: 2

- Define what is known, and what is not known, about a specific issue;
- This logically leads to a **specific problem statement**:
  - Example: “Acacia plantations in northern Vietnam may decrease rather than increase soil organic matter.”
- The problem statement should logically lead immediately to the goal and specific objectives.
  - Example: “The goal of this project is to determine if there are any significant differences in soil organic matter between mature Acacia plantations and adjacent natural forests.”

Defining the Goals and Specific Objectives

- This is the most important part of a paper (or a proposal)!
- Clear, specific objectives automatically define the design, location, and methods;
- Examples:
  - "Measure percent soil organic matter at 0-5 cm in mature Acacia plantations compared to adjacent native forests";
  - "Use Landsat imagery to measure the changes in mangrove area from 1980 to 2015 in Xuan Thuy National Park";
- Note that each of these leads to testable hypotheses, namely:

Re-defining the Goals and Objectives

- Defining the goals and objectives is almost always an iterative process;
- As one defines the objectives, one realizes that:
  - Other things need to be measured;
  - Maybe the objective or goal is not possible, or too ambitious;
  - Other things can be done that might be more useful or insightful;
- The goals and objectives may also have to be revised during the study if:
  - Something turns out to be too difficult to measure;
  - Unexpected events occur (typhoon, road washes out, or ??);

Goals and Objectives

- Goal(s) and objectives are usually at the end of the introduction, and should be very clearly identified and stated;
- They should lead to testable hypotheses IF we are to follow the scientific method:
  - Define a hypothesis;
  - Collect data;
  - Test the hypothesis;
  - Come to a conclusion.

Hypotheses

- Hypotheses are a useful step for further refining the specific objectives of the project;
- The majority of papers do not include specific hypotheses, but these are very useful for your own thinking, project design, and defining your methods.

Methods

- Methods should define the:
  - Study area;
    - This is typically the first sub-section of the methods;
    - Should include a map;
  - The number and type of sample units and how they were selected;
  - The techniques and frequency of data collection;
- Methods should be in the same order as the objectives;
- Methods should include a section on data analysis.

Methods

- The methods section should be sufficiently detailed to allow someone to repeat the study to validate (or disprove) your results.

Results

- Results are the factual results
- Results should be presented in the same order as the objectives;
- Key results should be presented as figures, as these are the best means to communicate;
- Key data can be presented as tables;
- Many journals now allow or require that you present more details as supplemental information;

Discussion

- The Discussion section explores selected issues that cannot be directly proven or tested by the results;
- Each discussion section should:
  1. Define the issue of concern;
  2. Present a logical argument based on the data, other studies and knowledge, and logical arguments based on well-documented behaviors or known physical, social, or economic processes;
  3. Come to a conclusion;
- Limitations, recommendations, and suggestions for future research should be sub-sections of the discussion.

Results and Discussion: Combine or separate?

- My preference is to separate the discussion (inferred results) from the factual results;
- Discussion is often the hardest section for people to write as it requires more integration and thought;
- When writing the discussion I often have new insights and ideas, so I go back and revise the results;
- Some journals do allow people to combine the Results and Discussion, while some reviewers object;
- The decision of whether to combine or separate the results and discussion is up to you, but it is scientifically more rigorous to keep the discussion separate from the results.

Conclusions

- Conclusions should summarize the results of the study;
- The conclusions should directly answer each of your objectives;
  - If you cannot answer an objective, revise your objectives!
- Conclusions **cannot** contain any new information;
- Conclusions should be 0.5 to 1.5 pages in length;
- Ideally the order of the conclusions should correspond to the order of the objectives, methods, and results;
  - A consistent, logical order through each section of your paper makes it much easier and clearer to read.

References

- Each journal has very specific requirements for formatting the references;
- My criterion is that each reference must allow the reader to easily find the same exact publication or web page;
- You need to make sure that all of your references in the text exactly match the references in the back;
  - (USFS, 2007) in the text must be listed in the references as "USFS, 2007", not "U.S. Forest Service, 2007"
  - If a reference is not in the text, it should not be listed in the references.
- Sorting out the references is one of the most painful and time-consuming tasks for writing a paper!

Review process

- Submit and wait 1-3 months for reviews;
- Accept as is (never happens!);
- Minor revisions: cause for celebration!
- Major revisions:
  - Some hard work ahead, but can be hopeful;
  - Usually requires another round of reviews;
- Reject;
- Learn from this, revise, and don't quit!
- Reviews are somewhat random;
  - In my experience, reviewers rarely agree;
  - Typically I get one review with minor revisions, and one review with major revisions;
  - Reviewers are not always right, as they sometimes don't spend the time to really understand your paper;
  - So some **limited** flexibility to argue against some suggested changes.

Good writing

- Use declarative sentences (subject, verb, object), especially for the first sentence in a paragraph or section of your article;
- Generally should not write:
  - "Figure 3 shows that tree height increases with increasing elevation and then decreases."
  - Instead put subject first: "Tree height increases with increasing elevation up to about 800 m, and then begins to decrease (Figure 3)."
- Keep your sentences as simple as possible;
  - One sentence, one thought;
- Paragraphs should be approximately two to seven sentences long;
  - Readers tend to lose interest if paragraphs are too long!

The key to good writing is practice and more practice…

Introduction: 1

- Begin by defining a problem; should not be too broad (e.g., global warming) but also not too specific (e.g., lack of information on phosphorus levels in the Cau River);
  - Example: "Increasing population growth and rapid economic development is adversely affecting water quality in Vietnam's rivers and streams."
- Rapidly narrow this broad problem to a much more specific issue;
  - Example: "Intensive agriculture may be causing high levels of nutrients and agricultural chemicals in the Cau River in X District (or a specific section of the Cau River).";
- Need to summarize what is known about this specific issue, and identify the gap(s) in knowledge that your paper will address;
  - Need references to support key statements and past studies.