Scientific Paper /Article Writing

For

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Writing a scientific paper,

The art of writing scientific paper

Writing a paper is rather like building a house: starting with a vision; converting that into a plan; beginning construction with the foundations and a framework; then filling in the details, usually in a modular fashion. Painting and decoration is done last. Think of your paper in the same way.

Aims of scientific writing

- The primary aim of scientific writing is to inform - not to impress or entertain
- Be concise
- Use simple short sentences
- Use simple short words/ one word instead of two or three

I see no reason to write 'metropolis' when they pay me the same to write 'city'. - Mark Twain

Some definitions

Science writing. A type of writing whose purpose is to communicate scientific knowledge to a wide audience including (usually) both scientists and non-scientists.

Scientific writing. A type of writing whose purpose is to communicate new scientific findings to other scientists.

Scientific paper. A written and published report describing original research results.

Developing an Effective First Draft of Manuscript

Twelve steps

1. **Consolidate (secure or strong) all the information.** Ensure you have everything you need to write efficiently, i.e., all data, references, drafts of tables and figures, etc.
2. **Target a journal.** Determine the journal to which you plan to submit your manuscript and write your manuscript according to the focus of the targeted journal. The focus may be clearly stated within the journal or may be determined by examining several recent issues of the targeted journal.
3. **Start writing**. When writing the first draft, the goal is to put something down on paper, so it does not matter if sentences are incomplete and the grammar incorrect, provided that the main points and ideas have been captured. Write when your energy is high, not when you are tired. Try to find a time and place where you can think and write without distractions.
4. **Write quickly.** Do not worry about words, spelling or punctuation at all at this stage, just ideas. Keep going. Leave gaps if necessary. Try to write quickly, to keep the flow going. Use abbreviations and leave space for words that do not come to mind immediately.
5. **Write in your own voice.** Expressing yourself in your own way will help you to say what you mean more precisely. It will be easier for your reader if they can—hear‖ your voice.
6. **Write without editing.** Don't try to get it right the first time. Resist the temptation to edit as you go. Otherwise, you will tend to get stuck and waste time. If you try to write and edit at the same time, you will do neither well.
7. **Keep to the plan of your outline.** Use the headings from your outline to focus what you want to say. If you find yourself wandering from the point, stop and move on to the next topic in the outline.
8. **Write the paper in parts.** Don't attempt to write the whole manuscript at once, instead, treat each section as a mini essay. Look at your notes, think about the goal of that particular section and what you want to accomplish and say.
9. **Put the first draft aside.** Put aside your first draft for at least one day. The idea of waiting a day or more is to allow you to "be" another person. It is difficult to proofread and edit your own work; a day or more between creation and critique helps.

Revise it. Revise it and be prepared to do this several times until you feel it is not possible to improve it further. The objective is to look at your work not as its author, but as a respectful but stern critic. Does each sentence make sense? In your longer sentences, can you keep track of the subject at hand? Do your longer paragraphs follow a single idea, or can they be broken into smaller paragraphs? These are some of the questions you should ask yourself.

10. **Revise for clarity and brevity (shortness)**. Revise sentences and paragraphs with special attention to clearness. For maximum readability, most sentences should be about 15-20 words. For a scientific article, paragraphs of about 150 words in length are considered optimal. Avoid using unnecessary words.
11. **Be consistent.** Often a manuscript has more than one author and therefore the writing may be shared. However, the style needs to be consistent throughout. The first author must go through the entire manuscript and make any necessary editorial changes before submitting the manuscript to the journal

Writing a Research Paper

Writing a paper is a process, a chain of gradual steps that lead to an acceptable and pleasing end product. There are four indispensable basic requirements for producing a good paper:

1. write clearly,
2. write accurately,
3. be brief (avoid verbose),
4. build a logical structure: the train of thought should be logical, avoiding a winding and repetitive course in the suite of ideas.

The subsequent paragraphs discuss the general structure of a research paper.

1. Title and Running Title
2. Authors
3. Abstract
4. Introduction
5. Materials and methods
6. Results
7. Analysis, Discussion and Conclusions
8. Acknowledgements and Dedications
9. References and Citations
10. Postscript and Appendix

A postscript is a note or series of notes appended to a completed letter, article, or book. It is reserved for a very special remark or statement. An appendix contains supplementary technical matter in tabular form, usually attached at the end of a paper.

What is title?

- The **title, important part of the whole paper, identifies the important components of the paper** and orients the reader by specifying the writer ‘s major findings or perspective
- It gives a glimpse of the content of the paper. It aims at providing a name representative of the whole of the scientific paper
- It is the **heart** of the article and draws **attention** of the reader.
- It is concise and focuses the study and the scope of the paper.
- It tells the reader what the paper is about. It reflects on paper's content
- A title conveys information on the research question, area of research, and the research method.
- It represents either the aim or the conclusion.
- Specific title describes sufficiently the contents (subject matter) of the paper.

Purpose of the title for the reader

1. It helps the reader decide whether the paper is worth reading further.

2. It gives the reader a first idea of the contribution: a new method, application, preparation, compound, mechanism, process, or system.
3. It provides clues on the type of paper (review paper or introductory paper or others), its specificity (narrow or broad), its theoretical level, and its nature (simulation or experimental). By the same means, it helps the reader assess the knowledge depth required to benefit from the paper.

Purpose of the title for the

1. It allows the writer to place enough keywords to find the title.
2. It catches the attention of the reader.
3. It states the contribution in a concise manner.
4. It differentiates the title from other titles.

Main features of the title

- The title should be at the beginning of article, together with the author (s) name.
- The title of a paper should be brief accurate, informative, simple, specific, unambiguous, complete and attractive.
- The title should not be too technical that only specialists will understand. The title should be appropriate for the intended audience.

Example: Effect of Smoking on Academic Performance

- Sometimes a title that summarizes the results is more effective: "Students Who Smoke Get Lower Grades"
- Successful titles can be determined after looking at the other titles in a particular area.
- Some people read only title, or only abstracts.
- Catchy titles are good, but it can be difficult to make them work, and they still need to indicate their subject and the conclusion or aim.
- A good title is important if the author wants the paper to be read by others. For example, abstracting and indexing services rely heavily on titles for categorization purposes.
- An inaccurate title may waste a reader ‘s time by suggesting, wrongly, that a paper contains certain information.

Qualities of a title

Once written, how will you evaluate the title quality? Here are a few adjectives to help you.

- A title should be **unique.** It differentiates your title from all others (present or future).
- A title should be **concise** (fewest words); but less than two lines; not too brief**.** Some keywords are overly detailed.
- A title should be **clear.**
- A title should be **descriptive**. It helps to know about the article type.
- A title should be **easy to find.** Its keywords are carefully chosen.
- A title should be **honest and representative** of the contribution and the paper. It sets the expectations and answers them.
- A title should be as **catchy** as can be.

Some rules for identifying a title

Creating a title can sometimes be a challenging exercise.

- *Abbreviation should never be used*. Remember that the paper may be read by people who are not experts in your own field, so never use abbreviation in the title.
- *Do not write illogical or unclear title*. This is dangerous as it indicates that your study has not resolved anything; it is thus a waste of time to read the paper.

- *Do not write a long title*. A title should not exceed **20** words (in general 10 to 12 words, less than 10 words for effective titles). Long title is at risk of distraction.
- *Try to make a "new" thing*. This can attract readers' attention. For example: ―A new family of mathematical models for describing the human growth‖ has a higher chance of getting attention than ―A family of mathematical models for describing the human growth. ‖
- *Do not make a statement in title*. Sometimes, titles such as ―Smoking causes cancer",
- *Keep in mind that the title also provides information used by computerized information systems*.

Some considerations for developing a title

- The title should contain important key words of the paper. The tile should have the most important key phrase first.
- If in doubt in determining the title, (a) read the 'Table of contents' of several issues to get a feel for their style of titles, and (b) make up a couple of possible titles and ask for reactions from colleagues who know this journal well.
- Try to keep your title as clear and short as possible.
- A title should be a label, not a sentence.
- On your sheet make a list of *key words* for the **Title.**
- Long titles are unattractive to readers. However, shorter titles may not be sufficiently specific, and therefore not as informative.
- If a title is long, then the author should provide an abbreviated\running title" for page headers.
- Although desirable that the **Title** be short, it should not be general. A reader, attracted by a title, may be disappointed to find the paper is about only one specialized aspect.
- If the title is too long it usually contains to many waste words
- No waste words (unnecessary or nonessential words) should be used in the title., ―Investigations on ...‖ ―Report on the‖, ―by use of‖ ―pilot study" ―assessment of, ‖ "A Study of" ―Observations on‖ ―on the‖, ―regarding‖, ―research on‖, are obviously wasted words Omit all waste words.

Excess words*:* Report on the Destruction of Renal Calculi (kidney stone) by Use of Ultrasound ***Better****:* Ultrasonic Destruction of Kidney Stones

- Do not use abbreviations (unless they are very well known, like LMC), and prevent grammatical errors and typos in the title.
- Avoid jargon (slang).
- Avoid ― symbols, formulas‖, include ―several keywords" ―is NOT underlined or italicized‖
- Include the scientific name (Genus and species) of any organisms mentioned within the title.
- As a rule, the genus and species of the organism studied should appear in the title for experimental laboratory studies
- There are, however, some exceptions to this. For example, when the species name of an organism is common knowledge, the common name may be substituted (fruit fly for *Drosophila melanogaster*), or when a study is large in scope such as a field study which includes many species, none need be named.
- Select the words in a title carefully for clarity and accuracy.
- If the inferences made in the paper are limited to a particular region, then name the region in the title.
- The title is what catches the reader's eye and deserves careful thought.
- A sub-title format can also be used in writing a title, for example, Tropical Moist Forest Silviculture and Management: A History of Success and Failure. One advantage of this two-level heading style is that it is easy to expose the main subject.
- Some journals, but not all, allow sub-titles.
- Many journals require a running title to be printed at the top or bottom of every page of the article when it is published. Usually, this is between 30 and 50 characters.
- Many journals require additionally a short 'running title'. An ingenious (original) paraphrase of the Title can supplement the latter. For example, the Latin name in a title and the common name in the running title.
- Do not be afraid to be grammatically creative. Here are some variations on a theme, all suitable as titles:

The effect of temperature on germination of corn
Does temperature affect germination of corn?
Temperature and corn germination: implications for agriculture

Catchy titles

Holes in the doughnut theory: the dispersion of ant lions

The self-thinning rule: dead or alive?

How the forest lost its trees: just so stories about juniper in Arabia

Titles that incorporate aims or conclusions

Forest buffalo prefer clearings to closed-canopy forest in the primary forest of northern Congo

Distribution and status of the Apennine hare *Lepus corsicanus* in continental Italy and Sicily

Titles that incorporate aims or conclusions

Meat prices influence the consumption of wildlife by the Tsimane 'Amerindians of Bolivia

Status of the Ganges river dolphin or shushuk *Platanista gangetica* in Kaptai Lake and the southern rivers of Bangladesh

The bush meat boom and bust in West and Central Africa

Preliminary observations on the distribution and status of dwarf blue sheep *Pseudois schaeferi*

Main functions of tile

- indicates content and main discoveries;
- attracts the reader's attention;

Preferred style

- short and simple;
- purposive (aims at specific audience);

Examples of titles

- The Training Impacts on Vegetable Production in the Eastern Hills of Nepal
- A Potato Production System in the Western Hills of Nepal
- Genetic variation in *Taxus baccata* (Himalayan Yew) of Central Nepal.
- Participatory approach in forestry research in Nepal.
- Is current level of financing sufficient for managing protected area? A case study of Economic Valuation of Bardia National Park, Nepal
- Modelling height-diameter relationship for Chir Pine trees
- Above-ground carbon stock assessment in different forest types of Nepal
- Change assessment of forest cover in Ghodaghadi lake area in Kailali District of Nepal
- Harvesting methods of *Cinnamomum tamala* leaves in private land: a case study from Udayapur District, Nepal
- Modelling the growth of *Shorea robusta* using growth ring measurements
- Value chain analysis of non-timber forest products in Baglung District, Nepal
- Morphological plasticity of corms in enhancing invasion of *Chromolaena odorata*
- Modelling height-diameter relationship for *Pinus wallichiana* trees for Lete and Kunjo of Mustang District
- Distribution and availability of raw materials for production of Nepali handmade paper from *Daphne* species in Darchula District, Nepal
- Medicinal plant knowledge of the Panchase region in the Middle Hills of the Nepalese Himalayas
- Using Landsat data for assessing forest cover change and fragmentation in Laljhandi corridor of Kanchanpur District, Nepal
- Utilization of plant resources in Dang District, West Nepal
- Conservation and management efforts of medicinal and aromatic plants in Nepal
- Time frame for the reclamation of degraded forest sites
- Die-back of Dalbergia sissoo plantation in Saptari and Rupandehi Districts, Nepal
- Regeneration of *Quercus semicarpifolia* Sm. In Shivapuri Hill, Nepal
- Landscape level conservation could promote a special category of protected areas
- Ethnomedical uses of plants from Salyan District, Nepal

- Decision making process in community forestry: a case studies from Kanchanpur and Kaski districts, Nepal
- Assessment of tree resources outside forests: a lesion from Tanzania
- Augmentation of germination in *Sapindus mukorossi* due to acid scarification in Jhanjhatpur nursery

Authors and addresses

- One should always discuss authorship in an open way: if you think you should be the first author, start a dialogue with the others and give your arguments.
- Never change author sequence on your own initiative only: dialogue is the only solution if you do not wish to permanently damage your relationship with colleagues with whom you collaborate.
- No one should be given authorship unless they were significantly involved in the creation of the paper (conception, design, data collection, analysis and manuscript writing). For example, Do not include heads of departments simply because they are the senior member of staff.
- The name of the worker who did the work should come first. Never omit names of people who did contribute to the work.
- The second name should be of that person who has supervised the work and help to write the paper or the person who has done some part of the work.
- It is good policy to include in the authorship any individual who has contributed to the concept and design of the study, analysis and interpretation of the data, drafting the article or revising it critically
- If co-authors have been involved in writing the paper, it is a must that their consent is taken before publishing.
- List author (s) with initials of first names followed by family name.
- When there are more than two authors, the names are separated by commas, except for the last which is separated from the previous name by the word "*and*".
- Degrees and titles are not required.
- Give the institutional address for each author following the journal style.
- If the author has moved away from where the research was carried out, give their present address as footnote.
- Include the corresponding address of the corresponding author (email compulsorily, phone, postal address).
- Every attributed author must see and approve the final draft of the paper before you submit it to a journal. However, journals may have different policy if each author should be responsible for the full content or not.
- Reviewers may discriminate against a paper with too many authors (they may not believe this number of people truly wrote the article), and may also discriminate against a paper with only one author (since the research has not been verified by a collaborator).
- At least one e-mail address is needed. It will be used as the corresponding author's e-mail address in all contacts with the authors.
- Readers sometimes might like to communicate with the author (s) regarding the published article. Therefore, the address of each author should be given after the title. The address should be the one that represents the author where the work has done.

Example of writing the address

Title of the paper

R. Shrestha[1] and B. Thapa[2]

1. Department of Forests, PO Box Babarmahal, Kathmandu, Nepal. E-mail:
2. Department of Soil Conservation and Watershed Management, PO Box Babarmahal, Kathmandu, Nepal.

For example- Participatory approach in forestry research in Nepal K. P.Acharya, N. Stewart, and P. Branney
Examples:

Modelling Height-diameter relationship for Chir pine trees, R. P. sharma[1]

[1].Department of Ecology and Natural Resource Management, Norwegian University of Life sciences. E-mail:

Is current level of financing sufficient for managing protected area? A case study of economic valuation of Bardia national Park, Nepal
B. Basnyat[1*], B. P. Sharma[2], R. M. Kunwar[3], R. P. Acharya[3] and J. Shrestha[1]
[1] Western Terai Landscape Conservation Project, Kathmandu, Nepal.
[2] Department of Economics, Tribhuvan University, Kathmandu, Nepal.
Practical Solution Consultancy, Kathmandu,
Nepal. * Corresponding author: E-mail:

What is abstract?

- An abstract is a condensed version of the manuscript, which highlights the major points covered, concisely describes its content and scope, and reviews its material in abbreviated form.
- Writing an abstract involves summarizing a whole manuscript and providing as much new information as possible
- An abstract summarizes, in one paragraph (usually), the major aspects of the entire paper
- An abstract, or summary, is published together with a research article, giving the reader a "preview" of what's to come. Such abstracts may also be published separately in bibliographical sources, such as Biologic al Abstracts. They allow other scientists to quickly scan the large scientific literature, and decide which articles they want to read in depth. The abstract should be a little less technical than the article itself; you don't want to dissuade your potential audience from reading your paper.
- Your abstract should be one paragraph, of 100-300 words (depends on the type of journal), which summarizes the purpose, methods, results and conclusions of the paper.
- It is not easy to include all this information in just a few words. Start by writing a summary that includes whatever you think is important, and then gradually prune it down to size by removing unnecessary words, while still retaining the necessary concepts.
- Do not use abbreviations or citations in the abstract. It should be able to stand alone without any footnotes.
- Abstract, a short paragraph, is a summary of the main points of a paper and states why the study was done, what was done, what was found, and what was concluded.
- The abstract is a short passage that summarizes all major elements of the paper: introduction (including objectives), methods, results, and discussion (including major conclusions).

An abstract is a shortened version of the paper and should contain all information necessary for the reader to determine:

1) what the objectives of the study were;
2) how the study was done;
3) what results were obtained;
4) and the significance of the results.

- This is an important section. Its purpose is to present the main points of the paper for readers who may (a) not require to know the details, or (b) not have time to read the whole article.

Even if the reader intends to read the whole paper, a reader may find it helpful first to gain some insight from the abstract.

- Every abstract must be within so that it can be read and understand without consulting the paper to which it relates.
- The abstract is NOT only an introductory statement.
- A good abstract contains a concise statement that describes the purpose of the paper includes results and conclusion (specific but not detailed)
- A good abstract should be a miniature version of the paper, which contains brief summary of each of the main sections of the paper.
- Abstract is a brief summary of the purpose and salient results of the study.
- The abstract is the advertisement for the paper, and it is often the only part many people read.
- An abstract is stand- alone**.** It lives by itself in its own world: databases of abstracts, journal abstracts.

Purpose of abstract for the reader

. It makes the title clear.
2. It provides details on the writer ‘s scientific contribution.
3. It helps the reader decide whether the article is worth reading or not.
4. It helps the reader rapidly gather competitive intelligence.
5. It helps the reader assess the level of difficulty of the article.

Purpose of the abstract for the writer

- It allows the paper to be found more easily, because it has more keywords than the title.
- It states the writer ‘s contribution in more precise detail than the title

Qualities of an abstract

- An abstract should be **complete.** It has four parts (what, how, results, impact).
- An abstract should be **tied to title.** All title words are found in the abstract.
- An abstract should be **representative** of the contribution of the paper. It sets expectations for the reader.

Some features of abstract

A summary should not be longer than about 10% of the whole paper and it should contain the following:

- brief statement of the objectives
- the main findings in the same order as in the body of the paper
- the conclusions and recommendations

While writing an abstract, the following points should be addressed briefly:

- the objectives of the work,
- significance of the work,
- description of the methods,
- main findings of the actual value,
- an interpretation of the results in terms of their leans of this significance and possible replications

The abstract should provide maximum information with minimum words and cover the following elements:

1. WHY was this research undertaken, and what is the objective of this study?
2. HOW did you do the research (observations, theory, calculations)
3. WHAT are the new results, and what do these new results mean and its implications?

The abstract should be a self-contained unit capable of being understood without the benefit of the text. It should contain these four elements:

- the purpose of the study (the central question);
- a brief statement of what was done (Methods);

- a brief statement of what was found (Results);
- a brief statement of what was concluded (Discussion, in part).

The abstract:

- puts your work into context and presents your conclusions;
- tells us what you did;
- tells us what you found out;
- clearly states the implications of your findings;
- must not go beyond the maximum number of words asked for by the journal;
- does not include references.
- Lengthy discussions are omitted from the summary/abstract.
- The abstract occurs near the front of the article, it is actually written last. Why? Because you need to select and summarize from the text of your article once it is written.
- The *Title* can only make the simplest statement about the content of your article, the *Abstract* allows you to elaborate (detailed) more on each major aspect of the paper.
- Title must be concise and easy to read and must cover the important points of the paper.
- Many publications have a required style for abstracts; the "Guidelines for Authors "provided by the publisher will provide specific instructions. Stay within the publisher's guidelines, or your manuscript might be rejected.
- It is used by the reader to determine whether or not it would be useful or interesting to read the entire paper, but as an author, do not try to attract the reader with mystery or cleverness.
- It usually consists of a single paragraph. In other words, readers should be able to understand what was done without having to refer to other sections of the paper.
- Be concise, but not too vague, so that readers can better decide if they want to read the paper. In most cases, this is the only section of your paper that readers will read.
- Every effort should be done to produce a good quality abstract as it is the 'shop window' through which you wish to sell your research to the readers or as a 'carrot' which you hope will attract the readers to read the rest of your paper.
- Nothing should be included in the summary that is not in the paper.
- The abstract should clearly summaries the important findings of the paper.
- The works, which are not included in the paper, should not be in the abstract.
- The abstract should include all relevant findings in a precise way.
- Each of these features should be described in an abstract with actual value. For example, rather saying trees survived after the treatment, it would be more meaningful if the statement is written as 98 per cent of the trees survived after the treatment applied.
- The abstract reduces the whole paper to a single paragraph.
- Give a skeletal outline of your purpose (one sentence), methods, (one to two sentences), results (one to four sentences) and conclusions (one to two sentences).
- Compose the abstract with great care. Editors frequently decide to accept or reject a paper (and readers decide to read it completely or not), after only reading the abstract.
- Ideally, the abstract should be written in a way that gives away the clue of the paper but still makes people curious to read the whole story.
- Do not cite others 'work in the abstract since it is a summary of your paper and your research.
- Write the methodology and results in the past tense. But information from any published source can be written in the present tense.
- Information not stated in the paper should never be given in the abstract.
- Avoid using acronyms, or listing references in the abstract. Acronyms should not be used unless they are commonly accepted terms, e.g. FAO, UNDP
- Abstracts are frequently reprinted in other journals or entered into computer literature retrieval systems, so they must be able to stand alone. In other words, this might be the only part of your paper some people read. Some websites let readers read the abstract free, and charge money for the rest of the paper.

- Writing an effective abstract will improve the chances of your manuscript being accepted, encourage people to read it, and increase its impact.
- A number of studies have indicated that a badly written manuscript with poor use of English, even with good science, has less chance of being accepted and published.
- It should be informative and not only present the general scope of the paper but also indicate the main results and conclusions.
- It should provide a sentence or two of background for the study, a brief overview of the basic methods used, a summary of results, and a brief interpretation of the data. Usually this section includes the scientific name of the organisms that were studied.
- In combination with the title and key words, the abstract is an indicator of the content of the paper.
- No table or figures

Information conveyed by abstract

Whether it is structured or unstructured, an abstract must convey the following information:

- The *question(s)* you investigated (or purpose). State the purpose very clearly in the first or second sentence. It is also a good idea to include a single lead sentence to state the critical background to provide context for the work.
- The *experimental design or methods* used. Clearly state the basic design of the study (treatments, controls, replication, sampling scheme, etc). Clearly explain the basic methodology used without going into excessive detail - be sure to indicate the key techniques used.
- The *major findings* including *key numerical results*. Report those results which answer the questions you were asking; identify trends, relative change or differences, etc.
- A brief summary of your *interpretations* and *conclusions*. Clearly state the implications of the answers your results gave you

Ten steps in writing an effective abstract

The best way to write an effective abstract is to start with a draft of the complete manuscript and follow these 10 steps:

1. Identify the major objectives and conclusions.
2. Identify phrases with keywords in the methods section.
3. Identify the major results from the discussion or results section.
4. Assemble the above information into a single paragraph.
5. State your hypothesis or method used in the first sentence.
6. Omit background information, literature review, and detailed description of methods.
7. Remove extra words and phrases.
8. Revise the paragraph so that the abstract conveys only the essential information.
9. Check to see if it meets the guidelines of the targeted journal.
10. Give the abstract to a colleague (preferably one who is not familiar with your work) and ask him/her whether it makes sense.

Types of abstract

There are **two basic types of abstract**:

- An informative abstract extract everything relevant from the paper, such as primary research objectives addressed, methods employed in solving the problems, results obtained, and conclusions drawn. Such abstracts may serve as a highly-aggregated substitute for the full paper. Informative abstract informs about the most important results and conclusions reported in the paper.
- an indicative or descriptive abstract rather describes the content of the paper and may thus serve as an outline of what is presented in the paper. This kind of abstract cannot serve as a substitute for the full text, for example, review papers.

- There are two kinds of abstracts: unstructured and structured abstracts. The former is a one-paragraph summary of the study. The latter is a summary of major aspects of the entire paper in a prescribed sequence such as Background, Methods, Results, and Conclusions.
- Many journals require a structured abstract, which includes subtitles such as objective, type of design, setting, material or subjects, methods, results, and conclusions.
- It is important to follow the journal guidelines on these issues.

Needless words in parentheses

• (already) existing	Mix (together)
• At (the) present (time)	Never (before)
• (basic) fundamentals	None (at all)
• (completely) eliminate	Now (at this time)
• (continue to) remain	Period (of time)
• (currently) being	(private) industry
• (currently) underway	(separate) entities
• (empty) space	Start (out)
• Had done (previously)	Write (out)
• Introduced (a new)	(still) persists

How to make abstract effective?

- Appropriate for intended reader (terms and concepts)
- A smooth logical flow between the components of the abstract
- Do not put statistics in the abstract (there are exceptions)
- Be confident (avoid using phrases like ―I think‖, ―I suppose‖, ―may‖, and etc.)
- Contain important key words of research
- Try to be creative (e.g. Different structure - conclusion/result first)

What is the conventions/structure?

- Be aware of length limitations
- Should have four main parts: context, problem, summary and main point (results) , in other words ―question(s) you investigated (or purpose)‖, ―experimental design and methods used‖, ―major findings including key quantitative results, or trends‖ and ―a brief summary of your interpretations and conclusions‖ (Bates College, 2008)
- State the problem, solution, technologies used, and how it is evaluated
- Avoid methodology unless important
- Define or avoid jargon (depends on audience), abbreviation, acronym, citations

Key words

There may be limits and types requested – check this in journal guideline

– Do not use words from the title here

- At the end of the abstract, list a few key words or phrases under which you think the paper should be listed by the abstracting and referencing services
- Most scientific journals require authors to provide 3 to 10 key words or short phrases that will assist indexers in cross-indexing the article.
- These are what people use when searching for articles in literature indexes. Some will be quite specific to your topic (such as the animals or plants you worked on or the particular conservation approach you took). They should not be as broad as ―ecology‖ or ―conservation‖.
- Keyword can be used an index to readers. The keywords must focus on the study and should be specific as possible.
- For example, a title such as 'Application of Molecular Markers in Forest trees for Developing Countries' would give the following keywords; Forest genetics, forest tree breeding, gene conservation application.

- Another example of key words from the title of the paper Argo forestry in Nepal: research and practice are Agro forestry, Nepal, research, practice, fodder tree
- Another example of key words from the title *Litsea monopetala*: variation in leaf nutrient concentration and implications for biomass transfer are: nutrient cycling, naturalized hedges, phosphorus, planted shrub, potassium.

Producing Your Key Message

What is a key message?

• This is one of the most important parts of writing your paper, and one that is often overlooked.

• **Think carefully about what it is that you want your readers to understand about your work – try writing it.**

• Remember, we are all busy and we need to absorb key messages quickly and clearly.

• This forms the core of Initial planning of your paper

• Unless you thoroughly derive your key message, it is not very fruitful to proceed further in outlining your paper

Why cannot I find a key message?

- −My paper/research is too complex and difficulty in getting clear messages‖
- Your own understanding of your research is still too vague for you to sort out the most important message(s) – work on it/talk it over
- If truly too many big messages, you have too much in one paper
- **—**I am not sure my work has enough of a contribution for such messages‖ o You need to get a better idea of what makes a contribution
- If you get that and find you are right, work on the research content.

Producing an outline

- Like painting a picture:
- You start with an idea….
- and make a sketch, a drawing …..
- then you start with some background colouring here and there …
- you add different colours in rough forms, using the drawing a bit …
- you add a bit more details and variations in the colour as your idea develops
- then you ‘re ready to start developing the painting in detail
- Writing an article outline:
- You start with an idea….
- and make a chapter outline….
- then you start with main words on content, which tables and figures go where, which theory is needed where, draft of the main model, what main points do you want in your discussion, what will the main conclusion be
- you add more details: text bites, formulations, references, subsection titles, key-equations and results, list more discussion points, sort and order them, list topics for the conclusion – sort and order
- now you are ready to start developing the article in detail…
- …you begin with the abstract

Some examples of abstract

Participatory approach of forestry research in Nepal
K. P. Acharya, N. stewart and P. Branney

There is a need to develop a new approach of forestry research which could involve local people to identify and prioritize research problems, interpret, evaluate and disseminate results. This is in connection with the Forest User Groups (FUGs) in managing Nepal's community forests. With this realization, the Natural Forest Research Management Section (NFMRS) of the Forest Research Division initiated participatory action research (PAR) study with the two Forest Users Groups. Its

aim was to explore the potential of PAR in community forestry. This article outlines the approach taken by such a research team in two community forests and suggests steps for constructing PAR in Nepal.

Contribution of leasehold forestry to generate financial asset in three western hill districts of Nepal
K. Baral and B. K. Poudyal

Leasehold forestry is an effective poverty alleviation mechanism, which explicitly targets the poorest section of the community. This paper tries to analyze its contribution in income generation and enhancement of financial asset of the leasehold forestry user group members of Tanahu, Gorkha and Lamjung districts of Nepal. Nine groups, three in each district, handed over before five years, were selected for the study. Semi-structured questionnaire, informal discussion and observation were used as data collection tools. The study reveals that there is good contribution of leasehold forestry in the creation and promotion of financial asset. However, income sources of group members could not be diversified. Majority of groups still stick to the cultivation of conventional crops instead of cash crops and medicinal herbs. The study has also found that income of the group members significantly differs in caste groups; members belonging to higher caste groups are making higher income than that of lower caste groups. The study recommends carrying out more extension and empowerment related activities, especially to minority groups so that they can effectively run saving credit programmes and promoting income generation activities.

Modelling height-diameter relationship for *Pinus wallichiana* trees for Lete and Kunjo of Mustang district
B. H. Wagle and R. P. Sharma

Quantifi cation of height-diameter relationship helps in better understanding of stand dynamics. Height-diameter models can be used as necessary inputs to growth and yield models and growth simulation systems. The researchers developed height-diameter models with 364 Blue pine (*Pinus wallichiana*) tree data from Lete and Kunjo Village Development Committees (VDCs) of Mustang district. Eighteen non-linear models were calibrated, among which, Weibull model described the largest proportion of height variation (R^2 adj = 0. 9362). Gunary and Chapman-Richards'models also appeared almost identical to Weibull model in terms of fi t statistics and graphical appearance. The researchers recommend Weibull model for predicting total heights of Blue pine trees for the VDCs covered by the study.

Distribution and availability of raw materials for production of Nepali handmade paper from *Daphne* species in Darchula district, Nepal
D. K. Kharal, B. N. Oli and I. Poudel

The study, conducted in 2005 in Darchula district of the far western region of Nepal, aimed at assessing the distribution of Lokta plants (*Daphne* species) and the sustainable availability of their bark as a raw material for Nepali handmade paper. Stratifi ed random sampling design was adopted for collecting primary data from 340 circular shaped sample plots. The study revealed asymmetric distribution and production of Lokta in different Range post areas of Darchula district. While the tree diameter at 30 cm from base (D30) varied from 1 to 18 cm, the maximum tree height varied from 2.1 to 6 m. On the basis of diameter class, about 87 % of the bark weight was found to be of exploitable category. For the entire district of Darchula, the annual yield of Lokta bark for six years rotation amounted only to about two-third of the four years rotation. The study concludes that the stock of Lokta bark that prevails in the district can sustain promotion of Nepali paper production enterprises.

Time frame for the reclamation of degraded forest sites M. B. Malla, S. R. Baral and J. H. Howell

Two forest plots in Rupandehi and Kabhrepalanchok districts were examined to assess the changes in soil characteristics under Sal (Shorea robusta) trees established through plantation and regeneration

processes respectively. Along with studies of the soil profiles, measurements were also made for pH, organic carbon, total nitrogen, available phosphorus and exchangeable potassium in sample collected from these plots. Indicators of reclamation such as development of tree cover, formation of an A (top soil) horizon, and rise in oil nutrient content were observed in both plantation and regeneration plots. The Plantation Plot took 30 years whereas the Regeneration plot required only 20 years to appear substantially and sustainably reclaimed.

Above-ground carbon stock assessment in different forest types of Nepal S.K. Baral, R. Malla and S. Ranabhat

This study assessed the above-ground carbon stock in the five major forest types, representing two physiographic regions and four districts of Nepal. Altogether, 116 circular sample plots were laid out systematically in different forests types to inventory the forest. Total above-ground biomass was derived with allometric equations. Results indicated variation in age of the stand (18-75 years), above-ground carbon stock per hectare (34.30- 97.86 dry wt. ton ha-1) and rate of carbon sequestration (1.30-3.21 t ha-1yr-1), according to different forest types. The rate of carbon sequestration by different forest types depended on the growing nature of the forest stands. Tropical riverine and *Alnus nepalensis* forest types demonstrated the highest carbon sequestration rates in Nepal.

Harvesting methods of *Cinnamomum tamala* leaves in private land: a case study from Udayapur district, Nepal
D. Lamichhane and N.K. Karna

Tejpat (*Cinnamomum tamala*) leaf is commercially one of the important non-timber forest products of Nepal. This paper attempts to elaborate and analyze the harvesting methods and techniques of Tejpat grown by the farmers in their private land. The study was conducted in the villages of Udayapur district where Tejpat was widely cultivated and harvested for income generation and trading purposes. Almost all farmers with private land had planted Tejpat. Complete lopping of leaves once a year was the exclusive practice for harvesting. The collection period for leaf was from Ashoj (October) to Magh (February) but the period for bark varied greatly, i.e. from Kartik to Poush (November to January) and Baisakh / Jestha (May / June). Bark collection was done only from old, dying, diseased and low leaf producing trees. Average number of trees per household ranged from 10 to 155. The mean diameter at breast height (DBH) of the trees was 39.58 cm. There was high positive correlation between the DBH and fresh weight of leaf. Fitting of linear regression of fresh weight of leaf with DBH proved that the relationship was statistically significant at 5% level of significance. The minimum age and size of trees for leaf harvesting were found to be five years and 16.18 cm, respectively.

Value chain analysis of non-timber forest products in Baglung district, Nepal
A. Paudel, B. P. Subedi, S. Gyawali, G. K. Thapa, and M. B. Sharma

This study was carried out in five Village Development Committees of Baglung district, Nepal. The main objective was to assess the constraints and opportunities to run the non-timber forest products based enterprises, and to design business solutions to make their value chains more efficient and competitive with the best utilization of the available resources. Primary data were collected through group discussions, key informants interview, informal meetings and direct observations, using open-ended questionnaires and checklists. Similarly, secondary data were gathered from reports and records of community forest user groups, District Forest Office and other organizations. The data were analyzed using qualitative and quantitative tools. The identified major constraints concerning the selected value chains are: absence of detailed resource inventory; inadequate knowledge and skills with local people about modern technology and product quality parameters, local resource management policy and sustainable resource harvesting; insufficient finance with local processors; lack of sufficient information about market; and poor infrastructure development. In addition, the

study also identified a number of opportunities such as the resource potential and monetary benefits to the local people; financial access through community forest user groups'fund and financial institutions; growing market demand for quality products; involvement of service providers in forest resource management; and supportive policy for employment generation from locally available natural resources. This paper has suggested some business solutions for the effective value chain of selected products.

ORIGINAL ABSTRACT

Aims. The objectives of our study were: (1) assessing oral health inequalities in preschool children depending on mother's socio-economic status (SES) and educational level; (2) comparing epidemiologic results of oral health (dmft) in 2.5 and 5 years preschool children with other country's results; (3) evaluation of the role of preschool children tooth decays in predicting caries in the permanent dentition. **Methods.** The authors initiated in 2004 a three-year longitudinal study which included 382 preschool children 2.5-3 years old and 455 preschool children 4.5-5 years old from 12 kinder gardens in Sarda, Robinia. Oral health was evaluated and dm ft index was established for each group of study. The family'knowledge level and SES were evaluated depending on the children's oral health status both in 2004 and 2007. The data were analyzed using the Statistical program, ANOVA, Pearson, Chi -square ($p<0,05$), and the multivariate linear regression method for the prediction model. **Results.** Depending on SES and educational level, there were found significant differences ($p<0,05$) in mothers'group regarding the frequency of dental brushing in children. The lower SES group encouraged seldom tooth brushing for their children in 2004 but recommended a daily brushing after the initiation of the program focused on dental health education. For the 2.5- 3 years old group, dmft was 1.34 lower compared to other countries' results, but for the 4.5-5 years old group the value of 2.4 is greater.**Conclusions.** The findings of this study revealed=a positive relationship between mothers' SES and the level of knowledge and attitudes towards oral health. The dmft results of our study vary compared with other countries'. Primary dental care is vital in maintaining oral health in children because the initiation and the extent of deciduous tooth decay is the main caries predictor for permanent dentition in order to achieve by 2010 WHO's goal of 90% 6 years old children caries free.

REVISED ABSTRACT

Aims of the study were: (1) to assess oral health inequalities in preschool children and any association with parents' socio-economic status (SES) and educational level, (2) to compare the mean dmft scores of 2.5 and 5 year-old preschool children in Sarda with those of children of the same age living in other Central and Easter European (CEE) countries, (3) to evaluate the extent to which dental caries in these pre-school children predicted caries in their permanent dentition. ***Methods***: In 2004, the authors initiated a three-year longitudinal study which included 382 randomly selected pre-school children aged between 2.5 and 3 years old and 455 randomly selected pre-school children aged between 4.5 and 5 years, all drawn from 12 randomly selected kindergartens in Sarda. Of the 12 kindergartens, 4 were attended by children mainly from high socio-economic groups, 4 from medium and 4 from low. The education level of each child's parents was determined and classified as university, high school or primary school level. Ethical approval for the study was obtained from the relevant regional committee. Oral health was evaluated by 4 calibrated examiners and the mean dmft scores for each group were calculated. Family educational level and SES were evaluated by questionnaire in both 2004 and 2007. Data were analyzed using the Statistical program, ANOVA, Pearson, Chi–square. ***Results:*** Statistically significant ($p<0.5$) differences were seen between the groups. Before the programme commenced in 2004, parents from the lower SES group seldom encouraged their children to brush their teeth. The mean dmft for the 2.5-3 year-old group was found to be lower than that reported for several CEE countries but for the 4.5-5 year-old group the mean dmft was around double that of other CEE countries. ***Conclusions:*** The findings of this study revealed a relationship between the child's dmft, parents' SES, educational level and attitude towards oral health. The dmft results of this study differed from those of other CEE countries. Primary prevention is vital in maintaining oral health in children because deciduous caries

experience is the main predictor for caries in permanent dentition.Prevention must be delivered to all, if the WHO goal that by 2010, 90% of 6 year-old children should be caries free is to be achieved.

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What is introduction?

- The Introduction "introduces" the paper.
- The **introduction is where the argument is presented for why the study was done**.
- It **places the work in a broad conceptual context** and gives readers enough information to appreciate the objectives.

Features of introduction

- **It is necessary to proceed from the general to the specific**, starting with a brief review of current knowledge of the topic and gradually narrowing to the specific question(s) that have addressed.

For example: ―Interactions among predators and prey are important in structuring communities‖, and end with, ―Our specific objectives were to determine if physid snails detect predators through chemical cues, and subsequently move to habitats that provide refuges from these predators‖.

- The **introduction usually concludes with specific research question, objectives, and/or hypotheses.**
- Enough background information is needed for the reader to be able to understand and evaluate the purpose of study without having to refer to other works.
- The rationale for the study has to be presented in 'introduction'.
- Some review of the literature has to be done to allow the reader to understand why the study is necessary and how you attempted to resolve it.
- Salient references are needed but an exhaustive review of the topic is not essential.
- If the problem is not stated in a reasonable, understandable and clear way, the reader will have no interest in your solution.
- The *Introduction* must be able to convey the following: (a) what have been done; (b) summary of conflicting findings in the literature; and (c) what you want to do.
- Introduction should be begun by reviewing background information that will enable reader to understand your study ‘s objective and its significance, relating the significance to the larger issues in the field.
- Only those information need to be included that directly prepares the reader to understand the question investigated.
- Most ideas in the *Introduction* will come from the literature, such as scientific journals or books dealing with the topic you are investigating. All sources of information must be referenced and included in the *References* section of the paper, but the *Introduction* must be in your own words.
- Refer to the references when appropriate. Unless otherwise instructed, place the author of the reference cited and the year of publication in parentheses at the end of the sentence or paragraph relating the idea for example, "(Finery, 1992)."
- **Remember the introduction should attract the reader to read further.**
- Describe clearly and concisely the topic of your paper. This description must be specific and focused, not vague.
- It must give your reader a clear idea of precisely what your paper is about. Finally, your introduction must focus your reader's attention
- It is good policy to write one sentence describing the study design. This could be written at the end of the introduction.
- Frequently the introduction is too long; many authors confuse the role of the introduction with that of the discussion section.

- Keep it short as readers can easily get bored and may never make it through to your important results.
- The introduction should start with the general framework and end with your specific questions/hypotheses and study system.
- **Never** start the introduction with a focus on the specific study organism (keep the focus on the general concept of interest) and Never use phrases like "little is known about...." because it is not a good reason to motivate a scientific study.
- This section provides background, specifically the conceptual motivation for your study, as well as a very brief (2 to 3 sentences) of the focus of your study.
- This section can be started to write even before writing other parts. In one to several paragraphs, give *specific* background information on your study.
- Write your introduction in the present tense, because you are giving established and accepted information.
- Unless absolutely necessary, however, DO not use direct quotes! Instead, read, learn and *paraphrase* the knowledge.
- Start with a strong opening sentence to set the tone of your paper.
- Keep the introduction brief, but do indicate the purpose of the experiments performed as well as present appropriate background.
- Make sure that the reader knows enough to appreciate the relevance of the work and why it is appropriate to ask the question that you will address with your study.
- Always state the hypothesis and/or objectives in your introduction
- Objective (s) of the study and the expected findings are included
- Give a clear statement of the problem you study, and draw the outline of your work. Make a brief literature review giving the most relevant papers related to your work, but avoid irrelevant citations (especially of the very few people you know personally).
- Only give references to papers that you have really read.
- If you refer to someone, refer to a specific and important paper, not just to a minor poster.
- In the introduction, but also throughout the rest of the paper, a proper paragraph structure should be maintained.
- A paragraph is a topic sentence where one and only one main point or idea is handled. It also includes directly-related sentences with details and information that support the paragraph topic.
- Finalize the introduction after finishing the discussion and conclusions.
- The introduction is where you place your study in the context of the field as a whole, and also provide the rationale for the study. This is best done by a sort of sophisticated story-telling.
- The introduction serves the purpose of leading the reader from a general subject area to a particular field of research.
- There are two essential components of an introduction: (a) a clear and complete statement of the research objectives, including carefully worded hypothesis, and b) sufficient background information to fully justify the objectives. Background may be historical in nature and should include citation of appropriate literature.
- In brief, the introduction should guide the reader to current state-of-the-art in the field and should allow the reader to understand the rest of the paper without referring to previous publications on the topic .
- Even though the introduction is the first main section in a paper, many researchers write – or at least finish – it very late in the paper writing process, as at this point the paper structure is complete, the reporting has been done and conclusions have been drawn.
- Use the work of others that have published on your topic before you to set the stage. It is not necessary to cite every article written that relates to your study, but you should have enough citations to develop a reasonable rationale and provide the background leading to the hypotheses you have tested.

- At the end, state your hypotheses clearly, and outline the predictions of the hypotheses and the expected results if your hypotheses are valid. State completely here the significance of the study you have done.
- A statement of purpose; what hypotheses were addressed and why is this an interesting problem?
- Introductions put a scientific report in context. Why was a study done? What questions were asked and why is this interesting?
- The introduction focuses a reader ‘s attention upon specific hypotheses and relevant background; have other scientists studied similar questions and how does the present study relate to this past work? Include brief descriptions of this earlier work and its relation to your study.
- Successful introductions are usually several paragraphs long and follow a basic organization that narrows a reader's attention onto specific issues or questions.
- Most begin with a general paragraph that introduces the issues being studied.
- Succeeding paragraphs provide increasing detail and focus. The concluding paragraph often describes the specific question or hypothesis addressed by the authors.
- Include only important references.
- If the abbreviations and acronyms used are not very common, give their full form on the first mention.
- Ensure your introduction with continuous flow of information and ideas.
- Avoid outdated arguments that have been resolved or that are not pertinent to your paper, even though you may have spent months researching these and you have a interesting solution to the debate.
- The introduction should not be too long, or it will be swamped with unnecessary information and mislead the reader.
- The introduction itself should have a logical structure to it and should flow from paragraph to paragraph.
- The first paragraph should introduce some general aspect of biology or conservation. The second paragraph can go on to more specific issues, perhaps those particularly relevant to your study. Subsequent paragraphs may add more detail or outline particular problems. The final paragraph should focus in on the objectives of your study. At this point it is good to be very specific – for example by listing a few questions that you will address).
-
- Examples:
- Which first sentence is better?
- *Elephants depend greatly on their habitat for survival* does not tell the reader anything new or exciting – most organisms require habitat to survive!
  OR *In Ghana, 40 per cent of the habitat on which elephants depend has been destroyed.*

The introduction also puts your work into a broader context.

Sunbirds pollinate many plants in Kenya may sound too specific to a general reader who is not a bird expert.

OR

Pollination is an important ecosystem service, and sunbirds play a role pollinating many plant species introduces the concept of pollination and ecosystem services and then focuses on your study group.

The introduction should contain

-The background of the work that allows evaluating the present work
-A brief review of the relevant literature

-The logical development that leads to undertake the present
work -A clear statement of the objectives of the work

-The introduction should be short. Any previous work published in the subject should be reviewed.

(i) describe the question tested by the experiments described in the paper,

(ii) explain why this is an interesting or important question

(iii) describe the approach used in sufficient detail that a reader who is not familiar with the technique will understand what was done and why?

(iv) very briefly mention the conclusion of the paper at the end (e.g., ―These experiments identified a …. ‖).

Some points to be considered in Introduction

- The purpose of the introduction is to **provide essential background information**, and to generate interest in the paper. Do not assume that people will automatically be curious to read the paper. It is up to the author (s) to spark the interest of the reader by writing a good introduction.
- Keep the use of jargon to a minimum. If it cannot be avoided, then jargons have to be explained for the readers who are unfamiliar with the specifics. Also, avoid abbreviations as much as possible, because they discourage comprehension of your introduction.
- The introduction should make clear why the topic of the paper is important, and provide the necessary information for the reader to evaluate and understand the relevance of your work. For instance, you could indicate why your approach is innovative or how your paper adds to previous work in the field.
- Always state the objective (s) (main question, hypothesis) of your research *clearly* in the introduction. Keep this objective clearly in mind when you write your manuscript.
- Make sure that the order in which your present information is logical. Most people start with providing information that places the paper in a wider framework, then zoom in on a particular problem, and finally mention the specific aims of their study.

Some points:

- Nature and scope of the problem
- Literature review
- Rationale (reasons why the study was carried out)
- Objective (what was done)

Introduction: an example

A very simplistic example follows:

- Previous studies (Finhead and Fishead, 1988) on the metabolic rates of rainbow trout, *Oncorhynchus mykiss*, have shown that short-term exposure to low temperatures results in decreased metabolic rates. Similar results were obtained using crustaceans (Crabhead, 1989) and amphibians (Toadface, 1990). However, little is known about how this decrease in metabolic rate is modified by the thermal history of the animal. Croaker (1992) has shown that a two-week acclimation to 10‘C has no effect on the metabolic rate of frogs at any temperature of measurement, whereas Claw and Jones (1988) showed that prior exposure to low temperatures for 5 weeks raised the metabolic rates of lobsters at low temperatures of measurement (for review, see Smith, 1994). We tested the effect of thermal acclimation for prolonged periods (6 weeks) on the metabolic rates of rainbow trout measured at both low and high temperatures. Any ability to compensate for low environmental temperatures, such as those experienced by the animal during the cold seasons of the year in the natural environment, would be manifest in the higher metabolic rates of cold-acclimated animals when compared to warm acclimated conspecifics.

Guidelines to write the Introduction

The *Introduction* usually consists of unstructured, free-flowing text. However, it is always helpful to keep in mind the following guidelines when write the introduction:

• *The Introduction should not be long*. Try to limit it within two double-spaced pages.

• *The Introduction should not contain an in-depth historical review*.

Assume that the reader has knowledge in the field for which you are writing, and it does not require a complete digest. Do not forget that citing appropriate and specific credit to relevant earlier works is part of your scholarly responsibility.

• *The Introduction should outline the objectives of your study*.

- ❖ You should try to make sure that when a reader finishes reading your introduction, he/she will know the significance of the question.
- ❖ Do not use the introduction as an information deposit to show the reader how much you found on a topic.
- ❖ Show the reader you understand the relevant issues in a field and know how your study complements this information.

• *Write the Introduction in past tense when referring to your experiment*, but when relating the background information, you can use both past and present tenses when referring to another investigator's published work.

Three phases of introduction

1. Establish a territory:
   a) bring out the importance of the subject and/or
   b) make general statements about the subject and/or
   c) present an overview on current research on the subject.

2. Establish a niche (place):
   a) oppose an existing assumption or
   b) reveal a research gap or
   c) formulate a research question or problem or
   d) continue a tradition.

3. Occupy the niche:
   a) sketch the intent of the own work and/or
   b) outline important characteristics of the own work;
   c) outline important results;
   d) give a brief outlook on the structure of the paper

What is the conventions/structure?

- You may want to structure the introduction according to this flow (As you describe each of these sections, refer to the different parts of the paper):

1. Context (background)
2. Problem (research question)
3. Motivation (why is it important to answer this research question)
4. Highlight your contribution/solution

- Short description of solution and hypothesis is addressed after problem
- Limit to 1-2 pages
- Start broad in your context and then work towards the specifics of your research.

1. "What we know"
2. 'What we don't know"
3. "Why we did this study"

Additional Tips

1. Move from general to specific: problem in real world/research literature ⇒ your experiment.

2. Engage your reader: answer the questions, "What did you do?" "Why should I care?"

3. Make clear the links between problem and solution, question asked and research design, prior research and your experiment

The last sentences of the introduction should be a statement of objectives and a statement of hypotheses.

For example, you might write the following:

"Our objective was to determine if the relationship between legumes and nitrogen-fixing bacteria is species-specific. We hypothesized that legumes would grow best when infected by the same *Rhizobium* species that it occurs within the field."

How to Cite Sources in the Introduction Section

It is important to cite sources in the introduction section of your paper as evidence of the claims you are making. There are ways of citing sources in the text so that the reader can find the full reference in the literature cited section at the end of the paper, yet the flow of the reading is not badly interrupted. Below are some examples of how this can be done:

"Smith (1983) found that N-fixing plants could be infected by several different species of *Rhizobium*."

Writing a scientific paper

"Walnut trees are known to be allelopathic (Smith 1949, Bond et al. 1955, Jones and Green 1963).“

"Although the presence of *Rhizobium* normally increases the growth of legumes (Nguyen 1987), the opposite effect has been observed (Washington 1999).“

Note that articles by one or two authors are always cited in the text using their last names. However, if there are more than two authors, the last name of the 1st author is given followed by the abbreviation **et al.** which is Latin for "and others".

The second citation (above) shows that it is acceptable, and encouraged, to cite more than one source for a particular statement. This gives the statement more validity in its context and suggests that your research was thorough. Note also that the three sources are ordered by publication date, so that the earliest citation comes first.

Make sure you give a full citation in the Literature Cited section for all sources mentioned in the text. What question did you ask in your experiment? Why is it interesting? The introduction summarizes the relevant literature so that the reader will understand why you were interested in the question you asked. One to four paragraphs should be enough. End with a sentence explaining the specific question you asked in this experiment.

Examples: Introduction

Modelling height-diameter relationship for Chir pine trees, R.P. Sharma, From BJ 19 (2)

The accurate information of tree height is required for both forest management and research. Diameter at breast height (dbh) and total height are the commonly measured variables in an inventory. Unlike dbh, total height is less frequently used for construction or application of forest models because measurement of dbh is more cost effective, easy and accurate than total height. An estimation of total height from height-diameter models might be a reliable option where such models are available. For height-diameter models, a representative sample of accurately measured total-height is used as the response variable and dbh as the predictor variable. Several of such models are available in the literature (e.g. Curtis, 1967; Wang and Hann 1988; Huang *et al*., 1992, 2000; Moor *et al*., 1996; Zhang; 1997; Fang and Bailey, 1998; Sharma and Portan, 2007; Trincado *et al*., 2007; Newton and Amponsah, 2007; Wagle, 2007).

For a given species, height-diameter relationship differs from stand to stand due to different stand densities and site qualities, sometimes even within the same stand, variation might be high (Calama and Montero, 2004). Also, height-diameter relationship may change over time (Curtis, 1967). For more comprehensive and accurate height-diameter models, additional variables describing stand density (e.g. basal area or number of stems) and site quality (e.g. site index) should be included into the models (e.g. Sharma and Zhang, 2004; Trimester and Gadow, 2004; Sharma and Portan, 2007; Newton and Amponsah, 2007). However, getting information on such attributes demand a lot of resources, and therefore cannot be considered for general purpose models.Chir pine (*Pinus roxburghii*) forest is located in a subtropical region with an altitude varying from 1000 mto 2000 m, and its standing volume is 6.3% of the total forest in the country (NFI/FINIDA, 1999). The economic contribution of Chir pine forest to national and local level development is valuable; and, therefore, its management is useful. For scientific management, species-specific individual tree or stand level models such as height-diameter models, site index models, growth models, and biomass and volume models need nto be developed. Height-diameter models can be used as a sub-model (input) in the more comprehensive models such as biomass models, growth and yield models or their simulation systems. Modelling works for Chir pine forests in the country include Joshi, 1984; Joshi, 1985; Rauntiainen, 1992; and Sharma and Pukkala, 1990. But, none of these are height-diameter models. This study, therefore, aims at constructing height-diameter models using data from various Chir pine stands of two mid-hill districts.

Above-ground carbon stock assessment in different forest types of Nepal S.K. Baral, R. Malla and S. Ranabhat From BJ 19 (2)

Gloobally, forests act as a natural storage for car bon, contributing approximately 80% of terrestrial above-ground, and 40% of terrestrial below-ground biomass carbon storage (Kirschbaum,1996). They play a critical role in reducing ambient CO2 levels, by sequestering atmospheric C into the growth of woody biomass through the process of photosynthesis and also by increasing the soil organic carbon (SOC) content (Brown and Pearce, 1994). Carbon sequestration from atmosphere can be advantageous from both environmental and socioeconomic perspectives. The environmental perspective includes the removal of CO2 from the atmosphere, the improvement of soil quality, and the increase in biodiversity (Batjes and Sombroek, 1997); while socioeconomic benefits include increased yields (Sombroek *et al.*, 1993) and monetary incomes from potential carbon trading schemes (McDowell, 2002).

The Kyoto Protocol recognized the importance of forest in mitigating the greenhouse gas emission (i.e. carbon dioxide, methane and other compounds) and has included forest and soil C sequestration in the list of acceptable offsets (UNFCCC, 1997). Thus, reducing emission from deforestation and forest degradation has emerged as an incentive mechanism for developing countries. However, updated national forest inventory data and technical capacity is poor and accounting of changes in forest cover biomass stock, carbon emission and carbon removal are limited in the developing countries like Nepal (Dangi and Acharya, 2009). Therefore, this study has endeavored to assess the above-ground carbon stock in the different forest types of Nepal.

Above-ground tree biomass and allometric relationships of *Cinnamomum tamala* grown in the western hill regions of Nepal B. S. Poudel, S.K. Gautamand D. N. Bhandari

Biomass is the total amount of living organic matter accumulation on a unit area at a specified point of time (Brown, 1997; Applegate et al., 1988). Tree biomass, which is used to denote the total quantity of materials in a tree, can best be measured in terms of weight (Poudel et al., 2003).

Biomass can be estimated by direct method, i.e., destructive techniques or by indirect method, i.e., developing an allometric relationship. Destructive techniques for biomass estimation are time consuming and expensive (Nath et al., 2009; Verhijst and Telenius,
1999).

Allometric relationships yield a non-destructive and indirect estimate of biomass and is often the preferred approach since it is less time consuming and less expensive (St Clair, 1993) than the direct method. Allometric equations are widely used for forest biomass assessment. Allomeric relationship through regression analysis has the advantage that once equations are developed and validated they can be used for similar forest types on a wide range of sites in a particular geographic region (Satto and Madgwick, 1982).

Biomass tables are similar to the volume tables in that they quantify the resources of interest (tree, stem wood, branch wood, foliage, bark) with reference to some measurement of the stand or tree, usually Diameter at Breast Height (DBH). Single tree biomass tables, which predict the weight of an individual tree from its diameter, have been found reliable (Applegate et al., 1985; Joshi, 1985; Hawkins, 1987). Previous biomass and volume tables in Nepal have been oriented towards traditional forestry practices focusing largely on timber production. Such tables are therefore largely concerned with only the timber species (Sharma and Pukkala, 1990). Some biomass information has been developed in the form of oven-dried forest products which makes it difficult to interpret by Forest User Group (FUG) members, whilst other information provides stem volume figures (Tamrakar, 1999) rather than branch, bark and foliage quantity which are equally important forest products for forest users. Most of the non-timber forest products are traded in terms of weight, often air-dry weight (Poudel et al., 2003). Biomass tables are the best means of estimating biomass of such parts in terms of weight based on field measurement of one variable i.e. DBH only. *Cinnamomum tamala* (Buch.- Ham.) Nees and Eberm. under family Lauraceae, locally called as Tejpat, Dalchini, Sinkauli in Nepali, is a moderate sized evergreen tree species . It is distributed in tropical and subtropical Himalayas (Edwards, 1996) and grown between 500 m to 2000 m asl in Nepal (Jackson, 1994). It grows on varieties of soils. However, it prefers well-drained moist soils. Tejpat trees are extensively managed for leaf and bark production in Nepal. Bark and leaves are used as spices and medicine; wood as fuel wood, agricultural implements, and in some instances, as furniture and roofing material. Tejpat contains etheral oil in the leaves and cortex of cells (Rendle, 1979) that enrich the plant with aromatic flavour thereby making bark and leaves suitable for spices and medicine. Leaves are used in colic, diarrhoea, rheumatism and found beneficial for cough and cold, diabetic patient and to reduce blood sugar level (Kirtikar et al., 1992). Harvesting is done at the age of 8 – 10 years. It coppices well and coppices are ready to harvest in the shorter period. *Cinnamomum tamala* is one of the major non-timber forest product species in Gulmi, Arghakhanchi and Palpa districts. Its bark and leaves are sold easily at high prices and people are interested to plant this species and some stands already exist in their lands but they can not make precise estimation of the amount of bark and leaf (DFO Arghakhanchi, 2001). Tejpat is listed among 30 medicinal plants prioritized for research and development by the Government of Nepal (DPR, 2006).

The aim of this study was to develop allometric equations to estimate biomass of foliage, bark, stem wood and branch wood, and prepare a biomass table including the stem wood, branch wood, bark and foliage for green condition and, bark and foliage biomass for green, air-dry and.

Some features of materials and methods

Two categories: Materials and the methods

- The materials such as equipment, chemicals., etc. that were used in the study should be described in logical order.
- While naming the materials **internationally recognized standards** should be used. All measurements should be given in the metric system.

- When monetary data are mentioned, a **conversion to US Dollars** should be included, based on the current rate at the time the study is done.
- Use scientific nomenclature (genus, species and authority) for living beings. Local and common names need to be presented once in the paper. e.g., Birch
- Methodology need to be described in detail. More detail is required for **unusual and innovative** procedures.
- If a method has been previously published in a standard journal, only the name of the method and a literature reference need to be given.
- Certain procedures need not be described thoroughly; i.e., routine lab procedures (mixing solutions, weighing materials, scrubbing of rocks, transfer of samples from the net to basins, etc.).
- If published protocols are being used, cite those sources and list in detail any alterations that you made to the protocol. If you have created your own protocol, you must describe it in complete detail. e.g., simply indicate ―were done as described by Hughes et al. (1990)‖
- You describe your methods in such a way that the description gives all elements needed to allow **experimental reproduction** of your work.
- Methods must be described concisely and completely
- Describe the **measurement of all relevant variables** and how they were monitored.
- Document **all methods performed** in your study.
- Summarize in your own words what you did.

What should not be in materials and methods

- Long sentences should be avoided. *Do not* use outline form or bullets.
- Do not include minor details that have no bearing on the results (e.g. what color pen you used, what type of paper you recorded data on).

- When working from a lab manual, DO NOT simply recopy the protocol from the lab manual; this is a waste of time. Instead, refer to the parts of the manual that provide a complete description of the method.

For example:

"We followed the methods of our laboratory manual (Bierzychudek *et al.* 1998), on pages x to y, with the following exception..." Be sure to include the laboratory manual in the Literature Cited section at the end of your paper.

- Avoid using more than 3 levels of heading.
- Remember that this section should only describe the methodology – it should not present the results (do not mix results into this section).
- Do not include any data or conclusions in this section
- Do not mix results with procedures.
- Do not try to hide or cover poor methods; reviewers will pounce on them.
- Do not include details of common statistical procedures
- Sub-headings are useful in this section, mainly for multiple experiments. and describe them individually.
- A brief mentioning on the sample size and how it was calculated is essential.
- A description of what was done - The "how", "where", and "when" of a study.
- How did you select them? Were there any exclusion criteria, did the process involve any
- Randomization? If yes, how did you randomize them?
- Cite which statistical tests you used and explain the reason behind choosing each of them.
- The methods section must include **sufficient information to enable others to repeat your work**. It should also list the analytical methods used. If you were working out of doors, describe the **environment and environmental conditions** at the time of data collection.
- Remember, as a description of what has already been done, methods should be written in the past tense.

- While it is persuading to report methods in chronological order in a narrative form, it is usually more effective to present them under headings devoted to specific procedures or groups of procedures.
- Describe in detail how the results were obtained so that a peer can repeat the procedure.
- Methods must be clearly related to your **research question and objectives**. Explain how you collected the data and how it relates to a research question that you stated in the introduction.
- Report what you actually did – not what you planned to do.
- It is important to include your specific experimental or sampling design, the kinds of data collected, and the methods of data analysis including the names of statistical tests.
- Also, any materials that are not routinely available or that may differ in quality from one supplier to another should be mentioned followed by the name of the supplier.
- One way to check the completeness of this section is to have a colleague read it and ask to verify if he or she could carry out this research project wholly from the Methods section.

Some points to be considered: Materials & methods

1. Explain why each procedure was done, i.e., what variables were you measuring and why? Example:

Difficult to understand: First, I removed the frog muscle and then I poured Ringer‘s solution on it. Next, I attached it to the kymograph.

Improved: I removed the frog muscle and poured Ringer‘s solution on it to prevent it from drying out. I then attached the muscle to the kymograph in order to determine the minimum voltage required for contraction.

2. Experimental procedures and results are stated in the past tense (what you did, what you found, etc.) whereas conclusions from your results are given in the present tense.

3. Mathematical equations and statistical tests are considered mathematical methods and should be described in this section along with the actual experimental work.

4. Use active rather than passive voice when possible. Always use the singular "I" rather than the plural "we" when you are the only author of the paper. Throughout the paper, avoid contractions, e.g. did not vs. didn ‘t.

Additional Tips

1. Provide enough detail for replication. For a journal article, include, for example, genus, species, strain of organisms; their source, living conditions, and care; and sources (manufacturer, location) of chemicals and apparatus.
2. Quantify when possible: concentrations, measurements, amounts (all metric); times (24-hour clock); temperatures (centigrade).

Materials and methods

1. **Function**: In this section you explain *clearly* how you carried out your study :

- the **organism(s) studied** (plant, animal, human, etc.) and, when relevant, their pre-experiment handling and care, and when and where the study was carried out (*only* if location and time are important factors);
- the **experimental OR sampling design** (i.e., how the experiment or study was structured. For example, controls, treatments, what variable(s) were measured, how many samples were collected, replication, the final form of the data, etc.);

Function

- the **protocol for collecting data**, i.e., how the experimental procedures were carried out, and,

- **how the data were analyzed** (qualitative analyses and/or statistical procedures used to determine significance, data transformations used, what probability was used to decide significance, etc).
- Organize your presentation so your reader will understand the logical flow of the experiment(s);
- Each experiment or procedure should be presented as a unit, even if it was broken up over time.
- In general, provide enough quantitative detail (how much, how long, when, etc.) about your experimental protocol such that other scientists could reproduce your experiments.
- You should also indicate the statistical procedures used to analyze your results, including the probability level at which you determined significance (usually at 0.05 probability).
- 2. **Style**: The style in this section should read as if you were verbally describing the conduct of the experiment.
- You may use the active voice to a certain extent, although this section requires more use of third person, passive constructions than others. In general, avoid use of the first person in this section.
- Remember to use the **past tense** throughout - the work being reported is done, and was performed in the past, not the future.
- . **Describe the organism(s) used in the study.** This includes giving the (1) *source* (supplier or *where* and *how* the organisms were collected), (2) *typical size (weight, length, etc)*, (3) *how they were handled, fed, and housed* before the experiment, (4) *how they were handled, fed, and housed* during the experiment. In genetics studies include the strains or genetic stocks used. For some studies, age may be an important factor. For example, did you use: Seedlings or mature plants?
- In genetics studies include the strains or genetic stocks used. For some studies, age may be an important factor. For example, did you use mouse pups or adults? Seedlings or mature plants?

FOR FIELD STUDIES:

Describe the site where your field study was conducted.

The description must include both *physical* and *biological* characteristics of the site pertinent to the study aims.

- In field-based studies, description of experimental site or study area is needed. Climatic, edaphic, geographic, demographic and administrative information are needed depending on the type of study done. Maps are also needed.

Maps should be simple, clear and informative.

- Some journals allow authors to employ a separate section to describe field sites, called *Study Site*; it is usually placed before the Methods section.

Include the date(s) of the study (e.g., 10-15 April 1994) and the exact location of the study area. Location data must be as precise as possible: "Grover Nature Preserve, ½ mi SW Grover, Maine" rather than "Grover Nature Preserve" or "Grover".

- When possible, give the actual latitude and longitude position of the site: these can be obtained using handheld GPS units, OR, from web resources such as Google Earth(TM) and MapQuest(TM).
- Someone else should be able to go to the exact location of your study site if they want to repeat or check your work, or just visit your study area.

For laboratory studies

- You need *not* report the date and location of the study *UNLESS* it is necessary information for someone to have who might wish to repeat your work or use the same facility.
- Most often it is *not*. If you have performed experiments at a particular location or lab because it is the only place to do it, or one of a few, then you should note that in your methods and identify the lab or facility.

Describe your experimental design clearly.

- Be sure to include the *hypotheses* you tested, *controls*, *treatments*, *variables* measured, how many *replicates* you had, what you actually *measured*, what form the *data* take, etc.
- Always identify treatments by the variable or treatment name, NOT by an ambiguous, generic name or number (e.g., use "2.5% NaCl" rather than "test 1".)

Describe the procedures for your study in sufficient detail that other scientists could repeat your work to verify your findings.

- Foremost in your description should be the "quantitative" aspects of your study - the masses, volumes, incubation times, concentrations, etc., that another scientist needs in order to duplicate your experiment.
- When using standard lab or field methods and instrumentation, it is not always necessary to explain the procedures (e.g., serial dilution) or equipment used (e.g., autopipette) since other scientists will likely be familiar with them already.
- You may want to identify certain types of equipment by vendor name and brand or category (e.g., ultracentrifuge vs. prep centrifuge), particularly if they are not commonly found in most labs.
- It is appropriate to report, parenthetically, the source (vendor) and catalog number for reagents used, e.g., ".... poly-L-lysine (Sigma #1309)."
- When using, a method described in another published source, you can save time and words by providing the relevant citation to the source.
- Always make sure to describe any modifications you have made of a standard or published method.
- Very frequently the experimental design and data collection procedures for an experiment cannot be separated and must be integrated together.
- If you find yourself repeating lots of information about the experimental design when describing the data collection procedure(s), likely you can combine them and be more concise.

- Although tempting, DO NOT say that you "*recorded the data*," i.e., in your lab notebook, in the Methods description.

Describe how the data were summarized and analyzed.

You will indicate what types of descriptive statistics were used and which analyses (usually hypothesis tests) were employed to answer each of the questions or hypotheses tested and determine statistical significance.

The information should include:

- **Statistical software used**: Sometimes it is necessary to report which statistical software you used; this would be at the discretion of your instructor or the journal;
- how the data were **summarized** (Means, percent, etc) and how you are reporting **measures of variability** (SD, SEM, 95% CI, etc)

- this lets you avoid having to repeatedly indicate you are using mean ± SD or SEM.

- which **data transformations** were used (e.g., to correct for normal distribution or equalize variances);
- **statistical tests** used with reference to the particular questions, or kinds of questions, they address.

For example,

"A Paired t-test was used to compare mean flight duration before and after applying stabilizers to the glider's wings. **—**

"One way ANOVA was used to compare mean weight gain in weight-matched calves fed the three different rations. "

"Comparisons among the three pH treatment groups for each variable were done using one way ANOVA (with Tukey's post hoc test) or a Kruskal-Wallis Test (with Dunn's post hoc test)."

- any other **numerical** (e.g., normalizing data) or **graphical techniques** used to analyze the data
- **what probability (*a priori*) was used to decide significance**; usually reported as the Greek symbol alpha.
- You *DO NOT* need to say that you made graphs and tables.

some additional advice on particular problems common to new scientific writers.

Problem*: The Methods section is prone to being wordy or overly detailed.*

- *Avoid repeatedly using a single sentence to relate a single action*; this results in very lengthy, wordy passages. A related sequence of actions can be combined into one sentence to improve clarity and readability:

Problematic Example: This is a very long and wordy description of a common, simple procedure. It is characterized by single actions per sentence and lots of unnecessary details.

"The petri dish was placed on the turntable. The lid was then raised slightly. An inoculating loop was used to transfer culture to the agar surface. The turntable was rotated 90 degrees by hand. The loop was moved lightly back and forth over the agar to spread the culture. The bacteria were then incubated at 37 C for 24 hr."

Improved Example: Same actions, but all the important information is given in a single, concise sentence. Note that superfluous (more than is needed or wanted) detail and otherwise obvious information has been deleted while important missing information was added.

"Each plate was placed on a turntable and streaked at opposing angles with fresh overnight E. coli culture using an inoculating loop. The bacteria were then incubated at 37 C for 24 hr."

Best: Here the author assumes the reader has basic knowledge of microbiological techniques and has deleted other superfluous information. The two sentences have been combined because they are related actions.

"Each plate was streaked with fresh overnight E. coli culture and incubated at 37 C for 24 hr."

Problem: Avoid using ambiguous terms to identify controls or treatments, or other study parameters

that require specific identifiers to be clearly understood. Designators such as Tube 1, Tube 2, or Site 1 and Site 2 are completely meaningless out of context and difficult to follow in context.

- This important part of the manuscript has become increasingly neglected and yet the methods section is the most common cause of absolute rejection of a paper. If the methods used to try to answer the question were inappropriate, or flawed, then there is no salvation for the work.
- The main purposes of the methods section are to describe, and sometimes defend, the experimental design and to provide sufficient detail so that a competent worker can repeat the study. The latter is particularly important when you are deciding how much to include in the text. If standard methods of measurement are used, then appropriate references are all that is required. In many instances "modifications" of published methods are used and it is these that cause difficulties for other workers.

This section provides all the methodological details necessary for another scientist to duplicate your work.

- It should be a narrative of the steps you took in your experiment or study, not a list of instructions such as you might find in a cookbook.
- You should assume that the other scientist has the same basic skills that you have, but does not know the specific details of your experiment. For example, it is unnecessary to write:

"We poured N-free fertilizer solution into a graduated cylinder until the bottom of the meniscus was at the 30-ml line. We poured the fertilizer onto the top of the soil in a pot and then repeated this procedure 24 times."

- Rather, you would assume that the scientist knows how to measure and add liquids to pots and write:

"We added 30 ml of N-free fertilizer to each of 24 pots. —

- An important part of writing a scientific paper is deciding what bits of information needs to be given in detail. **Do not quote or cite your laboratory manual!**
- In the last paragraph, provide a brief description of statistical tests you used (**statistics are methods!**). Be sure not to include extraneous information, though, as scientists know all about null hypotheses and when to reject them.
- 1. How did you answer this question? There should be enough information here to allow another scientist to repeat your experiment. Look at other papers that have been published in your field to get some idea of what is included in this section.
- 2. If you had a complicated protocol, it may helpful to include a diagram, table or flowchart to explain the methods you used.
- 3. Mention relevant ethical considerations. If you used human subjects, did they consent to participate. If you used animals, what measures did you take to minimize pain?

Examples: Materials and methods

Above-ground tree biomass and allometric relationships of *Cinnamomum tamala* grown in the western hill regions of Nepal B. S. Poudel, S.K. Gautam and D. N. Bhandari From BJ 21 (1)

Materials and methods

Study area

The study was conducted in three hill districts i.e. Gulmi, Palpa and Arghakhanchi of Western Development Region, Nepal where both natural and farmer raised stands of *Cinnamomum tamala* exist. The bark and leaf are commercially traded from these districts to Butwal and then exported to India. Total area covered by these districts is 3,708 km_2 (Fig. 1).

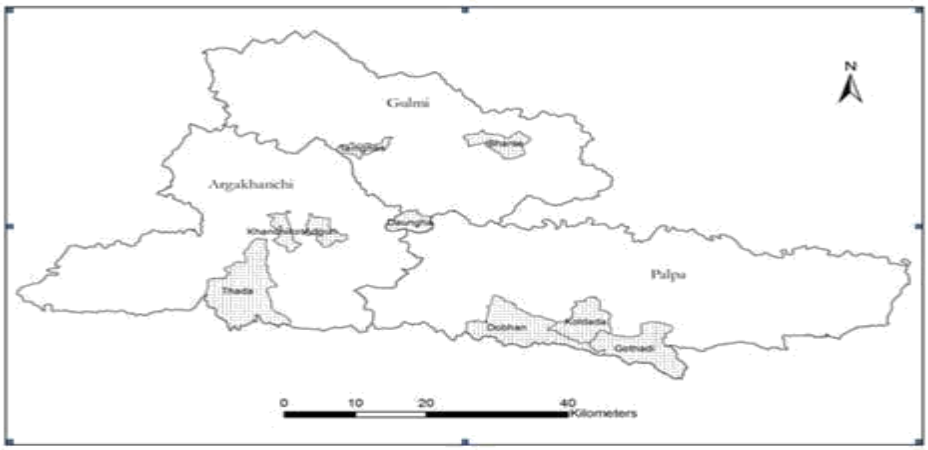

Fig 1: Map showing study areas

The climate of the study area is subtropical. Fig 1: Map showing study areas Tejpat is widely distributed and frequently planted in Narpani, Thanda Daha, Sitapur, Adguri, Khidim, Pokharathok, Datibang and Sidhdhara VDCs in Arghakhanchi district (DFO Arghakhanchi, 2001); Tamghas, Archale, Damuwa, Bharse, Gwaga, Purkot, Musikot, Mankot, Arlangkot, Malagiri and Isma VDCs in Gulmi district (DFO Gulmi, 2001); and Koldanda, Dovan, Gothandi, Barlyangadi, Styawati, Bhuwanpokhari and Masyam VDCs in Palpa district (DFO Palpa, 2001). The species is grown mainly in private lands especially on the terrace risers and marginal lands (grass fields and gullies). There are a few natural stands in community and national forests in these districts. Village Development Committee (VDC) containing natural and planted Tejpat stands were listed for each district separately by consulting respective district forest offices, potential traders and the secondary information. Three VDCs in each district (Narpani, Thanda Daha and Adguri in Arghakhanchi; Tamghas, Bharse and Damuwa in Gulmi; and Koldanda, Dovan and Gothandi in Palpa) were selected randomly from the list of VDCs. Since the community forests do not have sufficient trees to meet the objectives of the study. Therefore, Tejpat stands that have been grown in the private lands as part of agroforestry system or private woodlots were selected as study sites.

Biomass estimation

Biomass was determined destructively by harvesting randomly selected trees of different sizes. To make the data more representative, trees were classified into different size groups at the interval of 5 cm DBH class. Trees representative to each DBH class were chosen randomly in each site. Thus, a total of 56 (20 from Palpa, 18 each from Gulmi and Arghakhanchi district) were harvested for this study. These trees were cut in summer (September) 2002, so that this would coincide with the bark harvest time, which in study area is preferably summer

because of ease of extraction of bark. DBH over bark measured 1.3 m above the ground level of each tree was taken before felling. After harvesting, total height was measured. All trees divided into following components: stem wood, branch wood, foliage and bark. Components were separated and fresh weight of each component was weighed in the field. For determination of airdry and oven-dry weight of bark and foliage, composite sub-samples of bark of six trees from

1.3 m above the ground level and composite subsample of foliage from several branches of six trees were taken to laboratory of Institute of Forestry, Pokhara. Fresh weights of the composite subsamples were measured. Air-dry weight was obtained by drying the sub-samples in the sun for about one week. Oven-dry weight was obtained after drying at 105_0 C for about 48 hours in oven to constant weight. The dry mass of the bark and foliage components were then calculated. Oven-dry weight to fresh weight ratio was used to convert fresh weight

to oven dry weight. Summing all the biomass components yielded the above-ground tree standing biomass.

Statistical analysis

Statistical analyses were carried out using SPSS 11.0. Descriptive statistics, parameter estimates and regression coefficients were estimated. One-way ANOVA was used. Some candidate models (linear, logarithmic, quadratic, power, cubic and exponential) were analysed and compared. Model performance was assessed on the basis of various indexes. First,

the coefficient of determination (R_2) of each model was computed. Significance of regression coefficients were assessed by t-statistics and significance of regression model were assessed by F-statistics. Besides, SEE, F-value and T-value of the parameters were computed. The best fit-model based on R_2, SEE and F-value, was selected and used to predict biomass. Regression lines between observed and predicted biomass values of sampled trees were compared. Regression models were compared for their predictive accuracy by using root mean square

error (RMSE) (Gill et al., 2000; Leboeuf et al., 2007). RMSE was calculated by using the following formulae (Wallace and Goffinet, 1989):

RMSE (%) = (RMSE / X)*100%

$$RMSE= \sqrt{\sum_{i=1}^{16} (Xi-Yi) / N}$$

Where X_i = Measured biomass, Y_i = Predicted biomass by the model, N = Number of sample and X =Mean of the validation data

After the removal of three outliers, the 53 trees were randomly divided into two sets: 37 (70%) for model development as training dataset and another 16 (30%) for model validation as test datasets. The models were validated using 30% datasets for calculation of RMSE. The R_2 from the training and RMSE% from the validation dataset was used to assess the strength of the model.

Distribution and availability of raw materials for production of Nepali handmade paper from *Daphne* species in Darchula district, Nepal D. K. Kharal, B. N. Oli and I. Poudel From BJ 21 (2)

Study site

Darchula district is located in the far western development region of Nepal. It covers an area of 2329.6 km2 with wide range of altitudinal variation ranging from 357 to 7132 masl (MPRC, 2011). The district headquarter is situated in North 290 51' latitude and East 800 34' longitude. The district enjoys subtropical climate in the south to alpine and tundra in the northern belt. The topographic conditions vary from Mid mountain in the south and middle part and to High Himalayas in the north. Of the total forest cover of 79,538 ha of the district, 20, 064 ha have already been handed over to 226 Community Forest User Groups (CFUGs) (DFO Darchula, 2005). The district comprises eight Range posts. However the study area encompasses only six of them: Dethala, Joljibi, Khalanga, Khandeshwari, Khar and Rapla.

Sampling design

Stratifi ed random sampling technique was used to collect information on distribution of Lokta plant as well as on availability of bark materials for Nepali handmade paper in the district. Qualitative categories of Lokta plants were considered as strata for the resources survey. Based on area proportion, the total numbers of sample plots were distributed in each stratum of the Lokta forest. Using participatory process, high density, medium density and low density strata of Lokta distribution areas were traced out in the topographic map of the district. Like in Baglung Lokta Inventory (Mathema, 1990), circular plots of 25 m2 of 2.82 m radius were taken as sample plots for the measurement purposes. The fi rst plot was laid out where the Lokta plant fi rst appeared. The

subsequent plots were established at 1800 south at an interval of 100 m in each stratum. Isolated patches and blocks of Lokta plant were considered while allocating the sample plots. Altogether, 340 sample plots were laid out in all study area and allocated them in different strata based on proportion to area principle.

Plot measurement

The measurement was carried out in 2005. Lokta plants smaller than 30 cm in height were considered as seedlings and as such, were only counted, without measuring. However, Lokta plants greater than 1 m in height were measured at diameter: 30 cm from the base (d30); for bark biomass estimation. The height of the plants and D30 were measured to precisions of} 0.1 m and to •} 0.1 cm respectively. Randomly selected 20 plots were measured for bark biomass estimation. Out of 6 Range posts; 2 plots from Dethala, 1 from Joljibi, 6 from Khalanga, 3 from Khar and 8 from Rapla were taken for bark biomass assessment. The number of stems and bark weight per plot were estimated at fi rst, and later, average figures were derived at per hectare level. Lokta plants greater than 3 cm D30 were included for the harvestable Lokta biomass estimation. Green weight of the bark was used to estimate the Lokta biomass.

Data analysis

At first, the compiled data were analyzed at plot level using the MS Excel software. Later on, per hectare figures were estimated using appropriate conversion.

What are results?

- A simple descriptive part of the paper
- A summary of what was obtained from the study
- A summary of what was obtained from the study
- No comments on the Results section; interpretation is in the discussion part (Results and Discussion in different sections)
- Comments and interpretation of the results simultaneously (Results and discussion is one section)
- . Combining the results with a discussion of each point; in general, suitable for a short or simple experiment.
- Sub-headings in different topics makes it clear to deal with them one at a time.
- Straightforward (easy to understand) narrative (in the form of story-telling) and diagrammatic report of the data.
- Well organized, clear and complete presentation of findings
- Summarizes important data and statistics graphically and narratively
- Answers the question "*What did you find*? —
- A communication of facts, measurements and observations

What is the purpose?

- to present key results objective wise, without interpretation
- to present the analysis of the data collected from the experiment

❖ Differentiate between statistical significance and practical importance

How to make results effective?

Use graphs and tables, wherever appropriate

o Appropriate captions for the figure or tables to stand alone from the body of the paper
o Use the tables, if the results are not in figure

o Data to be placed in columns to compare with one another 34

- Summarize your main findings in the text
- Write concisely and objectively
- A strong tie with the Materials and methods section. Data presented in Results should have a corresponding description of how the same data was collected in the Methods section.

What is the conventions/structure?

- Do not place raw data values
- Avoid qualifying adjectives implying opinion
- Quote not only the p values but the value of the statistical parameter (r, t, or whatever) ‖
- Report confidence intervals
- Describe or cite a reference for type of statistical procedures used
- Report the statistical packages which are used to perform the test.

The results should

- Present the results in a sequential (following in order of time or place) way in text, tables or figures that should logically correspond to the study objective (s).
- Describe the various data obtained during a study.
- Summarize results in a condensed form that allows a reader to easily digest and interpret the findings.
- Summarize the results of any analyses that were conducted.
- Clear and relevant figures and tables with accurate legends to provide sufficient information to interpret the figures correctly.
- Short and sweet, without excessive verbiage (too many words or difficult words to express ideas).
- Provide sufficient detail to allow other scientists to assess the validity and accuracy of the results.
- Describe adequately statistical analysis of the results
- Avoid repetition numerical data in the text which are in figures and tables.

Results: some features

- Results can be presented in three basic ways: 1) within the text; 2) as a part of a figure; or 3) within a table.

For example, when comparing groups of observations, means and standard deviations could be reported directly within the text.

- Alternatively, a figure showing how means (plotted on the y-axis) varied by group (along the x-axis) could show the same thing.
- The effectiveness of a Results section depends largely upon the effort put into organizing the raw data into tables and figures.
- Attempt to present results in a manner that effectively and efficiently communicates their meaning and importance.
- Relating results to the specific questions or hypotheses presented in the introduction can improve the cohesiveness of a report.

For example, "As we predicted, the trees covered with ivy (one of the climbing evergreen plant) tended to have less moss on their trunks than the trees without ivy." Follow this general statement with more specific, quantitative information. For example, "Trees without ivy had an average of 45.7 square millimeters of moss (range: 25 to 53), while trees with ivy had an average of ....".

- Your results need not necessarily always agree with what other people have found. **Unexpected results** are often the most interesting. The most important thing is to always be **hones**t about your data.
- All results should be presented, including those that do not support the hypothesis.

- Statements made in the text must be supported by the results contained in figures and tables.
- Begin each paragraph with an opening sentence that tells the reader what question is being tested in the experiments described in that paragraph.
- Write the opening sentence in bold font for emphasis. (Sometimes a complete sentence is used and sometimes a short phrase is used – either style is OK but the style should be used consistently throughout the manuscript.)
- The text should describe what kinds of information are in each table and figure, the most salient features of the data presented.
- No need to point out every datum, but do point out trends you may want to focus on later in the Discussion portion of the paper.
- Report only results that are important in supporting or refuting hypotheses, or in meeting objectives. However, you should reveal whether or not hypotheses presented in the introduction are supported.
- The data must direct the reader toward the solution to the problem.
- Organize the data in logical steps that describe the trail of investigation you followed to get conclusions. If your logic is sound, the reader will easily understand why you performed certain measurements and will be interested in the actual data obtained.
- Present only representative data not endless repetitions of the same data.
- Keep the presentations concise and make the reading of your data as pleasant as possible. Interest fades quickly if the reader has to work hard to figure out what is being presented or why.
- Choosing a method for clear presentation of your data depends on the type of information.
- Try to summarize the results into a few tables and graphs.
- Include enough data to enable the reader to be confident that you have done what you said you would do, and that your conclusions will be trustworthy.
- Abbreviations and acronyms should be used carefully and consistently. Where they first appear in the text, they should be defined.
- *Avoid a long list of results with no interpretation.* For example: "Hours in sunlight significantly affected growth (Table 1). Soil moisture significantly affected growth (Table 2). Soil nitrogen also had a significant effect on plant growth (Table 3).

Using the tables and figures in Results

- A table is a compact arrangement of facts, figures or values, usually in rows and columns. In contrast, a figure is a chart, graph, diagram, or drawing.
- Figures and tables are usually the clearest way of showing results compared with text.
- Decide on these before you start writing and develop a roadmap for this section that provides a ‗story' by connecting the messages of the different figures and tables.
- Every table or figure must (1) have a number, (2) have a legend or caption, and (3) be referred to at least once in the text of the paper.
- Each table and figure is numbered in order of its introduction in the text. Tables and figures are numbered separately; you may have both Tables 1, 2, 3 and 4 and Figures 1, 2, 3 and 4.
- A legend or caption is a statement of one to several sentences or phrase that fully describes the contents of the table or figure; it includes a list of the statistics or variables (including names of organisms) described by the table or figure, and the source of the information (the name of the experiment, the location of the field observations, etc.). You must also clearly label the axes of your graphs.
- If the exact number for each data point is important then you should use a table; however, if the **trend or pattern** between data points is important then a graph is more informative.
- Results should be written up in relation to the tables and figures. Sentences such as 'the results of experiment A are reported in table 1' should not be written. The above sentence could be more meaningful if it is written as 'The treatment used in experiment A gave 90% greater yield than the control (Table 1).

- When referring to a particular table or figure, they should be capitalized (e.g., Table 1, Figure 6, etc.) The text of the Results section should be concise but should provide the reader with a summary of the results of each table or figure.
- Keep your figures and tables simple.
- As a rule of thumb, figures are preferable to tables. You should avoid repeating data in both tables and figures, or in tables and text.
- Avoid three-dimensional graphics -- do not allow for accurate presentation or interpretation of results
- Not all results deserve a separate table or figure. As a rule of thumb, if there are only a few numerical results or a simple conclusion describe the results in the text instead of in a table or figure.
- Include figure legends below graphs and table legends above tables. (for example: Fig. 1. Metabolic rates of rainbow trout at different temperatures.), and a sentence or two of explanation (i.e., Metabolic rates of n=6 fish were measured at both 5 and 20‘C. Measurements were made using closed chamber respirometer. All animals were acclimated to 10‘C for 6 weeks prior to measurements.).
- Look at published examples of graph and table presentation and mimic that style. There is no harm in that and this is not considered as plagiarism.
- Each figure must be able to "stand alone" with its figure legend. A descriptive title includes why the figure is important. Present information in the figure and legend.
- Try to keep the table as simple as possible — vast tables are confusing and hard to read.
- Tables and figures should present information in a format that is easily evaluated by the reader. A good rule of thumb is that it should be possible to figure out the meaning of a Table or Figure without referring to the text.
- When possible, the results should provide some way of evaluating the reproducibility or statistical significance of any numbers presented.
- If necessary to interpret the table, specific descriptions about what a result represents or how the results were obtained can be described in a legend below the table.
- Tables and figures should not be directly copied from another source without credit. Even when credit is given, the table or figure should be redrawn.
- Tables and figures should be used when they are a more efficient way to convey information than verbal description.
- They must be independent units, accompanied by explanatory captions that allow them to be understood by someone who has not read the text.
- Whenever possible, use a figure instead of a table. Relationships between numbers are more readily grasped when they are presented graphically rather than as columns in a table.
- The scientific paper format also includes Tables, Figures, and Equations. Each table, figure, or equation must be numbered and referenced in the text.
- The legend should be detailed enough that the figure or table makes sense if read separately from the paper.
- Do not use a table when you wish to show a trend or a pattern of relationship between sets of values - these are better presented in a Figure.

  For instance, if you need to present population sizes and sex ratios for your study organism at a series of sites, and you planned to focus on the differences among individual sites according to (say) habitat type, you would use a table. However, if you wanted to show us that sex ratio was related to population size, you would use a Figure.
- Figures are visual presentations of results, including graphs, diagrams, photos, drawings, schematics, maps, etc. Graphs are the most common type of figure.

Poor figures and tables

- Graphical presentations should help the reader **understand the arguments** in the paper.
- Most of the publications are in black and white. It makes no sense to point in the Figure caption to blue and red dots when the publication is in gray scale.

- The most common typesetting errors in Tables are the column alignment (most authors center every column), the mixing of the mathematics minus and the dash, the number of significant digits not conform to the accuracy of the result, and **forgetting the leading zero before a decimal (write 0.1000, not 0.1 nor .10). Using figures in Results**

Rules for choice of figure format:

- line diagrams or scatter grams if independent and dependent variables are numeric;
- bar graphs if only the dependent variable is numeric;
- bar graphs or pie charts for proportions.
- If a figure has been published, the original source has to be acknowledged and a written permission from the copyright holder to reproduce the material should be submitted.

- Authors may use line diagrams and photographs to illustrate theses from their text. The figures should be clear, easy to read and of good quality. Styles and fonts should match those in the main body of the article. All figures must be mentioned in the text in consecutive order and be numbered with Arabic numerals.
- Authors should indicate precisely in the main text where tables/figures should be inserted, if these elements are given at the end in the original version of the manuscript.
- Whenever possible, use figures |rather than tables |to illustrate, clarify, and emphasize the points you want to get across.
- But use figures selectively. Do not show absolutely every result you generated. Some results (especially from tests you've done) can be summarized in the test.
- When preparing figures for your paper, follow these four rules.

Using tables in Results

- Tables should be used to show the exact values of more data than can be summarized in a few sentences of text; or when the objective of presenting data is to present specific inter-relationships.
- Tables should not be used when the data can be easily presented in the text.
- A table should be readily understood without reference to the text. After reading the title and abstract, many readers often glance through the tables and illustrations before deciding whether or not to read the text.
- It should have short or abbreviated headings for columns and rows and, if necessary, a footnote for explanation of non-standard abbreviations that are used, and for identification of statistical measures of variations, such as standard deviation and standard error of the mean.
- A table should not include in its title any unnecessary words, nor a repetition of column and row headings. There should be no ambiguity (doubt) about the purpose of the columns and rows.

For purposes of publication:

- The table should not exceed the width of the journal columns. A single-column table, in a journal with a double-column page, should not include more than 60 characters (and equivalent spaces) in a row (with its row heading). A table running the full width of a page should not include more than 120 characters in a row.
- If data are used from another published or unpublished source, permission is needed and should be acknowledge fully.
- The use of too many tables in relation to the length of the text may produce difficulties in the layout of pages. Issues of the journal to which the paper will be submitted can be checked to estimate how many tables can be used per 1000 words of text.
- A general rule is no more than one table (or illustration) per 1000 words of text (4 pages of manuscript).
- Common abbreviations can be used without definition; others should be defined in a table footnote if they are not defined in the accompanying text.
- Tables allow you to present a great deal of information in a non-narrative (non-story) format, i.e., tables are lists.

❖ The list can be of measurements, specimens you examined, etc. However, a table should not repeat all the information given in text.

Illustrations

- Illustrations should be used only for a specific purpose. An illustration may be used as evidence to support the argument, since ―seeing is believing‖.
- Illustrations may be used as a more efficient way in presenting data. A flow chart is such an example. The use of illustrations for emphasis, just to stress a point, is not a good purpose. It may be more appropriate for a presentation than a written paper.
- Graphs are used to illustrate relationships. If exact values are important, a table is preferable to a graph; when trends and relationships are more important than exact values, a graph is more efficient. A graph is a better alternative than a table with many entries.
- Unless three dimensions are actually needed, avoid 3D figures.
- **Use easily distinguishable patterns** to distinguish the separate bars.
- If the legends are in very tiny boxes, it is very difficult to distinguish the pattern or shade in them – ensure these key boxes are easily read.
- Submit the figures in final size using the font size and line weights actually desired. When unnecessarily **big figures** are greatly reduced by the journal, the lines and letters may become too small or thin. Avoid using **FULL CAPITALS** or bold as they make the artwork ugly and difficult to read.
- Mention the sources for illustrations within the legend to the figure (check the journal) style.
- Avoid using a **pi-chart** in most instances. In a scientific paper, other **chart types** are almost always more helpful than a pi-chart which does not easily allow for comparison between data.
- While scanning photographs, maintain a resolution of 300ppi (or dpi) or more. But line artwork (charts, etc.) needs a higher resolution – 700ppi for example.
- If possible, use a proper drawing package to prepare your artwork, and supply to the publisher as a high-resolution jpeg or eps files. Consult experts for this.
- Electronic artwork as Excel or Word pictures is acceptable, but can sometimes cause problems for the publisher.
- When an experiment has provided many observations, these may be better presented graphically than as a table.
- The more values the better the basis of a graph, whereas many values in a table may confuse.
- A graph needs an indication of precision, such as an estimate of confidence limits, or symbols of a size to indicate the s.e.m.
- Be sure to include both a north arrow and scale for any map

Appendices

Function:

- An Appendix contains information that is non-essential to understanding of the paper, but may present information that further clarifies a point without burdening the body of the presentation. An appendix is an *optional* part of the paper, and is only rarely found in published papers.
- **Headings**: Each Appendix should be identified by a Roman numeral in sequence, e.g., Appendix I, Appendix II, etc. Each appendix should contain different material.
- **Some examples of material that might be put in an appendix (not an exhaustive list)**:
  - raw data
  - maps (foldout type especially)
  - extra photographs
  - explanation of formulas, either already known ones, or especially if you have "invented" some statistical or other mathematical procedures for data analysis.
  - specialized computer programs for a particular procedure

- full generic names of chemicals or compounds that you have referred to in somewhat abbreviated fashion or by some common name in the text of your paper.

- diagrams of specialized apparatus

Figures and Tables in Appendices

- Figures and Tables are often found in an appendix., but are numbered in a separate sequence from those found in the body of the paper. So, the first Figure in the appendix would be Figure 1, the first Table would be Table 1, and so forth. In situations when multiple appendices are used, the Table and Figure numbering must indicate the appendix number as well.
- The appendices are where the author will usually place any material that is not directly relevant to the paper, and will typically only be read by a small number of people interested in some details of the work.
- An appendix contains **supplementary technical matter** in tabular form, usually attached at the end of a paper, not to confuse with the postscript.

  If your journal of choice seems not to have **published appendices**, then **check with the editor** to see if they are allowed.
- Appendices represent an excellent solution to the problem of presenting background information (legislation, policy statements, questionnaires and measures, speeches, protocols) that is too long for the body of the paper.
- A **postscript** is a note or series of notes appended to a completed letter, article, or book. It is reserved for a very special remark or statement.
- The Appendix is an optional section that shows information that is not essential to the understanding of the paper, but may help clarifying some points, without burdening the main text.
- Appendices contain information that does not belong in the body of your paper. For instance, appendices are good places for mathematical derivations, apparatus details, or additional tabulated data.

Some points to be considered in Results

- Raw data are never included in your scientific paper unless they are needed to give evidence for specific conclusions which cannot be obtained by looking at an analysis, or summation, of the data.
- By presenting converted data, you make your point concisely and clearly.
- The table or figure should then be presented, complete with title. The title should explain what the table or figure is showing.
- The most common mistakes in this section are the inclusion of unnecessary data and their double presentation, e.g. repeated in a table or a figure as well as within the text.
- Only those variables that affect results should be given in tables or graphs. If the data do not conform to a clear trend, it can be stated in a few words or a sentence.
- Write concisely – scientific papers should enable fast comprehension of the research, and not present lengthy discussions or opinions. For example, do not use it is clearly shown in figure 3 that the rate of growth depends on temperature but use rate of growth depends on temperature (figure 3).
- Select only meaningful data from the collection; present them only once – in text or table or figure.
- Text: Do not limit the Results section to graphs and tables; text is essential to guide the reader to the important patterns in the data.

  For example, in the results you might write a simple descriptive statement, such as: "Seed germination was lower in treatments receiving concentrated plant extracts than in controls." The following interpretive statement, however, would be left to the discussion: "The data suggest that organic chemicals produced by these plants can inhibit the growth of neighboring plants."
- Summarize your data in the most complete and efficient manner possible.

Do not state:

"It is clearly evident from Fig. 1 that bird species richness increased with habitat complexity". State instead

"Bird species richness increased with habitat complexity (Fig. 1)".

- If you did not get the anticipated results, it may mean your hypothesis was incorrect and needs to be reformulated, or perhaps you have failed onto something unexpected that warrants further study.
- In either case, your results may be of importance to others even though they did not support your hypothesis.
- Do not fall into the trap of thinking that results contrary to what you expected are necessarily "bad data". If you carried out the work well, they are simply your results and need interpretation.

Results

Main functions

- gives summary results in graphics and numbers;
- compares different 'treatments';
- gives quantified proofs (statistical tests);

Preferred style

- past tense;
- use tables and graphs and other illustrations;

Rules of thumb

- present summary data related to the RA objectives and not all research results;
- give more emphasize on what should be emphasized
- `- call attention to the most significant findings;
- make clear separation between yours and others work;

Statistics in 'results'

- The number of individuals, the mean value and a measure of variability should be stated.
- Point out how the data look (trends, new effects, frequencies, . . .), but the data only state the bare facts, without making inferences.
- Give experimental errors, and state the accuracy of the results (but avoid tabular and graphical redundancy since Tables and Figures illustrating the same results are mostly not accepted by journals).
- When describing your data, it is generally better to report standard deviation (SD) instead of standard error (SE). Do not report the coefficient of variation (CV), since it adds no new information to the SD.
- If you are certain that you used the appropriate statistical treatment for your data, but your analyses do not show the significant differences that you were hoping to find – be frank about this and do not manipulate your data to get a ―better‖ result.
- The results of statistical tests can be presented in parentheses following a verbal description.

Example: Fruit size was significantly greater in trees growing alone ($t = 3.65$, $df = 2$, $p < 0.05$).

- Data is summarized in some form; for example, means are reported, not individual observations, or the data are plotted in a manner which illustrates the trends you want to emphasize.
- Include descriptive and analytical statistics; i.e., standard deviations (or standard errors of the means, SE), the results of t-tests or analyses of variance (ANOVA).
- It is sufficient to indicate where statistical significance occurred and the confidence level.
- No need to provide all of your calculations. Some complex calculations may be provided in an Appendix at the end of the paper.
- When describing statistical results, present (1) the basic information being compared (e.g. means and standard deviations when comparing across groups, percentages when doing a

Chi-square type comparison, or a slope if doing a regression (2) some statistical parameter (t value, chi square, etc) and a P value (probability).

- Example: Alpha males were significantly larger than beta males (800 ± 25 kilos (N = 25) for alpha males, 550 ± 31 kilos (n = 41) for beta males; t = 4.21, P < 0.001).

Numbers and statistics

- When you quote numbers, make sure you use the minimum number of significant digits or decimal places. For example, 23 ± 7 years is appropriate but not 23.4 ± 6.6 years; the loss of accuracy is not important because the measurement is not significant to the first decimal place.
  However, 23.4 ± 0.6 is correct because this measurement is accurate to the first decimal place
- Use the appropriate number of digits: two significant digits for standard deviations (one digit if the standard deviation is for a descriptive statistic like height or weight, or if precision is not important); two decimal places for correlations, two significant digits for percentages. Examples: 73 ± 5; r = 0.45; r = 0.08; 16%; 1.3%; 0.013%.
- If it is more convenient to show p values than confidence limits, show the exact p value to one significant digit (for p < 0.1) or two decimal places (for p > 0.10). Rather than using p < 0.05 or p
  > 0.05 it might be better to use the following examples: p = 0.03; p = 0.007; p = 0.09; p = 0.74
  when the exact p value is important for anyone using your data to calculate confidence limits or using your data in a meta-analysis.
- If you have a table or figure with a large number of comparisons it may be simpler to use the p < notation to refer to a group of observations.
- Make sure the significant digits of the mean and standard deviation are consistent. Examples:20 ± 13; 0.020 ± 0.013; 156 ± 7; 1.56 ± 0.07; 15600 ± 700 NOT 1.6 ± 0.07 or 20 ± 13.1
- Use the standard deviation as a measure of spread. Do not use the standard error of the mean.
- Show 95% confidence intervals for effect statistics like a correlation coefficient or the difference between means.
- You must interpret the observed effects and the confidence limits. For example, you might have to say that you observed a moderate effect, but that the true value of the effect could be anything between trivial and very strong.
- *Do not use qualitative words in the Results section*, e.g. do not write "This difference was highly significant (p = 0.001)," but simply state "This difference was significant (p = 0.001)."
- *Do not interpret the data in the Results section.*
- Comments such as "the data suggest that ...." are not really meaningful, a sort of "putting words into the readers' mouth." Save these indirect interpretations for the *Discussion* section.
- *It is very unwise to make statements such as* "The ANOVA showed that…." Statistical tests do not show anything; they just crunch numbers. It is up to you to use the right test and consider its results.
- *You should report negative results* - they are important!

Examples: Tables

Table : Average dbh, dbh range, standard error, coefficient of variation for five species

Species	Mean DBH (cm)	DBH range (cm)	Standard error (cm)	Coefficient of variation (%)
Acacia auriculiformis	8.4b	4.0-18.5	0.26	32.96
Acacia catechu	11.3a	5.9-20.3	0.36	27.26

Species	Mean DBH (cm)	DBH range (cm)	Standard error (cm)	Coefficient of variation (%)
Dalbergia sissoo	8.4b	2.8-15.5	0.36	38.72
Eucalyptus camaldulensis	10.1ab	3.2-18.0	0.43	38.14
Eucalyptus tereticornis	7.4b	2.2-19.1	0.72	56.86

Table: Comparative growth and nodulation of seven tree legumes at the age of four months grown in degraded soil in Chittagong, Bangladesh

Species	Shoot length (cm)	Collar dia. (mm)	Root length (cm)	Oven dry weight (gm)			Total oven dry weight (gm)	Nodule No.	Nodule oven dry weight (gm)
				Leaf	Shoot	Root			
A. auriculi	46.00b	6.83b	29.00b	3.14b	1.55b	2.97b	7.67b	132a	0.48b
A. lebbeck	56.33b	8.20b	24.62bc	6.64b	6.62b	19.01ab	32.26b	118a	1.44a
A. mang	71.66a	6.33b	24.40bc	6.09b	4.15b	8.88b	19.11b	38b	0.77b
A. nilotica	61.00ab	5.80b	23.00c	1.30b	5.06b	3.23b	9.60b	36b	0.70b
A. procera	23.00c	5.87b	23.66abc	1.39b	1.73b	16.95b	20.06b	11b	0.50b
G. sepium	74.33a	12.30a	44.50a	15.43a	14.73a	34.62a	64.81a	66b	0.40b
L. leucoc	60.00ab	8.40a	41.63a	2.88b	4.03b	4.87b	11.78b	28b	0.20b

Note: Means followed by the same letter (s) in the same column do not vary significantly at $p<0.05$. Duncan's Multiple Range test (DMRT).

What is discussion?

- The discussion is the most important section and main body of your paper.
- The **Discussion** is the part of the paper in which you have greatest freedom.
- The **Discussion** must not be so long as to discourage a potential reader, yet it must contain logical argument.
- The Discussion is likely the most difficult section to write and define.
- The results are interpreted and explained.
- Relate analyzed data to other similar studies.
- The opening of the discussion usually gives the answer to the research question, or a restatement of the principal findings.
- It is advisable that the discussion start with a sentence that clearly shows that **the paper includes new information**.
- Many papers submitted for publication are rejected based on problems with the Discussion.

What is the purpose?

- To let the reader, know your interpretation of the analyzed data
- Highlight, interpret and compare your results with those already known about the subject of the investigation, and to explain new understanding of the problem after taking your results into consideration. ‖

How to make Discussion effective?

- Be concise and make your points clear.
- Avoid overstatement and exaggeration. Be neutral or understate.
- Questions you can answer

  o Did your experiments prove or disprove your hypothesis? o
  Were the results different from what you expected?
  - o What have you learned from your analysis?
  - o How does your work relate to other work in the field?
  - o Does it confirm or refute (prove to be a wrong) existing information?

  o What kinds of conclusions can you draw from the results?

- Point out the features and limitations of the study
- Specify any limitations of the study
- Provide logical discussion about the results
- Do not draw any conclusions that go beyond the reported data (applicable, if there is no Conclusion section separately)

Points to be considered in Discussion?

- In this section, you should answer the question "*What do these results mean*?" and possibly "*What gaps in knowledge remain to be filled*?"
- Discussion should provide implications of the results
- Research results should be interpreted in such a way that readers understand the meaning of the findings.
- Particular attention should be paid to the original hypothesis or objective that have put forward in the introduction.
- Negative results should also be discussed.
- Explain your results in light of other published data, by adding information from sources you cited in the *Introduction* as well as by introducing new sources.
- Decide if each hypothesis is supported, rejected, or if you cannot make a decision with confidence.
- Do not simply dismiss a study or part of a study as "inconclusive".
- Make what conclusions you can, then suggest how the experiment must be modified in order to properly test the hypothesis(es).

- Refer to work done by specific individuals (including yourself) in past tense.
- Refer to generally accepted facts and principles in present tense.
- Did the study lead you to any new questions? Try to think up a new hypothesis and briefly suggest new experiments to further address the main question. Be creative, and do not be afraid to consider.
- Deal with how observed facts are related, how the present study agrees or disagrees with previous studies, and how the study might be extended in order to test or make a hypothesis.
- Present clear and valid **reasoning and argument**. Regardless of how important the research is, if it is not carefully considered and discussed within the article, then the overall research results are undermined (weaken).
- Analyze perfectly and draw believable conclusions – make sure this is not a fault of your paper.
- Ensure that all your arguments and assumptions are scientifically formulated, clearly stated, and well supported, either by your own results or by citing other people ‘s work. All your statements must be accurate (true or falsifiable) and logical.
- Ensure that you have provided all the necessary information for your reader to make an independent judgment.
- Refer to the original objective (main question, hypothesis) of your research. Explain whether or not you have succeeded in reaching your objective.
- Make sure to explain why your results are of importance in a wider context.
- Some journals require you to formulate your conclusion in a separate section. If not, you should end the discussion with a concluding paragraph.
- If your data do not allow you to draw any firm conclusions, you can make generalized inferences.
- Trends that are not statistically significant can still be discussed if they are suggestive or interesting, but cannot be made the basis for conclusions as if they were significant.
- Do not repeat detailed descriptions of the data and results in the Discussion.
- End the Discussion with a summary of the principal points you want the reader to remember.
- It is also the appropriate place to propose specific further study if that will serve some purpose, but do not end with the tired cliché ‘(phrase or idea which is used so often that it has become meaningless) "this problem needs more study." All problems in biology need more study.
- Compare your results and conclusions with published materials. Clearly contrast and compare your interpretations with previous studies and findings.
- Discuss the theoretical implications (inferences) of your work and practical applications that you foresee (anticipate or expect).
- Present a summary of evidence for each major finding.
- Enlarge upon their significance and explain how your new results add to existing knowledge. If, in the Introduction, you had formulated your problem as a question, discussion is facilitated when you can give the answer.
- This section of the paper should emphasize the new and important aspects of the study and the conclusions that follow from them.
- It should not repeat in detail data or other material given in the Introduction or Results sections.
- Brief summary of the results, whereas the focus lies on discussing and not summarizing the results.
- In particular, if your findings are unusual, or very much at odd with other people's conclusions, you should explain why you think this might be. Otherwise, the reader will probably assume you have just made a mistake.

The Discussion should contain

The Discussion should contain at least:

- the relationship between the results and the original hypothesis, i.e., whether they support the hypothesis, or cause it to be rejected or modified.
- an integration of your results with those of previous studies in order to arrive at explanations for the observed phenomena.
- possible explanations for unexpected results and observations, phrased as hypotheses that can be tested be realistic experimental procedures, which you should describe.

Strength and weaknesses of the study

- Equal emphasis should be given to both strengths and weaknesses. Reviewers are more interested in seeing that the author is aware of the weaknesses. If the reader discovers in the paper weaknesses that are not mentioned by the author, the trust in the paper will be shaken.
- A subheading such as ―limitations of the study‖ or data is useful. Findings that have not been described in the results section should not be discussed.

Strengths and weaknesses in relation to other studies

- All evidence bearing on the argument, with or against, should be considered. Authors should discuss the opposing point of view. Full credit should be given for supporting evidence.
- It is not enough to simply summarize published papers. The authors should critically evaluate their methodology, findings and conclusions.

Structure for a good discussion

• *Begin the Discussion by summarizing the background, aims (or hypotheses) and findings***,** e.g. is/are your hypotheses "proved"?

Example: "There has been little doubt that BMD (Bone Mineral Density) measured at various sites is one of the best measurable determinants of fracture risk. BMD is, in turn, regulated by genetic, hormonal, dietary and mechanical factors. The present study addressed a small part of this complex system by using the classical twin design. It was found that (i) both lean mass and fat mass were associated with areal BMD; however, fat mass alone appeared to have an independent effect on BMD/height ratios and volumetric BMD; (ii) both lean mass and fat mass as well as BMD were under strong genetic influence and (iii) the association between fat mass (and lean mass) and BMD were mainly mediated through environmental influences.″

- Do not, however, simply reformulate and repeat points already made; each new statement should contribute to your position and to the reader's understanding of the problem.

Example: "This study confirms the familial influence on bone density with estimates of heritability for the lumbar (lower part of back) spine, femoral neck and total body BMD of 78%, 76% and79%, respectively, comparable with previous estimates. However, the present study also indicates that a common source of genetic and ... ."

- How do your results fit in with what you know? What is the significance or implication of your results? Can your results be generalized to other populations? You are free to examine, interpret, and qualify the results, as well as to draw inferences from them. Emphasize any theoretical consequences of the results and the validity of your conclusions.
- *Provide a generalization of your findings, if possible*.
- Comment on how your results can be applied to other settings or populations.
- *Discuss weak and strong points of your study, take into account sources of bias or imprecision*.
- List weaknesses you have identified in your study or experimental design. You may remark on certain shortcomings of the study, but do not dwell on every flaw.

Simple guidelines to write Discussion

1. Link your results to your original hypotheses.
2. Do you accept or reject your null hypotheses? Why or why not?
3. Explain your experimental observations in *specific* terms.

- DO NOT make statements such as: "The reaction was faster because it had a greater reaction rate." We hope we do not have to explain the illogicality of this.

4. Be logical, imaginative. and--above all--HONEST.
5. Discuss possible sources of error and how they might have affected your results.
   - This is your chance to show us your amazing capacity for creative, scientific thought.
   - Feel free to refer to published literature on the subject, but do not be shy about offering your own insights into your experimental results.

Six components of Discussion

The discussion should preferably be structured to include the following six components (Docherty and Smith, 1999):

- Statement of principal findings
- Strengths and weaknesses of the study
- Strengths and weaknesses in relation to other studies
- Meaning of the study, possible mechanisms and implications for clinicians and policymakers
- Unanswered questions and future research
- Conclusion.

Limitations

- Describe in brief detail the suboptimal aspects of your research. This new trend has come with demand for more transparency in research publishing.
- Junior authors are often afraid that being open about the limitations of their research will create prejudice (injustice) against a paper. Non-sense.
- Senior researchers (i.e., editors and reviewers) will see flaws in your work that you will likely not see. Reviewers and the editor ask only that you acknowledge limitations.
- To do so is not a sign of weakness in you or your approach, but much to the contrary; it shows that you are on top of what are best practices, and you are a person who sees the need for better methods (as opposed to those who stumble along pleased with their inadequate work).

Some tips in writing Discussion

1. **Move from specific to general:** your finding(s) --> literature, theory, practice.
2. **Do not ignore or bury the major issue.** Did the study achieve the goal (resolve the problem, answer the question, support the hypothesis) presented in the Introduction?
3. **Make explanations complete.**

- Give evidence for each conclusion.
- Discuss possible reasons for expected and unexpected findings.

4. **What to avoid:**

   - **Do not** over generalize.
   - **Do not** ignore deviations in your data.
   - **Avoid** speculation that cannot be tested in the foreseeable future.

Citing literature in the text

- It is important to give credit for other works! Cite your sources of facts and ideas in the text of your paper by indicating the author (s) last names and year of publication.

Example:

Hubbell and Foster (1986) stated that disturbance plays a major role in forest community structure in the tropics.

or

Disturbance plays a major role in forest community structure in the tropics (Hubbell and Foster 1986).

Note that in the second example, the period at the end of sentence follows the citation.

- For article authored by one or two authors, all of the authors' last names are included in the citation. When there are three or more authors, the first author's last name is given followed by the latin "et al.", meaning "and others". et al. -

For example:
Hairston et al. (1960) stated that …….
The full citation of these articles occurs in the literature cited section of the paper.

Conclusions and recommendations

- The conclusion gives the overall findings of the study and its importance in a larger context.
- Your conclusions should really be statements that can be concluded from your study.
- A conclusion is not a summary.
- It is often necessary to write conclusion for scientific papers, because the meaning and implications have already been dealt with in the discussion part.
- This is where you wrap-up your article by either summarizing the main points (**Summary**) or by interpreting the significance of your article (**Conclusion**). If either of these is short (one or two sentences), then you can just add it to the end of the **Main Body** rather than make it a distinct section.
- The **Conclusion** is a good place to set your results in a bigger picture, which might help the reader understand the significance of your article.
- The **Conclusion** is also a good place to recommend future research, perhaps in the form of a hypothesis. For example, the abundance of large dinosaur eggshell fragments at a site might suggest the possibility that a nesting site was once nearby.
- Regardless of what you include in the **Conclusion**, the last sentence should convey closure so that the reader recognizes ―The End‖ without you having to write those words.
- It closes the door on the past before it opens doors into the future
- Everything in an abstract is new to the reader. In a conclusion, nothing is new.
- The conclusion does not surprise the reader who has read the rest of your paper. Even the section about future works is expected.
- In the discussion section, you undertake new hypotheses to explain some results, or discover that using different methods might be helpful to avoid undesirable limitations and get better results.
- The reader who has read your discussion therefore anticipates that, in your future work, you will explore these new hypotheses or use these different methods.
- In some journals, any recommendations that are made by the author appear in the same section as the conclusions. They are closely related though the conclusions refer to the present while the recommendations refer to the future.
- It is sometimes thought to be more thoughtful to write any recommendations with the conclusions. However, in terms of reference of a paper may call for recommendations to be made, and in such a case these should be listed in a separate section.

Recommendations

- In this section the author normally includes any advice he or she wishes to offer to the reader.
- Some people use the recommendations sections for suggestions of further work (this might also be included in the Conclusions section).

Purpose of the conclusion for the reader

1. It brings better closure to what has been announced in the introduction.
2. It allows readers to understand the contribution better and in greater detail than in the abstract so as to evaluate its usefulness them.

Qualities of a conclusion

- A conclusion is **POSITIVELY CHARGED.** It maintains the excitement created in the introduction.
- A conclusion has **PREDICTABLE** content. There are no surprises.
- Everything has been stated in the other parts of the paper.
- A conclusion is **CONCISE.** Restate the contribution. Close the door. Open new doors.
- A conclusion is **COHERENT** with the title, abstract, and introduction. It is a part of one same story.

- Examine your conclusion. How positively charged is it? How consistent is it with the claims you made in the abstract and introduction? Does it ―open new doors‖?

Conclusions and recommendations

- No new information should be added in the conclusion.
- All the facts and evidences were presented in the previous sections.
- The conclusions should connect the results presented in your work, and not the results presented anywhere else, to the initial hypothesis and/or objectives.
- It should be noted that a negative finding could be as important as a positive finding.
- Do not repeat the wording; paraphrase it. If the reader has not understood, another version may help him.
- A good paper ends with strong clear conclusions.
- Conclusions should be linked with the goals of the study, and should be limited to the boundaries of the study.
- Authors should avoid unqualified statements and conclusions not completely supported by the data.

Some questions to be answered in conclusion

• Is there any problem with the methodology employed?
• Did you obtain what was expected? If not, which could be the applications of your result?
• How your results compare with previously published work?

Acknowledgement

- This section of the paper should consist simply of "We wish to thank ...." all those
- Who deserve recognition for their contributions but who have not made a significant intellectual contribution and are therefore not included as authors.
- Editors may require you to obtain written permission from each person acknowledged by name because readers will assume that anyone acknowledged endorses the data and the conclusions.
- This section is optional, and it is where you should give credit to everybody that helped in your work through advice, permission, technical advice, monetary support, or any other kind of help.
- One or more statements should specify: contributions that need acknowledging but do not justify authorship, such as general support by a department chair; acknowledgement of technical help; acknowledgements of financial or material support, which should specify the nature of the support; and relationships that may pose a conflict of interest.
- Technical help is better acknowledged in a paragraph separate from that acknowledging other contributions.
- This small section should be included as the last section of text. It will only be a few sentences, but it is important to recognize those people who helped you formulate and complete your experiments.
- Place the Acknowledgments after the conclusion.
- If local people were also involved in the study, they should also be acknowledged in the paper.
- It is also a matter of honesty and fairness towards your supervisor, a colleague, or the referee.
- When mentioning people, give their complete names (Jim, John and Jane will appreciate if their family names are included).
- Acknowledge for
    - significant technical help received from others

- grants, fellowships or other financial assistance
- Do not thank someone without identifying the nature of the assistance
- Do not thank peer reviewers. Do not thank someone just for inspiration.

Where to cite references?

- Introduction
- Materials and methods (seldomly)
- Discussion

Commonly used referencing systems

References can be typed out either alphabetically (called "the Harvard System") or numerically (called "the Vancouver System").

Commonly used referencing system

1. **Name and Year System**. References are cited by their respective authors and the year of publication, e.g., ―Chuck and Norris (2003) define ....‖

This system is very convenient for authors, as the citation does not have to be changed when adding or removing references from the list.

2. **Alphabet-Number System**. This system lists the references in alphabetical order and cites them by their respective number in parentheses or (square) brackets, e.g., ―As reported in [4], ...‖ This system is relatively convenient for readers, as it does not break the flow of words while reading a sentence with many citations.

On the other hand, the author has to keep an eye on the references cited in the text as their numbers may change when the reference list is updated.

3. **Citation Order System.** This system is similar to the alphabet-number system with one major difference: the reference list is not sorted alphabetically, but in the order of appearance (citation by number) in the text.

Some points to be considered in References

- The style of citing a paper/ or article from a journal, book, thesis, proceeding, web sites, chapter from a book are different.
- References are not intended to convince anybody that you have read a lot.
- If a paper has two authors both name should be given, e. g. (Karki and Shrestha, 2000). If more than two authors have written a paper, the name of the first author should be followed by *et al*. Basnet *et al.* (1997) or Basnet et al. (1997).
- References are cited in the text and reference list is given at the end of the article.
- The purpose of giving reference is (a) to acknowledge the use of other peoples' work to give the credit for it, and (b) to enable the reader to refer to quoted work for further information.
- A reference should be marked in the text either by a number or in brackets or by quoting the author's name and the date of publication.
- The references are listed at the end, either by number or alphabetically.
- It is a common mistake to include all the references that you have looked at while planning, performing, and writing up the study; that's not necessary.
- Only if a specific piece of information in your paper is directly from a reference that should be cited.
- Include sufficient but not too many references: you need to provide a citation (reference) every time you state a fact that is not generally known, or if you are showing how your work has built on that of others.
- Review articles usually require high numbers of references.
- Too many references may indicate an inability to discriminate and select appropriately – you need to show good judgment in the selection, there is no right or wrong number of references to include in any article.

- The references indicate about the quality of your work: if they are all old and refer to work that is now out of date, then this may invalidate your findings because the ideas and facts developed in recent times may contradict the ones you cited. Including up to- date references shows that you are aware of recent research and have taken this into account with your own work.
- Inclusive pagination (this information allows the reader to distinguish between a single-page communication and a ten-page paper. It also helps them to decide whether to read the source, or even purchase a copy), Journal (publication) name (this is essential in allowing the reader locate an article or chapter)

Three common mistakes found in references and their citations are (all waste the editor ‘s time and increase the likelihood of rejection):

a. Not all the citations in text are listed in the references and not all the references are cited in the text. (This usually happens when the paper is revised, so care must be taken to avoid this.)
b. No uniformity in the presentation of references. (This indicates carelessness, and may make the editor/reviewer/author think that your research work is also carelessly done.)
c. Incomplete information given about the references. (This may be interpreted to mean that you have not read the reference, but are including it to add support to your work.)

- To avoid missing references (or text citations) make a careful cross-check on the final draft of your paper before submission. This can be done on the computer or manually by checking the text against the references.
- All finalized references must be converted to the journal style. There are some software packages, such as

  EndNote.com, that can convert them to international journal styles, otherwise you need to follow the author guidelines, and also compare with articles published within the journal.
- If you are unsure as to which information to include within a reference, give all information you have available – more information is better than too little.
- It is important to stay updated with the latest literature. Always cite the most recent papers that are relevant to your work. It looks very unprofessional if you refer to a book from 1975 but neglect to cite a paper from 2002 providing new data and insights that are pertinent to your topic.
- Make sure that you **cite your sources properly**.
- Journals always provide guidelines on how to cite references, including scientific papers, book chapters, and even Internet sites. It is important that you *strictly* follow the format used by the journal to which you intend to submit your work.
- When citing a work by three or more authors, refer to them as ―et al.‖ in your paper. For instance: (Cohen, Bills, Cocquyt, and Caljon 1993) should be cited as: (Cohen et al., 1993). In the references section, you should list every author.
- Focus on **peer-reviewed scientific sources** of information to support the statements that you make in your paper.
- Peer-reviewed means that the editor of the journal and at least two peers (persons with expertise in the field) read and commented on the paper after it was submitted.
- Peer-reviewed papers are only accepted and published by the journal after the author has successfully addressed the concerns of the reviewers.
- The journals of all the major professional scientific societies are peer reviewed
- Manuscripts that are accepted for publication or in press can be cited as peer-reviewed papers (instead of noting the publication issue and page numbers, you add *in press*).
- Manuscripts that are in preparation or under review should be cited as personal communications within the text and NOT listed in the reference section.
- Try to avoid citing so-called _grey‘ or _gray‘ literature as much as possible. **Grey literature** includes all literature that is not peer-reviewed, such as unpublished reports, newsletters,

working papers, theses, government documents, environmental impact reports, bulletins, fact sheets, book chapters and conference proceedings.

- Grey literature is not subject to the same degree of thorough evaluation as peer-reviewed papers are. If you cannot avoid using grey literature you should be cautious about the risk that the authors may have used poor methods or jumped to unjustified conclusions.
- The same problems that exist with grey literature also count for the **Internet**. Therefore, you have to be extremely cautious when using the Internet as a source of data. Avoid referring to Internet sites, unless you can ascertain that they represent a reliable source, recognized authority or database (e.g. IUCN Red List database, UNEP WCMC Global Biodiversity Atlases, or FAO Fishbase).
- When citing **personal communications** with other experts, it is your responsibility to cite only reliable sources and recognized authorities. Do not list personal communications in the references section
- **Do NOT plagiarize other people's work**. Plagiarism means literarily copying or using someone else's words, ideas or results without any attribution.
- Plagiarism is highly unethical and qualifies as a form of scientific misconduct. If you use someone else's words, ideas or results, you should always acknowledge this and refer to the original source.
- Avoid literally copying text, unless it is functional (e.g., if you want to emphasize its original meaning or phrasing). When using original text, *always* use quotation marks.
- Before submitting your manuscript, always make sure to check if your reference list is complete!

1. Both the name and date can go inside parentheses is the name is not actually part of your sentence.

- Not all journals include the comma between author and year.
- For example: Enzymes are inhibited by cyanide (Grubb 1977). Because enzymes are inhibited by cyanide (Grubb 1977), I expect to find....
- Notice that the parenthesis is placed at the end of the sentence of clause containing the reference and that punctuation FOLLOWS the citation.

2. Another way to cite a study is to make the last name of the researcher the subject or object of the sentence or clause and follow it immediately with the date of the study in parentheses: Grubb (1977) found that cyanide inhibits enzymes. Because Grubb (1977) found that cyanide inhibits enzymes....

- These data support the conclusions of Grubb (1977).

3. If you wish to emphasize the date of the cited study, you can omit the parentheses:

- As early as 1977, Grubb observed the inhibitory effect of cyanide on enzyme action.
- This strategy is often effective for presenting an historical perspective of the problem (i.e., useful in Introduction).

4. It is INCORRECT to separate the date of publication from the author's name:

- Incorrect: Grubb found that cyanide inhibits enzyme action (1977).

5. If you wish to cite more than one study per reference, i.e., if more than one author has reached the same conclusion or worked on the same problem independently, you may list them together in the same parentheses and separate their names by semicolons:

- Cyanide has been found to inhibit enzyme action (Grubb 1977; Smith 1980,; Taylor 1983).
- By convention, these citations are listed in chronological order.

6. In the case of more than three authors, you may use et *al.* (from "et alii," Latin for "and others") after the first author's name:

- Cyanide has been found to inhibit enzyme action (Jones et *al.*, 1985)
- Personal communication. Sometimes, information is not gained from a publication, but rather in a personal conversation with or letter from an expert on the subject, Dr. X People, for example. When you have talked with, or written to, someone, and have gained some information or data that are not published, you should give credit to that person in the

following way: ―It has been found that male subjects .... (Dr Peter M. Smith, personal communication).‖ No date is entered for a personal communication, nor will not be entered in your *References* section.

- If the citation is from same author (s) for different articles in the same year, cite them as (Shrestha, 2009a) and Shrestha, 2008b) in the text and details should be given in the reference list.
- If the author is not known, use the word (Anon. ,2011).
- If there is no date of publication, use n.d. (not dated).
- If you cite the reference used by author (s) in his or publication, you have to cite in this way, (Shrestha, 2008, cited by Tamrakar, 2010.

Journal articles: References

- Family name, first and middle name of author (s), in abbreviated form or not depending on the type of journal.
- Year of publication
- Full title of the article
- Title of the journal (either in italics or not depending on the journal type)
- Volume number; and issue number (in bold in Banko Janakari)
- Issue number, page number in range

Examples

Sharma, R. P. 2006. Modelling height-diameter relationship for Chir pine trees. *Banko Janakari* **16 (2)**: 30-36.

Journal articles: Examples of references

Huang, S. and Titus, S. J. 1993. An index of site productivity for uneven-aged or mixed forest stands. *Canadian Journal of Forest Research* **23**: 558-562.

Jhang, I. J., Bi, H. Q., Cheng, P. F. and Davis, C. J. 2004. Modeling spatial variation in tree diameter-height relationships. Forest Ecology and Management **189 (3)**: 317-329.

Strong, D. R., Jr. 1980. Null hypothesis in ecology. Synthese **43**: 271-285.

Book: References

- Family name, first and middle name of author (s),), in abbreviated form or not depending on the type of journal.
- Year of publication
- Full title, sub-title (in bold in Banko Janakari)
- The edition number
- Name of the publisher, city and country
- Range of page number

Examples:

Pretzsch, H. 2009. **Forest Dynamics, Growth and Yield**. Springer Verlag, Berlin, Germany.

Examples:

Draper, N. R. and Smith, H. 1981. **Applied Regression Analysis**. Second edition. Wiley and Sons, New York, USA.

Khanna, L. S. and Chaturvedi, A. N. 1994. **Forest Mensuration**. International Book Distributors, Dehradun, India.

Bista, M. S., Adhikary, M. K. and Rajbhandary, K. R. (eds.). 2001. **Flowering Plants of Nepal (phanerogams)**. Department of Plant Resources, Kathmandu, Nepal.

Eadie, W. R. 1954. Animal control in field farm and forest. MacMillan Co., New York, New York, USA. *BS/LBS 158H*

Edited books/Proceedings: References

- Family name, first and middle name of author (s),), in abbreviated form or not depending on the type of journal.

- Year of publication
- Title of chapter or paper
- Title of book, conference proceedings or symposia
- Names of editor (s)
- Name of the place where the conference was held
- Name of the publisher, city and country
- Range of page numbers
- Ghimire, S. K. and Aumeeruddy-Thomas, Y. 2005. Approach to *in situ* conservation of threatened Himalayan medicinal plants: a case study from Shey-Phoksundo National Park, Dolpo. In *Himalayan Medicinal and Aromatic Plants: Balancing Use and Conservation* (eds.) Aumeeruddy-Thomas, Y, Karki, M., Parajuli, D., and Gurung, K., IDRC Canada, WWF Nepal and UNESCO/WWF People and Plants Initiative, 209—234.
- Tewari, A. and Karky, B. S. 2007. Carbon measurement: methodology and results. In *Carbon Measurement Methodology and Results: Reducing Carbon Emissions through Community Managed Forests in the Himalayas* (eds.) Banskota, K., Karky, B. S. and Skutsch, M. International Centre for Integreted Mountain Development (ICIMOD), Kathmandu, Nepal.
- Werner, P.A. 1979. Competition and coexistence of similar species. Pages 287-310. *in* O.T. Solbrig, S. Jain, G. B. Johnson and P. Raven, editors. Topics in plant population biology. Columbia University Press, New York, New York, USA.

Thesis: references

- Family name, first and middle name of author (s),), in abbreviated form or not depending on the type of journal.
- Year submission of the thesis
- Title of the thesis, B. Sc., M. Sc. PhD or others
- Name of the University, country

Examples:

Wagle, B. H. 2007. Growth of Blue Pine (*Pinus wallichiana*) in Lete and Kunjo of Mustang district. M. Sc. Thesis, Tribhuvan University, Instotute of Forestry, Pokhara, Nepal.

Calvo, R. N. 1990. Pollinator limitation, cost of reproduction, and fitness in plants: a demographic approach. Dissertation. University of Miami, Coral Gables, Florida, USA

Technical Reports: References

- Family name, first and middle name of author (s);), in abbreviated form or not depending on the type of journal.
- organization‘ name, if it is involved
- Year
- Title of the report (in bold in Banko Janakari)
- Name of organization responsible for carrying out the study
- City and country

Example:

Bhuju, U. R., Aryal, R. S. and Aryal, P. 2009. **Report on the Facts and Issues on Poaching of Mega Species and illegal Trade in Their Parts in Nepal**. Transparency International, Kathmandu, Nepal.

Heinselman, M. L. 1981. Fire intensity and frequency as factors in the distribution and structure of northern ecosystems. Pages 7-57 H. Mooney, I. M. Bonnicksen, N. L. Christensen, J. E. Loten, and W. A. Reiners, editors. Fire regimes and ecosystem properties. USDA Forest Service General Technical Report WO-26.

Paper (Seminar/Workshop): Reference

- Family name, first and middle name of author (s) or paper presenter (s),), in abbreviated form or not depending on the type of journal.
- Year
- Title of the paper presented (inside aphostrphy in Banko Janakari)
- Place where paper is presented

- City and country

Example:

Alder, P. and Kwon, S. 1999. "Social Capital: The Good, The Bad and The Ugly" paper presented at the Academy of Management, Chicago, USA.

Citation from Internet

- Full address of the website
- Date of accesion

Example:

Dudoit S, Yang YH, Callow MJ, and Speed TJ. Statistical methods for identifying differentially expressed genes in replicated cDNA microarray experiments [Online]. Dept. of Statistics, Univ. of California at Berkeley. http://www.stat.berkeley.edu/users/terry/zarray/Html/matt.html [3 Sept. 2000].

How to Cite Sources in the Discussion Section

It is important to cite sources in the discussion section of your paper as evidence of the claims you are making. There are ways of citing sources in the text so that the reader can find the full reference in the literature cited section at the end of the paper, yet the flow of the reading is not badly interrupted. Below are some example of how this can be done:

"Smith (1983) found that N-fixing plants could be infected by several different species of *Rhizobium*.—

"Walnut trees are known to be allelopathic (Smith 1949, Bond et al. 1955, Jones and Green 1963).—

"Although the presence of *Rhizobium* normally increases the growth of legumes (Nguyen 1987), the opposite effect has been observed (Washington 1999)."

Abbreviations and acronyms

- Use standard abbreviations (hr, min, sec, etc) instead of writing complete words.
- Define all other abbreviations the first time they are used, then subsequently use the abbreviation [e.g. Ampicillin resistant (AmpR)].
- As a general rule, do not use an abbreviation unless a term is used **at least three times** in the manuscript.
- In general, abbreviations should **not be written in the plural form** (e.g. 1 ml or 5 ml, not mls).
- Sentences should never begin with an abbreviation or an acronym.
- You can introduce an acronym for a term that is repeated often: if your paper deals with soybeans, *Glycine max*, you may use the full scientific name once and substitute *G. max* thereafter.
- Tidal freshwater marshes (TFM) are important transitional zones in the landscape." Throughout the rest of your paper, you would refer to TFM.
- Never abbreviate units of measure when using them in a non-data context (e.g., "we measured length in millimeters"; "time was recorded in minutes

Some important points for writing a scientific paper

1. Do not use abbreviations in the text except for units of measure. Always abbreviate these when using them with data (2 mm; 10 min).

   Use standard abbreviations (hr, min, sec, etc) instead of writing complete words.
2. Except for temperature units (F,C, K) never abbreviate units of measure when using them in a non-data context (e.g., "we measured length in millimeters"; "time was recorded in minutes";
3. Always abbreviate units when reporting numerical information.

   "The maximum depth of lake A was 124 m approximately 2.3 km due south of ……—
4. **Singular** and **plural** units are abbreviated the same.
5. *Percent* is not abbreviated, but is represented by the familiar "%" symbol.

6. Always put a space between the *number* and *unit*, e.g., 203.65 m, 75 kg Exception: 75%.
7. pH: The proper method for reporting pH is to place the unit before the number (pH 7)
8. Never insert the word "of" between the unit and number and avoid splitting the unit and number within a sentence - they should always go together.
9. When starting a sentence with a number and unit, both must be spelled out as words e.g., "One thousand six hundred and eighty-seven kilograms of ground beef were randomly sampled and tested for *E.coli* contaminants between 21 August and 21 November, 1995.— Note: Mention one, two, three… nine, 10, 11, 12 in the text. Exceptions: a 2-m tape measure; 3 million.
10. The Metric System of measurement is the standard used by most scientific disciplines. The system is based upon measures of distance (in meters), volume (in liters), and mass (in grams).

    e. g. kilogram (kg), kilometer (km), meter (m), centimeter (cm), milligram (mg), millimeter (mm), years (yr), days (d), hours (hr), minutes (min), seconds (sec or s), microgram (µg), microliter (µl), nanogram (ng), pacogram (pg)
11. You do not have to try to impress people by using words most people have never heard of. Many published articles are like this, and they are poor papers on account of it.
12. Do not use colloquial speech (words, phrases, etc. belonging to or suitable for normal conversation but not formal speech or writing), or slang (very informal words , phrases, etc. commonly used in speech, esp. people from the same social group or who work together, not considered suitable for formal contexts and often not in use for long).
13. Contractions In formal writing, you should never use contractions (..). for example, didn't, can't, haven't, don't, and isn't, etc.
14. Whether to enter numerals or words for a number is often confusing. In different situations, this will vary, but probably a fair generality is that a numeral is shorter than a word.
15. **When not speaking of data or experimental groupings, use words instead of numerals for *small numbers*:** "two centuries ago," "For well over fifty years..", "Of the many millions of fish released..."
16. Numbers are generally written as numerals when a specific value is named, and always when associated with a unit of measure: **"270 centuries ago," "59 people...", "...47.8 g dry weight...".**

    "Males (180.5 ± 5.1 cm; n=34) averaged 12.5 cm taller than females (168 ± 7.6 cm; n=34) in the Biology majors in 1995 (two-sample t-test, t = 5.78, 33 d.f., p < 0.001)."

    If the summary statistics are shown in a figure, the sentence above need not report them specifically, but must include a reference to the figure where they may be seen:

    "Males averaged 12.5 cm taller than females in the Biology majors in 1995 (two-sample t-test, t = 5.78, 33 d.f., p < 0.001; Fig. 1)."

    Note that the report of the key result (shown in blue) would be identical in a paper written for a course in which statistical testing is not employed - the section shown in red would simply not appear except reference to the figure.
17. For an **individual value** you would write, "the mean length was 10 m", or, "the maximum time was 140 min"
18.. When including a measure of variability, place the unit *after* the error value, e.g., "...was 10 ± 2.3 m".
19. Likewise place the unit after the last in **a series of numbers** all having the same unit. For example: "lengths of 5, 10, 15, and 20 m", or "no differences were observed after 2, 4, 6, or 8 min of incubation".
20. Means: Always report the mean (average value) along with a measure of variablility (*standard deviation(s)* or *standard error of the mean*). Two common ways to express the mean and variability are:

    "Total length of brown trout (n=128) averaged 34.4 cm (*s* = 12.4 cm) in May, 1994, samples from Sebago Lake."

"Total length of brown trout (n=128) averaged 34.4 ± 12.4 cm in May, 1994, samples from Sebago Lake."

If the summary statistics are presented in graphical form (a Figure), you can simply report the result in the text without verbalizing the summary values:
"Mean total length of brown trout in Sebago Lake increased by 3.8 cm between May and September, 1994 (Fig. 5).—

Frequencies: Frequency data should be summarized in the text with appropriate measures such as percents, proportions, or ratios.

"During the fall turnover period, an estimated 47% of brown trout and 24% of brook trout were concentrated in the deepest parts of the lake (Table 3)."

21. **Reporting Results of Inferential (Hypothesis) Tests**. In this example, the *key result* is shown in blue and the *statistical result*, which *substantiates* the finding, is in red."Mean total length of brown trout in Sebago Lake increased significantly (3.8 cm) between May (34.4 ± 12.4 cm, n=128) and September (38.2 ± 11.7 cm, n = 114) 1994 (two sample t-test, $p < 0.001$)."
22. Write 0 before decimal, e. g., 0.32 is correct, NOT .32.
23. Use the appropriate number of digits: two significant digits for standard deviations (one digit if the standard deviation is for a descriptive statistic like height or weight, or if precision is not important); two decimal places for correlations, two significant digits for percentages. Examples:73 ± 5; r = 0.45; r = 0.08; 16%; 1.3%;
24. If it is more convenient to show p values than confidence limits, show the exact p value to one significant digit (for $p < 0.1$) or two decimal places (for $p > 0.10$). Exact p values can be given, e. g., $p = 0.03$; $p = 0.007$; $p = 0.09$; $p = 0.74$, when the exact p value is important for anyone using your data to calculate confidence limits.
25. Make sure the significant digits of the mean and standard deviation are consistent. Examples: 20 ± 13; 0.020 ± 0.013; 156 ± 7; 1.56 ± 0.07; NOT 1.6 ± 0.07 or 20 ± 13.1
26. Use the standard deviation as a measure of spread.
27. Show 95% confidence intervals for effect statistics like a correlation coefficient or the difference between means.
28. Sentences should never begin with an abbreviation or an acronym.
29. Define all other abbreviations the first time they are used, then subsequently use the abbreviation [e.g. Ampicillin resistant (AmpR)] but not for common abbreviations e. g. m for meter, kg for kilogram.
30. As a general rule, do not use an abbreviation unless a term is used at least three times in the manuscript. With two exceptions (the degree symbol and percent symbol).
31. In general, abbreviations should not be written in the plural form (e.g. 1 ml or 5 ml, not mls).
32. **Chemical elements** are not proper nouns, so do not capitalize them. Only the first letter of the symbol is a capital letter: nitrogen (N), carbon (C), calcium (Ca).
33. **Data** The word "data" is plural, as in "the data *were* collected on January 21, 2001.—
34. **Direct quotes** should be avoided, unless you are presenting another author's specific definition or original label. You can usually paraphrase the writing effectively and more concisely, taking care to properly attribute the sources of your statements.
35. **Fluff** Read and re-read your references. Consult a textbook or another reference to help you resolve any aspects of the paper you do not understand before you start writing.
36. **Footnotes** should not be used in scientific paper.
37. **Run-on sentences** You should review your writing to make sure that each sentence presents one or two clear ideas. This will also help you organize sentences within paragraphs in a logical order.
38. **Scientific names**, consisting of genus and species, should be underlined or italicized, with only the genus capitalized: *Abies pindrow* or Litsea cubeba.

39. Significance In science, the word "significant" implies the result of a statistical test. It cannot be used to say, "the number of root nodules on red clover plants increased significantly when nitrogen was added," if you did not perform a statistical test to determine significant differences. You should analyze your results to determine whether they are
    statistically significant and report the test you used, the significance level (p=0.05), calculated statistic (t_{calc}), and degrees of freedom.
40. Spell-check Your word processor's spell-check and/or grammar-check function is not error-free. It cannot tell you when to use "it's" and "its," and it cannot tell you that a particular sentence does not make sense. Give yourself enough time to proofread and correct your paper.
41. Tenses When describing methods and results, you should use the past tense. The present tense is appropriate for accepted facts, such as the background information presented in the Introduction. In addition, you may use the present tense when you state conclusions. Looking over other scientific papers may help you answer questions you might have on this topic.

42. Phrases Avoid using phrases that do not contribute to understanding. For example, the following phrases could be shortened (or completely deleted) without altering the meaning of a sentence: ―the fact that ...‖ (delete); ―In order to ...‖ (shorten to simply ―To ...‖).
43. Proofreading: Always spell check your paper and carefully proofread your paper before submission. In addition to checking for errors and typos, read your paper to yourself .
44. Underline or *italicize* Latin usage, such as *et al.* and *e.g.* It is not necessary for names of family or other more inclusive taxa to be italicized. In general, enclose the scientific name in parentheses following the first mention of the common name. Thereafter, use the common name except for species where the scientific name is more often used or for species which have no accepted common name.
45. Do not capitalize common names except when the word begins a sentence or the common name includes a proper noun (e.g. Blanding‘s turtle, New York fern). If a different species of a genus previously referred to is mentioned, use the initial of the genus with the specific name (e.g. *Rana clamitans* and *R. sylvatica* both eat crickets…). If the specific name is unknown, list the genus name followed by sp. (*e.g.* (*Bauhinia sp.*) If the genus name may refer to several species, use the genus name followed by spp. (*e.g. Ficus* spp. are all fodder trees). Do not underline or italicize sp. or spp.
46. Avoid writing in the first person. There are times when this is okay, such as when describing what you did, but never use modifying phrases like ―I think...‖ or ―We feel...‖ If you are expressing opinion, it is best to say something like ―It appears that…‖ or ―The data are consistent with…‖
47. Plagiarism (use of others words, ideas, images, etc. without citation) is not to be tolerated and can be easily avoided by adequately referencing any and all information you use from other sources. In the strictest sense, plagiarism is representation of the work of others as being your work.
48. Be careful with commonly confused
    words: Temperature has an *effect* on the
    reaction. Temperature *affects* the reaction.
    Less food (can't count numbers of food) Fewer
    animals (can count numbers of animals) A large
    amount of food (can't count them)
    A large number of animals (can count them)
    The erythrocytes, which are in the blood, contain hemoglobin.
    The erythrocytes that are in the blood contain hemoglobin. (Wrong. This sentence implies that there are erythrocytes elsewhere that don't contain hemoglobin.)
49. Words and phrases

Simplicity

Instead of	**Write**
Possess	have
Sufficient	enough
Utilize	use
Demonstrate	show
Assistance	help
Terminate	end
Purchase	buy
Utilise	use
Facilitate	make easier
Comprehend	understand
Initiate	start
Endeavour to ascertain	try to find out

50. Use concise terms

Verbosity

Instead of:	**Write:**
prior to	before
due to the fact that	because
in a considerable number of cases	often
the vast majority of	most
during the time that	when
in close proximity to	near
It is clear that	clearly
It is obvious that	obviously
It has a tendency to	it tends
For the reason that	because
Take into consideration	consider
Bring about an increase	increase

❖ **Try to avoid such phrases as:**

In relation to
Owing to the fact that
At the present time
As far as …. Is concerned
In a number of cases
From the point of view of
In the majority of instances

❖ **Precision**

Some words have a vague or uncertain meaning
Avoid using them, for example

Instead of	**Write**
Transport	lorries (or trucks)
Communication	letter, …
Overall	total
Considerable	large
Involve	include
Viable	profitable

51. Use short sentences. A sentence made of more than 40 words should probably be rewritten as two sentences.
52. *Italic and bold letters.*

    Use *italics* for emphasis and **bold** for strong emphasis.

53. *Paragraph construction*
    Always start a paragraph with a sentence which sets the topic for the paragraph.
54. *Sentence checking.* Each sentence should be checked to ensure that it has a subject and a verb, and that they agree. For example, many readers will waste a few seconds working out what is wrong with: ―The new group of drugs were associated with many adverse reactions.‖ In fact, the verb should be was (not were) because the subject in this case is group, a singular noun.
55. ***Punctuation***
    - A *comma* can be used wherever there would be a slight pause between words or phrases in the sentence.
    - A *semicolon* is used between two parts of a sentence; both parts must be able to stand alone as separate sentences.
    - Use a *colon* to introduce an explanation or an example of something: here is an
    - example. If there are several simple explanations or examples, separate them with
    - commas; otherwise, use semicolons.
    - Avoid excessive use of *parentheses* ( ). Never use parentheses within parentheses: find another way of saying it.
    - Use *dashes* -- two hyphens with no spaces anywhere-- for emphatic asides.

Use double *quotation marks* (") for speech and verbatim quotations.

- Use double quotation marks the first time you introduce a newly coined or slang term; do not use quotation marks thereafter.
- Use single quotation marks (') for quotes within quotes.
- Use the apostrophe (') to denote possession: ―a patient's responses,‖ and ―many patients' responses.‖ But note that its = of it, whereas it's = it is.
- Use of *and/or* instead of *or* is acceptable when you want to emphasize *either or both.*

56. **Do not cite references wrongly.**
57. **Some Confusing Words and Expressions**
    - **Above** ("the above method," "mentioned above," etc.). Often, you are referring to something preceding, but not necessarily *above*; a loose reference, convenient for writers, but not for readers. Be specific. You know exactly what and where, but your readers may have to search
    - (sometimes through much preceding material).
    - **Affect, effect**. Affect is a verb and means to *influence.* Effect, as a verb, means to *bring about*; as a noun, effect means *result.*
    - **Agree to, agree with**. Use *agree to* when you mean "to grant or to give approval." Use *agree with* when you mean "to be in harmony," "to conform," or "to hold similar views."
    - **A lot**. Write *a lot* as two words. However, avoid use *a lot* in formal writing.
    - **All of, both of.** Just "all" or "both" will serve in most instances.
    - **Among, between**. Use *among* with three or more objects or people. Use *between* with only two.
    - **Amount, number**. *Amount* refers to mass or quantity. It is followed by the preposition *of* and a singular noun. *Number* refers to things that can be counted. It is followed by *of* and a plural noun.
    - **And etc** is a redundant expression, because *etc.* means "and other things" or "and so forth".
    - **Anyone, any one**. *Anyone* means "any person at all." It refers a specific person or thing within a group. Similar cases are *everyone, every one* and *someone, some one.*

- **Apparently (apparent)** means *obviously, clearly* but also means *seemingly* or *ostensibly* as well as *observably.* You know the meaning that you intend, but readers may
- not. Ambiguity results. Use *obvious(ly), clear(ly), seeming(ly), evident(ly), observable* or *observably,* etc., as needed to remove doubt.
- **Appear, appears**. Seem(s)? "He always *appears* on the scene, but never *seems* to know what to do." "Marley's ghost *appeared* but *seemed* harmless.—
- **As**. Dialectal when used in place of *that* or *whether*; do **not** use *as* to mean *because* or *as much as.*.
- **At the present time, at this point in time**. Say "at present" or "now" if necessary at all.
- **A while, a while**. *Awhile* is an adverb meaning "for a short time." It is not preceded by the preposition *for*. *A while* is an article plus a noun. It is usually preceded by *for*.
- **Being as, being that**. Use the more formal *because.*
- **Beside, besides**. *Beside* is a preposition that means "next to." *Besides* can be a preposition (which means "in addition to" or "except for") or an adverb (which means "furthermore.")
- **But** (to begin a sentence). Go right ahead (see "And" and "However").
- **By means of**. Most often, just "by" will serve and save words.
- **Case**. Can be ambiguous, misleading, or ludicrous because of different connotations; e.g., "In the case of Scotch whiskey,...." *Case* also is a frequent offender in padded, drawn-out sentences. For "in this case," try "in this instance."
- **Compare with, compare to**. Use *compare with* when referring to the similarities between essentially unlike things. Use *compare to* when referring to the similarities and differences between things of the same type.
- **Comprise**. Before misuse, comprise meant to contain, include, or encompass (not to constitute or compose) and still does, despite two now opposite meanings. Use and meanings now are so confused and mixed that "comprise" is best avoided altogether.
- **Continual, continuous**. *Continual* means "recurring regularly." *Continuous* means "occurring without interruption.—
- **Convince, persuade**. *Convince,* which is often used with *of,* means "to cause to believe.— *Persuade,* which is often used with and infinitive, means "to cause to do
- **Correlated with, correlated to**. Although things may be *related to* one another, things are *correlated with* one another.
- **Criteria, data, phenomena**. These words are plural and in formal writing take plural verbs.
- The singular forms are *criterion, datum, phenomenon*.
- **Different from, different than**. Different from! Also, one thing *differs from* another, although you may *differ with* your colleagues.
- **Disinterested, uninterested**. *Disinterested* means "impartial." *Uninterested* means "indifferent" or "not interested."
- **Due to**. Make sure that you don't mean *because of.* Due is an adjective modifier and must be directly related to a noun, **not** to a concept or series of ideas gleaned from the rest of a statement. "Due to the fact that..." is an attempt to weasel out.
- **During the course of, in the course of**. Just use "during" or "in.—
- **Either....or, neither...nor**. Apply to no more than two items or categories.
- Similarly, *former* and *latter* refer only to the first and second of only two items or categories.
- **Etc.**. Use at least two items or illustrations before "and so forth" or "etc.—
- **Everyday, every day**. Use *every day* as an adverb. Use *everyday* as an adjective.

- **Experience(d)**. To experience something is sensory; inanimate, unsensing things (lakes, soils, enzymes, streambeds, farm fields, etc.) do not experience anything.
- **Farther, further**. Use *farther* to refer to geographical distance. Use *further* to refer to time, quantity, or degree.
- **Fewer, less**. Use *fewer* to refer to things that can be counted. Use *less* to refer to a collective quantity that can not be counted.
- **Firstly, secondly**. Use *first, second* instead.
- **Following.** "After" is more precise if "after" is the meaning intended. "After [not *following*] the procession, the leader announced that the ceremony was over."
- **High(er), low(er).** Much too often used, frequently ambiguously or imprecisely, for other words such as *greater, lesser, larger, smaller, more, fewer*; e.g., "Occurrences of higher concentrations were lower at higher levels of effluent outflow." One interpretation is that greater concentrations were fewer or less frequent as effluent volume(s) ncreased, but others also are possible.
- **However**. Place it more often within a sentence or major element rather than at the beginning or end. "But" serves better at the beginning.
- **In, into**. *In* indicates position. *Into* indicates direction of movement.
- **In order to**. For brevity, just use "to"; the full phrase may be used, however, [in order] to achieve useless padding.
- **In regard to**. Use *in regard to* or *regarding* or *as regards*.
- **Irregardless**. Never use this, but write *regardless*. However, *irrespective* might do.
- **It should be mentioned, noted, pointed out, emphasized, etc.**. Such preambles often add nothing but words. Just go ahead and say what is to be said.
- **It was found, determined, decided, felt, etc.**. Are you being evasive? Why not put it frankly and directly? (And how about that subjective "felt"?)
- **Less(er), few(er).** "Less" refers to quantity; "fewer" to number.
- **Lot of, lots of**. In formal writing, use *a great deal of, much, plenty of,* or *many* instead.
- **Majority, vast majority**. See if *most* will do as well or better. Look up "vast.—
- **May be, maybe**. *May be* is a verb phrase. *Maybe* is an adverb meaning "perhaps.—
- **May of, might of, must of**. Use *may have, might have,* or *must have* instead.
- **Partially, partly**. Compare the meanings (see also *impartially*). *Partly* is the better, simpler, and more precise word when partly is meant.
- **People, persons**. Use *people* to refer to a large group collectively. Use *persons* to emphasize the individuals within the group.
- **Percent, percentage**. Not the same; use *percent* after a specific number; use *percentage* after a general adjective indicating size. Example: "The data show that 75 percent of the subjects have the disease." "A large percentage of subjects had the disease."
- **Predominate, predominant**. *Predominate* is a verb. *Predominant* is the adjective; as an adverb, *predominantly* (not "predominately").
- **Principle, principal**. They're different; make sure which you mean.
- **Prior to, previous to**. Use *before, preceding,* or *ahead of*. There are *prior* and *subsequent* events that occur before or after something else, but *prior to* is the same kind of atrocious use that attempts to substitute "subsequent to" for "after.—
- **Proven**. Although a *proven* adjective, stick to *proved* for the past participle. "A *proven* guilty person must first have been *proved* guilty in court.—
- **Provided, providing**. *Provided* (usually followed by "that") is the conjunction; *providing* is the participle.

- **Raise, rise**. *Raise* is a transitive verb meaning "to lift." Its past and past participle forms are both *raised. Rise* is an intransitive verb meaning "to go up." Its past and past participle are *rose,* and *risen.*
- **Really, real**. *Real* is an adjective. *Really* is an adverb.
- **Reason is because**. Use *that* instead of *because.*
- **Reason why**. Omit *why* if reason is used as a noun. The reason is...; or, the reason is that...(i.e., the reason **is** the why).
- **Sensual, sensuous**. Both of these adjectives mean "appealing to the senses." However, *sensual* describes something that arouses physical appetites, while *sensuous* describes something that leads to esthetic enjoyment.
- **Shall, will**. The distinction between the two words is fading. In formal writing, however, use *shall* with first person pronouns, and *will* with second- and third-person pronouns to indicate simple futurity. Reverse the order to indicate determination, duty, or need.
- **Since**. This word has a time connotation; use "because" or "in as much as" when either is the intended meaning.
- **Small in size, rectangular in shape, blue in color, tenuous in nature, etc.**. Redundant.
- **Sometimes, some time**. Use *sometimes* as an adverb to mean "at an indefinite or unnamed time." Use *some time* after a preposition.
- **That, which**. Two words that can help, when needed, to make intended meanings and relationships unmistakable, which is important in reporting scientific information. If the clause can be omitted without leaving the modified noun incomplete, use which and enclose the clause within commas or parentheses; otherwise, use *that*.
- **To be**. Frequently unnecessary. "The differences were [found] [to be] significant.—
- **Varying**. Be careful to distinguish from *various* or *differing*. In saying that you used varying amounts or varying conditions, you are implying **individually changing** amounts or conditions rather than a selection of various or different ones.
- **Where**. Use when you mean *where*, but not for "in which," "for which," etc.
- **Which is, that were, who are, etc.**. Often, they are not needed. For example, "the data that were related to age were analyzed first" means that the *data related to age* were analyzed first. Similarly, for "the site, which is located near Ames," try "the site, located near Ames" or "the site, near Ames." Rather than "all patients who were present voted," just say that "all patients present voted." Rephrasing sometimes can help. Instead of "a survey, which was conducted in 1974" or "a survey conducted in 1974," try "a 1974 survey."
- **While**. Preferably not if, *while* writing, you mean *and, but, although,* or *whereas*. Remember that a research report should communicate and record information as accurately and concisely as possible. The purpose is to report, not to impress with elegance. Excess wordage, tortuous construction, unnecessary detail, duplication, repetition, third-person passive pseudoobjectivism, etc., obstruct rather than facilitate communication. It's the message that is important, not sheer numbers of words. Use precise words and expressions of unmistakable meaning; avoid the clouded, ambiguous, vague, and needlessly complex.

Checklist for scientific manuscript (source: McMillan, V.E. 2001 and Morgan, J.G., and M.E.B. Carter. 1999
Title

Is the title sufficiently informative?_____
Is the title concise?_

Abstract

Does the abstract summarize all major sections of the paper, including the introduction, methods, results, and discussion?_____
Does the abstract consist of a single paragraph?_____
Is the abstract sufficiently informative, yet concise?_____
Are citations of references absent?_____

Introduction

Does the introduction begin with a review of current knowledge of the general topic to be studied?_____
Are appropriate references cited to support your statements?_____
Are references cited in the proper format?_____
Are your research questions or objectives explicitly stated?_____
Are hypotheses explicitly stated?_____
Does the introduction gradually narrow in focus and conclude with specific questions, objectives, and hypotheses to be addressed in your study?_____

Methods

- Are subheadings used to help organize this section?_____
- Is the study site sufficiently described? If the study was conducted in the laboratory, has this been made clear?_____
- Is the experimental design sufficiently described so that the study can be evaluated and repeated? Are independent and dependent variables identified and described? Has information been provided regarding the number of treatments, the number of replicates per treatment, and statistical analysis techniques used?_____
- Is the discussion of procedures restricted to those directly affecting the study results?_____
- Are appropriate references cited to support your statements?_____
- Are references cited in the proper format?_____

Results

- Are tables and/or figures used to summarize the important results?_____
- Are tables and figures properly labeled with captions and axes labels?_____
- Are tables and figures referenced properly in the manuscript text?_____
- Are key results from statistical analyses (e.g., t statistics, critical t values) presented in tables or parenthetically in the manuscript text?_____
- Are key results in tables and figures summarized in the manuscript text?_____
- Did you indicate if hypotheses were or were not supported by statistical analysis results?_____
- Did you correctly refrain from interpreting results, comparing your results of other researchers, and speculating as to why results did or did not support hypotheses, etc.?_____

Discussion

- Does the discussion begin with a brief summary of key results?_____
- Are all key results interpreted and discussed in light of whether they did or did not support hypotheses?_____
- Are key results compared and contrasted with results from other studies?_____
- Are appropriate references cited to support your statements?_____
- Are references cited in the proper format?_____
- Does the discussion gradually broaden in focus and conclude by addressing the broader significance of this research project to advancement

References

- Are at least five peer-reviewed references cited in the text of the paper?_____

- Were at least three of these references published between 2000 and the present year?_____
- Are cover pages of at least five cited sources included with your manuscript?_____
- Are all sources cited in the text listed in the references section and vice versa?_____
- Are sources cited using the proper format?_____

What to avoid?

1. Writing Things that you do not Understand

Never add sentences that you do not fully understand (one of the pitfalls of the copy and paste facility).

2. Drowning in Acronyms
3. Mixing American & British styles
4. Poor Figures and Tables
5. Footnotes

Avoid footnotes since they interrupt the reading process.

6. Vague Concepts
7. Unnecessary Emphasis

Some authors too often use boldface or italics to give some words and sentences particular prominence.

8. Non-standard Nomenclature
9. Improper Words and Word Combinations