General Writing Guide
for Courses in EES at LUC

Table of Contents

1. General comment

Your assignments at LUC are evaluated on the quality of your work. Emphasis will be placed on scientific content and critical thinking skills. Still, you should realize that poor writing and poor formatting can obscure good science, and diminish the quality of your work.

We herein provide a list of common writing style practices across the EES disciplines. EES students (and students taking GC-Sustainability) should be aware of these guidelines when preparing written or oral presentations for EES classes. Read this closely!

2. Read the instructions!

Students too often lose marks because they do not read the instructions closely … **do so**!

Common mistakes include:

- Not sticking to the assignment
- Not considering the criteria provided in the grading rubrics (if provided)
- If you are asked to develop a risk model… develop one, and do not give a detailed essay on whether you agree or not with risk models (except when asked to do so!)
- Wrong formatting
  - Font size, line spacing
  - Margins
- Mistakes in referencing
  - Cited references in the text do not match the reference list
  - Chaotic mix of and inconsistent citation style (e.g., journal titles sometimes in italics and some-times not)
- Figures and tables
  - Lacking or misleading table header and figure captions
  - Data sources for figures or tables not provided or improperly sourced
  - Wrong numbering of figures and tables
- Too many pages or words: Max 1 page = max 1 page… max 100 words = max 100 words
  - We don't have a 10% rule as you learn in other courses: unless specifically mentioned
  - It is about the content, not the length of the text. Strive to communicate your study in as few words as possible.

3. Scientific report structure: Reporting on original research

Papers presenting the results from a scientific study (e.g., mapping vole habitats, sampling groundwater contaminants; interviews with stakeholders; or laboratory experiments) always follows the **standard format for structuring scientific reports**. **This format will be your guide when writing up for your capstone in EES.** And not: *We mostly do not write "essays."*

The standard sequence of sections is:

Title Page - Abstract – Introduction – (Background) - (Study area) – Data and Methods – Results – Discussion – Conclusion – References

Standard examples are available here:

Bauer, K.,T. Bosker, K.N. Dirks, and P. Behrens. 2018. The impact of seating location on black carbon exposure in public transit buses: Implications for vulnerable groups." *Transportation Research Part D* 62: 577–83. https://doi.org/10.1016/j.trd.2018.04.009.

Van der Most, M. and P.F. Hudson. 2018. The influence of floodplain geomorphology and hydrologic connectivity on alligator gar (*Atractosteus spatula*) habitat along the embanked floodplain of the Lower Mississippi River. *Geomorphology* 302, 62-75. 10.1016/j.geomorph.2017.09.032

However, some journals such as Nature, Science, PNAS and others do not include a methods section in the main flow of the paper itself. The Methods is pushed to the end of the paper and is often shorter than may be expected. See the structure here for example:

Behrens, P., M.T.H. van Vliet, T. Nanninga, B. Walsh, J.F.D. Rodrigues, D Rodrigues. 2017. Climate change and the vulnerability of electricity generation to water stress in the European Union. *Nature Energy* 2 (July): 17114. https://doi.org/10.1038/nenergy.2017.114

The full information for these papers (often including the full method detail) is then reported in the **supplementary information**. This is in an entirely different PDF file and something you should look out for when you are doing your reading for classes (often some of the most interesting things are buried in there, like data for your own projects!).

3.1. Title page

Provide a title page (not numbered) that includes full student name, course title, instructor name, organization (LUC), date, and word count. Check with the instructor whether you can add a picture on the title page (not all instructors like this).

3.2. Abstract

The abstract is a summary of between 100 and 500 words with one or two sentences presenting the essence of each of the above-mentioned sections (except for the "References"). If you would like an annotated example see here: https://www.nature.com/documents/nature-summary-paragraph.pdf However, do note that in EES (as in the natural sciences) we commonly **do not include citations** in the abstract.

3.3. Introduction

The introduction provides some context for your study, identifies the research gap and states the objectives and / or hypotheses of your study. What you will also notice if you read an introduction in a paper is that **introductions have a very clear flow**, from the larger issue at hand (ideally in an international or global context), and, step-by-step zooming into the problem addressed in the paper. This is done to clearly justify why the research is needed. **It should be the same in your introduction**: After justifying why the topic has relevance and outlining the main traits of previous scientific work, tell how your contribution aims to add insight to the problem.

Thesis statement' in science? No. -- We normally don't use the term *thesis statement.* What you will see are terms like *purpose*, *goal, or aim* etc. They mean the same, and you need to equally justify why you want to address those specific research goals. Study *objectives* can be considered as specific research steps necessary to accomplish the research goal (study purpose or aim). For example, if the study purpose is to determine the amount of nutrient sequestration associated with large flood events along the Rhine River, the study objectives (may) include (i) identifying hydrologic variability across a representative floodplain section, (ii) sampling sedimentary deposits after a large flood event, (iii) laboratory determination of nutrients adsorbed to specific particle size classes (clay, silt, sand), and (iv) applying a geospatial model across a larger area for different flood frequencies. Each study objective requires different research methods (discussed below), and in some ways the study objectives provide a 'road map' for how to conduct the research.

Citations in the introduction? Yes, after almost every sentence -- When stating why the topic is important, this needs to refer to prior scientific research in that specific field (see next point). **So almost every sentence in your introduction needs one or more relevant references.** What do we mean by that? To see how it works, grab a scientific paper, read the introduction and you will see. After nearly every sentence in an introduction you will notice one or more references. Notable exceptions are statements which are now thought to be common knowledge (i.e., you do NOT have to refer to Watson and Crick when you mention the double Helix structure of DNA, or Darwin when referring to evolution). If you are not sure if something is common knowledge, simply check how something is described in other scientific published papers or just reference to be sure. When citing, it is preferable to 'tell the story' and cite references **at the end of the sentence** in parenthesis. Avoid overuse of 'Häger et al. (2020) found this…' and 'Cinelli et al. (2020) found that…'

3.4. Background (*optional, dependent to topic and/or journal*)

If you have a topic that has a large amount of background detail needed to understand the paper, you can sometimes have a background section. This can be useful, for example, when you're conducting research that builds upon a long history of investigation that needs to be reviewed to understand the intricacies of the topic. Background material can strengthen the study rationale and justification of the research design, providing greater depth into the topic then can be obtained within the Introduction. This often includes key benchmark research and contemporary research (articles) that helps to elucidate knowledge gaps in the research topic. This can include historic data and/or figures (that illustrates development of the topic). **In some majors they call this a literature review, but in EES we have specifically adapted the practice of referring to this as Background**. This helps to make a clear distinction with a 'systematic literature review' (i.e., Siddaway, 2019), which refers to a particular type of review study with specific protocols limited to published literature. Note that in practice the Background section often (but not always) has a thematic title related to the topic (e.g., Hydrologic connectivity and alligator gar habitat). Several examples of articles with background sections are herein provided:

Behrens, P., J.F.D. Rodrigues, T. Brás, and C. Silva. 2016. Environmental, economic, and social impacts of feed-in tariffs: A Portuguese perspective 2000-2010. *Applied Energy* 173: 309–19. https://doi.org/10.1016/j.apenergy.2016.04.044.

Wistuba, M., A. Sady, A., and G. Poręba. 2018. The impact of Wallachian settlement on relief and alluvia composition in small valleys of the Carpathian Mts. (Czech Republic). *Catena* 160, 10-23. https://doi.org/10.1016/j.catena.2017.08.017

Van der Most, M. and P.F. Hudson. 2018. The influence of floodplain geomorphology and hydro-logic connectivity on alligator gar (*Atractosteus spatula*) habitat along the embanked floodplain of the Lower Mississippi River. *Geomorphology* 302, 62-75. 10.1016/j.geomorph.2017.09.032

3.5. Study area (*optional, dependent to topic and/or journal*)

Note: In some reports in environmental sciences a section is inserted describing relevant features of the **study area**, that is, the area where a field study occurs. This section might be placed after the introduction, within the methods section or after the methodology section. Be sure to describe your study area using information relevant to your topic. For example, if you're conducting a study that examines avalanche risk and climate change in the Tirolian Alps, it is rather obvious that you should provide information related to slope steepness, tree-line elevation, annual snow pack, precipitation regime, vegetation cover, etc… as this relates directly to the phenomenon being investigated. It is probably less important, and perhaps completely unnecessary, to provide socioeconomic details of local inhabitants. If you're studying sand dune management in coastal Holland you probably don't need to provide information on the Tertiary history of the North Sea basin, but you should include information as regards the late-Holocene and historic evolution of the coastline. And here, if you're also considering human impacts to sand dune environments, it could be very relevant to include sociodemographic information and number of visitors.

Note that to complete a good study area characterisation may require you to look beyond the scientific literature. Often you will want to consult government reports and data sources, such as vegetation maps and inventories, topographic maps, lists of species, tide tables, precipitation data, geologic maps, etc… Such resources may require you to consult multiple organisations across a range of governmental scales (i.e., local to international). Don't think of the study area characterisation as 'normative,' but rather as an active component of your research that deepens the study rationale by fleshing out key (and perhaps unique) environment aspects of the area, and ultimately piques reader interest in your study.

3.6. Data and Methods

The Methods section is usually structured as follows:

- Study site (including study dates: in some cases can be a separate section, see 3.6).
- Data collection
- Data analysis

One of the founding principles of scientific research is that it needs to be replicable. This means it must be absolutely clear what your methods are. **You are not writing this section for your instructor. You are writing this section for a person who has no idea whatsoever what your study is about. After reading this section, this person should be able to repeat your study.** And this in turn means you need to include, when applicable, the following:

If you used existing data, how did you do this?

- What were your data sources?
- How did you manipulate and analyse the data?
- How did you select your data?

If you collected your own data

- What was your study design?
- How did you collect your data (sampling strategy)?
- What materials did you use, and what where the vendors?

If you did modelling or used formulas;

- Provide the model or formula
- Describe what all variables mean
- Justify the assumptions you have made and provide justifications (i.e., references) for such choices

As you are building on methods and approaches of others, it is absolutely crucial to include references in your methods section to justify your approach.

When describing the methodology, don't be too detailed:

- RIGHT: 'The average consumption was calculated by dividing total use by the number of capita.'
- WRONG: 'I used a calculator to divide the use by the number of persons. For 2015 this was 130/234=21,5. For the next year it was 345/56=23,4 etc etc.'
  What's wrong? 1) Too detailed, provides no real information if the reader was supposed to understand basic mathematics. 2) The sentence mixes information to be placed in the methodology section (how ere results produced) and what happened when applying the method, which is information to be only presented in the results sections.

3.7. Results

Present the main outcomes based on the application of methods stated above. This section describes your findings, without interpreting them. You do this using two complementary ways:

- By using figures and tables which highlight your main findings (often not more than 4-8 in total, but can differ per field)
- By text that describes these figures and tables (and thus, you need to refer to the figures and tables)

For the figures and tables:

- Determine what the key information is that you need to get across
- Those are often best captured in a figure or table (for details on how these should look: see below)
- Don't present the same data twice (i.e., in both a figure and a table)
- Always ask yourself: is this information REALLY needed to understand the results? If yes, include it. If no, don't.
- If you have very basic data (e.g., only two means, you can often simply write this as text, and not include a figure or table.

Written results section:

This is the place to tell what cool thing you found. But do not present results that were not based on the methodology previously described.

- Don't kick in open doors. Example:
  - In scenario 1 I simulated a 75% reduction in population size. The model showed me the population was indeed reduced by 75% in year 1.
- Summarize complex data: look at patterns!
  - After XX years the population recovered to 95% of K
  - After 25 years the population was reduced to 5% of K

<u>Do not discuss, speculate, or reflect; just present results of your analysis!</u> For you it may feel as if this is a very dull section. Yes, and very often it is also the shortest section of a report. You should still aim to write in an engaging and interesting way.

Referring back to tables and figures

- Always refer to your **tables and figures:** After XX years the population recovered to 95% of K (Fig. 1).' Similar as with citations: Tell the story and then refer to Tables and figures in parenthesis. Avoid overuse of 'Figure 1 shows …', or 'As seen in Table 2 …'. This usually adds to fluff and is tedious to read.
- Wherever eligible, present data and numeric information in figures and tables.

3.8. Discussion

This section is about interpreting your findings in the context of other research. Contrary to the introduction here you move from your specific findings to their broader implications. Start by (very briefly!) restating the main findings, then compare your results to previous research, using references. Is there agreement? Or disagreement? Why? What does this mean? Then move to broader implications, applications, and / or possible future research directions. It is important to discuss potential limitations honestly, if you consider this necessary, but please do so only very briefly and towards the end of the section. **Make sure to end on a positive note on the importance / implications of your study.**

Note, critical thinking is not just giving critique and questioning fundamental notions *per se* … This section is about coming up with a review on advances you made, (methodological) limitations, possible solutions, alternatives, and it is about referring to what others have found. So, in this section you should:

- Report the most important things you found;
- Place your findings in the context of other research (e.g., what did other literature say about the research topic you have work on? Are your findings similar or different from the literature), and;
- Discuss shortcomings and provide an outlook on future research.

3.9. Conclusions

The final section will **briefly** summarize and synthesize the main points from the Results and Discussion sections and deliver a clear take-home message. Make your point by explaining how the findings of the present study benefit the (wider) scientific community.

3.10. List of References

References. Not: *'Bibliography'.* This is the place to properly list all the sources (and only these) that occur in the text body of your report. See formatting tips below.

Which reference style?

In general, the science community works with the reference list citation style ('Author name - Year – Title – Source' sequence). However, there are many different styles across journals. The best approach is to use a reference manager and make sure all the major fields are filled. Then you can use any particular reference style you like. The key thing is to maintain consistency across the references. Here is an example reference (but this can change from journal to journal).

Common mistakes are inconsistently using commas, initials, full-stops, capitalization, journal abbreviations etc.

4. Formatting in-text citations, tables and figures, and the like …

4.1. Common mistakes of in-text citing

Never have a period between the end of your sentence, and the reference.

- Wrong: There are 100-1000 different ways to reference. (Bosker, 2015).
- Right: There are 100-1000 different ways to reference (Bosker, 2015).

Never use ibid.

- Wrong: There are also 100-1000 different ways to present the list of references (ibid).
  - We do not use **'ibid'** or the like but always give the full in-text citation

Almost never reference to page number:

- **The reference to page numbers in in-text citation** is extremely rare in scientific publications (they sometimes are used when referring to books). However, if you think you need them do check with your instructor.

Although there are many styles of reference, be aware that:

- One or two authors: **add both**. For example (Hudson, 2015) or (Cinelli and Daly, 2021)
- Three or more authors: **use et al**.: For example: Bosker et al., 2018 or Häger et al., 2020)
- When citing two or more papers at the same time, then **place them in order in a systematic way**, separate by a semi-colon. For example you can use a **chronological order** (Hudson, 2015; Bosker et al., 2018; Häger et al., 2020; Cinelli and Daly, 2021), **or alphabetically order** (Bosker et al., 2019, Cinelli and Daly, 2021, Häger et al., 2020; Hudson, 2015). Not that ordering hem chronologically is more common.

4.2. Footnotes

Generally **footnotes** are **not used** in the natural sciences. Only use footnotes after approval by your professor.

4.3. No quotes

No quotes in scientific writing. Always write in your own words (and… of course cite!). The exception is when you provide certain quotes in your results section from interviews you conducted.

4.4. Decimal places

There is no golden rule, **but you have to be consistent**! Do think about what it is that the number represents. For example, if it is the distance from Amsterdam to Paris, do you need to show the number down to micrometer accuracy? Not really. Providing no decimals places is fine in this case. If you need to show very large or small numbers, then consider using exponential notation. If you are still unsure, best guess is simply to not use too many (avoid 'false precision'):

- RIGHT: The intrinsic growth rate (r) was: ln(0,125)= 0,165
- WRONG: The intrinsic growth rate (r) was: ln(0,12546334134351)= 0,16546316841316

4.5. Specific to equations

- Always number an equation on the right-hand side. When an equation is introduced we always describe what the variables mean. For example:

The correlation ratio, also known as the *first order sensitivity index*, is a statistical measure of global 'variance-based' sensitivity (Saltelli et al., 2008). It is defined as:

$$S_i \equiv \eta_i^2 := \frac{V_{x_i}(E_{x_{\sim i}}(y|x_i))}{V(y)} \tag{4}$$

where $V(y)$ is the unconditional variance of y, obtained when all factors x_i are allowed to vary and V_{x_i} is the variance of x_i as a function of the expected value $E_{x_{\sim i}}(y|x_i)$ for y given x_i. The expected value is the mean of y when only x_i is fixed, emphasised by the term $x_{\sim i}$, which is the vector containing all the variables $(x_1, \ldots, x_n)$ except variable x_i. Thus, $E_{x_{\sim i}}(y|x_i)$ is conditional on x_i and is, for that reason, also referred to as the *main effect* of x_i.

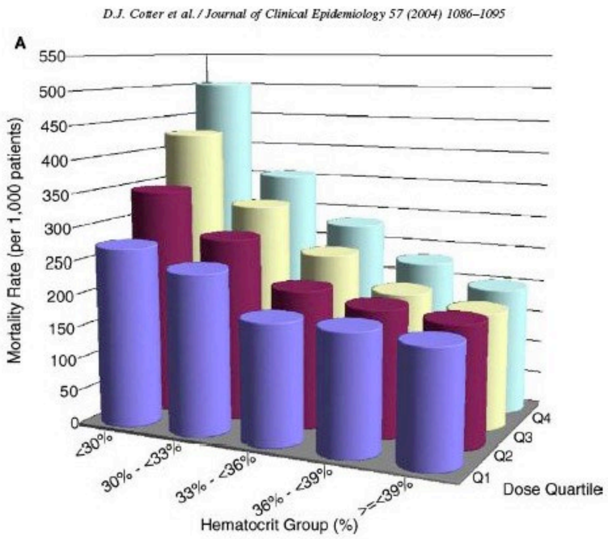
4.6. General pointer on figures and tables

- Pay close attention to formatting of figures and tables, and check for consistency.
- Note, never present data twice: Do not include the same data/information in both figures and tables
- The caption should be detailed, succinctly describe the information, but should not include speculation: The reader should be able to comprehend the figure (with its caption) without going to the text. Center figures and tables on a page (do not wrap text around figure).
- Table titles and figure captions are usually single-spaced.
- **Figures and tables should always be referenced in the main text.** Avoid ghost (uncited) figures.

4.7. Specific to figures

- Figures are by definition visual, so you should pay close attention to what is being presented because the meaning can vary across your audience.
- A caption should always be placed **below** a figure.
- Each data axis needs to **clearly show labels and units**.
- Pay attention to the **data range along the X and Y axes**, as this can exaggerate or compress variability. This is especially important when making comparisons.
- Color: why do you need it and what does it mean? Most often differences between blue/green and yellow/red imply increased value or intensity, ranging from low to high. Ask whether this is the intended meaning, or else your figure (map) could be misleading. Don't use color if black and white and/or grey will suffice. Be aware that some people are color blind, and still need to be able to interpret the figure or table.
- Shading and texture of figures might range from smooth to rough (or hatched). Is this important and what type of information and meaning is the figure (map) trying to communicate?
- **Write**: 'Fig. 1' or 'Figure 1', but be consistent.
- **Don't write**: Not: fig 1, fig. 1, figure 1. Diagram 1, graph 1, plot 1 etc.
- Some figures may have subpanels (e.g. Fig. 1A, Fig. 1B, etc.). For example if the same type of data is plot for different locations. **The difference between the subpanels should be clearly explained in the Figure caption.**

- Figures are always meant to tell a story. You have to think about what you are showing. These, while they have the major parts needed, are two examples of low-quality figures because variability in values are difficult to discern and labels are poorly represented.



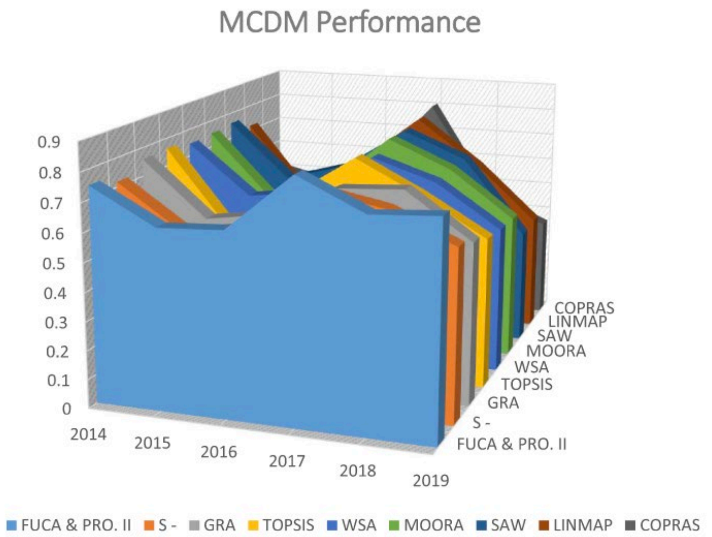


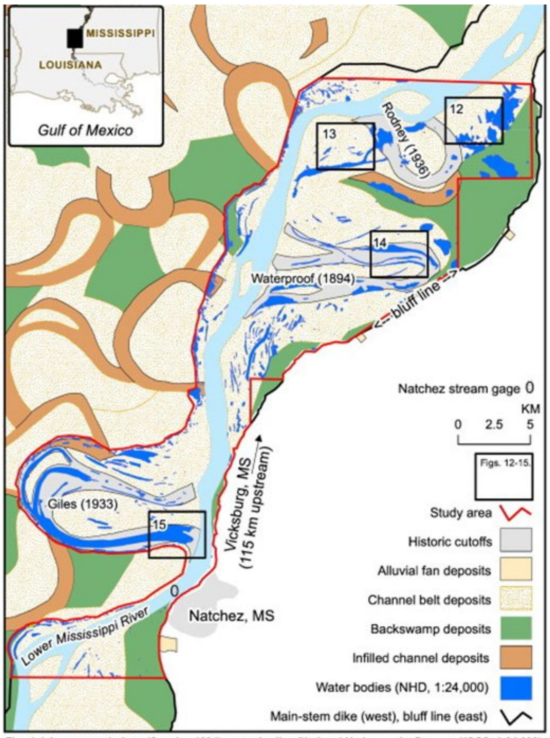
Fig. 2. Line Graph demonstrating the Spearman's results of the rankings of MCDM methods with share returns in the given period.

4.8. Specific to maps

- Maps-I: Most EES studies are situated somewhere, which implies that a map could be an essential element of the study. Maps visually present geospatial information. They can be used to show where a study is located, or they can be the main way to present the actual research analysis (output). **Please don't use a simple screen-shot from Google Earth.** You may be able to use existing maps from a government report or the scientific literature, but first confirm with your professor.
- Maps-II: Proper cartographic conventions should be followed. In *most* instances a map should include the following: i. scale, ii. some international orientation, iii. north arrow (for small areas), iv. legend, v. data sources, and vi. perhaps the map source (citation). Additionally, care should be taken so that the map includes proportionality, symmetry, hierarchical lettering, and (as much as

possible) is unbiased and does not distort the information presented. Whether displaying qualitative (nominal or ordinal) or quantitative (interval or ratio) data, take note of color, shading, and symbology because it influences comprehension and interpretation. Some color conventions should be observed, such as "green" vegetation and "blue" water, although exceptions can be tolerable for specific applications (i.e., color infrared for forest in a study of vegetation health). Data classification is particularly important to consider when displaying quantitative (continuous) data. Don't underestimate the time required to make a proper map.

Example of a good map:



Floodplain geomorphology (Saucier, 1994); water bodies (National Hydrography Dataset, USGS, 1:24,000).

Figure 1. Study area within the Lower Mississippi River alluvial valley in the vicinity of Natchez, Mississippi (MS). The extent of the study area is 405 km. The study area (red line) lies within the embanked floodplain between the bluffs of the eastern valley wall and the main-stem dike system of the Lower Mississippi. Floodplain geomorphic units are provided from Saucier (1994). The floodplain water bodies are mapped from the high resolution (1:24,000) National Hydrography Dataset (NHD) available from the U.S. Geological Survey (USGS).

Source: Van der Most and Hudson, 2018.

4.9. Specific to tables

- Captions are always placed **above** the table.
- Write 'Table 1', not 'table 1'.
- Tables should have clear headers and structured rows and columns. Note that units should be displayed in the table header for the variables shown beneath.
- Horizontal lines should be used to separate the header from the data presented beneath. It is also recommended to not use vertical lines to separate columns.
- Really, it's the same as for figures. Tables should help the reader understand the article. They should be able to 'stand alone'.

Here is another bad example where most of the elements are fine, but the number of decimal places makes the table incredibly hard to read:

- **Table 5**
  Simulation results for using full data, CRs only, and proposed method under four missing mechanisms

Method	Bias[a]		Variance[b]		95% CI[c]	
	$(\hat{\beta}_W)$	$(\hat{\beta}_X)$	$(\hat{\beta}_W)$	$(\hat{\beta}_X)$	$(\hat{\beta}_W)$	$(\hat{\beta}_X)$
(M.1) $P(R=1)=0.66$						
Full	0.01346	0.02229	0.04008	0.03685	0.955	0.950
Comp	0.03062	−0.003561	0.1149	0.06732	0.960	0.955
Impu	0.01431	0.021	0.04088	0.05169	0.980	0.975
(M.2) logit $P(R=1)=2Y$						
Full	0.007908	−0.02116	0.03838	0.03624	0.975	0.925
Comp	0.01945	0.07096	0.107	0.06581	0.960	0.950
Impu	0.006966	0.01597	0.04227	0.05226	0.975	0.985
(M.3) logit $P(R=1)=2X$						
Full	0.007908	−0.02116	0.03838	0.03624	0.975	0.925
Comp	0.01225	0.0589	0.08856	0.06818	0.980	0.975
Impu	0.009563	−0.04699	0.03865	0.04923	0.985	0.970
(M.4) logit $P(R=1)=X+Y$						
Full	0.01346	0.02229	0.04008	0.03685	0.955	0.950
Comp	0.02404	1.613	0.1102	0.08202	0.955	0.580
Impu	0.01814	0.08289	0.0578	0.06075	0.955	0.970

[a]Bias = $(\hat{\beta}-\beta_0)/\beta_0$.
[b]Simulation variance.
[c]Confidence interval using jackknife standard error.

4.10. Species names

Note: one species, two species. A specie doesn't exist.

Homo sapiens sapiens

All scientific names of organisms should be in italics, and include the genus and the species (e.g. Humans fall in the genus of *Homo*, and are species *sapiens*). The genus is capitalized, the species name is not.

Wrong: Humans (homo Sapiens), Humans (*homo sapiens*) Humans (Homo Sapiens), Humans (Homo sapiens)

Right: humans (*Homo sapiens*)

4.11. Abbreviations and acronyms

- First mention: You abbreviate an acronym in the main text body the first time you refer to it (which excludes the title, tables and figures and the abstract).
- Be consistent in the use of the abbreviation or acronym once it is mentioned. Also pay attention to abbreviations that are closely related (e.g. don't confuse sea level rise (SLR) with relative sea level rise (RSLR)).
- If you utilize many acronyms it may be helpful to provide a formal list of acronyms at the end of your manuscript, usually as an appendix.

5. Stylistic considerations in scientific writing

There are many open debates about the right style for scientific writing. The acceptable writing style has shifted substantially over the last couple of decades. Some previously forbidden approaches are now used in the most widely read journals. In general, you are allowed to use "I" and "We". You are also allowed to shift tense between sections (i.e. keep the same tense in the introduction, but this can be changed naturally in the method, more on this below). The main rule is that you should be telling a clear story to the reader. However, there is still a lot of variation in style expectations. Make sure you are clear with your instructor on their style expectations.

Here we'll discuss some common issues.

5.1. Subject

Historically, scientific work has always been written in the third person. As a reminder, first person generally refers to 'I/we', second to 'you', and third to 'it/them'. For example:

> "This study explores the stakeholder perceptions of a mining company and development process to date."

In the above example, the mining company is 'it'. The use of third person places distance between the writer and the action, which is perceived to be more objective. However, this has almost shifted to a point where the majority of papers now use the first-person plural ("we") or even singular ("I") if it is single author paper. For example:

> "We explore the stakeholder perceptions of a mining company and development process to date."

There are even first person singular examples, for example:

> "I now incorporate emissions from land-use change, as well as other greenhouse gases"

> In the article: Matthews, H. Damon. 2015. "Quantifying Historical Carbon and Climate Debts among Nations." *Nature Climate Change*, no. September: 1–6. https://doi.org/10.1038/nclimate2774.

5.2. Tense

Tense (i.e. past, present, or future) is another aspect of scientific writing that has changed over time. Previously, scientists had to keep to the same tense throughout the paper. However, today there are many (perhaps majority of) papers that shift tense through the article. The tense usually follows the flow of the paper. The introduction may be either past tense or present tense, for example:

> "Smith et al, 2020 *find* that microplastics are ubiquitous in the environment", or

> "Smith et al, 2020 *found* that microplastics are ubiquitous in the environment"

The methods may also be written in past or present tense, for example (first and third person examples are given):

> "We performed a statistical analysis of microplastic distribution" (first person past tense), or

> "A statistical analysis of microplastic distribution is conducted" (third person present tense).

The discussion section is often present tense or future tense, for example:

> "The influence of temperature will be an important subject of future research"

> "The influence of temperature is an important future subject for more research"

The conclusion can be a mix of tenses as you move through the paper to describe what you did in a shorter format.

5.3. Active vs Passive speech

Active speech reduces the number of words while keeping the same information, thereby resulting in more effective communication. This makes articles much easier to read and understand. A shift from passive to active speech usually cuts between 15 and 30% of the words. An example in present tense is:

> Passive: The risk of hair loss is increased by vitamin A.
>
> Active: Vitamin A increases hair loss risk.

As you can see, we have cut 40% of the words. In the active voice the subject of the sentence performs the action – the subject acts. In the passive voice the subject of the sentence receives the action of the verb – the subject is acted upon. Generally, first person lends to more *active voice* in writing, for example:

> Passive: No attempt was made to contact non- responders because they were deemed unimportant to the analysis.
>
> Active: Non-responders were not contacted because of being unimportant to the analysis.
>
> An additional reason for using an active voice in scientific writing is that it is more authoritative, providing confidence to the reader of the author's expertise on the subject.