



**Utrecht
University**

Reading scientific literature

Resource modules for MSc students in Earth Sciences
Departments of Earth Science and Physical Geography
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1 Introduction

When starting a research project, diving into the literature without knowing where to start and how to find what you are looking for can be daunting and overwhelming. The aim of this module is to walk you through (a) searching for, (b) reading, (c) citing scientific literature, and staying organised while preparing for and conducting a research project.

2 On the hunt: Finding literature

Learning outcomes

At the end of this chapter you will be able to:

- Find relevant and reliable literature and information in relation to the research question

2.1 Research baby steps: Preparation

There are many ways to find useful literature for your own research. There are different online databases and engines, and each database/engine has its pros and cons. So firstly, you need to ask yourself two questions before you start looking:

1. What subject(s) am I looking for? You could already write down some key words that describe the topic you are looking at. You can use these as search terms later.
2. What kind of document do you expect to find this information in? Would this be a hard copy book or map, or only an article which you want in PDF-format? Or are you just looking for raw datasets from other research projects?

If you can answer these questions, you already have an idea of where to look for the literature. Below is a list of databases organized by document type to help you get started:

- **Hard copy books/maps/journals**
 - WorldCat (Search Utrecht University Library (worldcat.org)) is the search engine that contains all the available hard copy literature (books, journals and maps) available through the UU library. Moreover, if the UU does not possess a hard copy, WorldCat shows you the nearest university that does. You can also see different versions of the specific publication you are looking for – sometimes an online version of a book is available through the UU, WorldCat indicates this as well. As a student of the UU, you can rent literature for free from the library.
 - [Books | Utrecht University \(uu.nl\)](#)
 - [Maps and atlases - Special material - LibGuides at Utrecht University \(uu.nl\)](#)

- **Articles (PDF-format)**

There are several online search engines you can use to find the article you are looking for. Each engine works slightly differently, and your choice of preference should be based on the search strategy you are going to apply (see below).

- Google Scholar
- Scopus
- Web of Science
- WorldCat

- **Datasets**

Sometimes you want to use already existing data sets for your own research. There are various ways to find existing data sets on the internet, depending on what you are looking for. Some examples are listed below:

- [Dataregister van de Nederlandse Overheid | Data overheid](#)
This is the database from the Dutch Government.
- [Welkom bij NLOG | NLOG](#)
This database contains 'deep' subsurface data from the Netherlands.
- [Research Data - Mendeley Data](#)
This is a database with a specialization in beta studies.
- [Dataset Search \(google.com\)](#)
The Google search engine, specifically for data sets.
- [Home | re3data.org](#)
- [NOAA – Global Climate Data](#)
The National Oceanic and Atmospheric Administration has data sets on a multitude of land, atmospheric, and ocean observations from around the world.
- [US Geological Survey - GIS Data](#)
[This is a database from the American geological survey.](#)
- [WMO Climate Explorer – Climate data](#)
Contains 10 TB of climate data and dozens of analysis tools. It is part of the WMO Regional Climate Centre

The Research Data Management Support at the UU has made a [useful tutorial](#) on how to use the different search engines to find existing datasets. For more information, see also [Finding existing data | Utrecht University \(uu.nl\)](#)

2.2 On a roll: Finding similar resources

Searching strategies:

Once you have identified the type of literature you are looking for, you can think about the strategy you want to apply during the search. There are three main strategies:

1. Key words

You can use the key words that describe your subject in the search engine. Most engines work with Boolean operators. With this, you can either narrow down or broaden your search with key words.

Boolean Operator	Function	Example
AND (narrowing down)	The engine only gives you results that include the key words connected by the 'AND' operator	'Literature AND Search' Only hits with Literature and Search are shown
OR (broadening)	If you connect two key words with the operator 'OR', the engine will give you alle the possible combinations	'Literature OR Search' All hits that either contain literature, search or both literature and search are shown
NOT (narrowing down)	If you place the operator NOT before a key word, this key word will be excluded in your hits.	'Literature NOT Search' Only the hits that contain Literature but not contain Search are shown.
* (broadening)	By truncating a key word with a '*', you are marking the root of your key word. The engine will show you all hits with words based on this root.	'Inclusi*' Hits that contain words with the root 'Inclusi' will show up. For example, 'inclusion', 'inclusive', 'inclusiveness' etc.
"..." (narrowing down)	With the double quotation marks, the engine only gives you hits with the key words in the exact same combination.	"Literature search" Only hits that have the combination of 'Literature' and 'search' (with no other words in between) are given.

In addition to these Boolean operators, each search engine has its own filters to further specify your search.

2. Snowball

Another strategy is to use the citations from useful sources you already found, and then the citations within these citations, etc. This is called the snowball or chain search. The easiest way to start the search is by finding a very recently published article that is closely related to

the subject you are looking at. Most likely, the references within this article contain useful citations for your subject as well. This searching method does not restrict to only finding older publications than the one you started with. Most search engines (i.e. Google Scholar, Scopus) have a 'cited by' function. This function allows you to search for publications that cited the article you have in front of you. In this way, you can find more recent publications.

3. Advanced Search

Most search engines have an 'advanced search' option. With this option, you can apply more filters to your search than described above. The advanced search option in Scopus is particularly good. Here, not only can you filter with keywords, but for a specific subject area or funding source.

For more information on searching strategies, see [4. Search - Training information skills for Sustainable Development Master in GEO4-2328 - LibGuides at Utrecht University \(uu.nl\)](#)

2.2.1 Accessibility

Almost all articles published in journals nowadays are available in PDF and books in e-format. However, for these online versions a license is often required to access them. In general, the UU has a license for all major journals, but unfortunately not all. If there is a UBU-link available for the article or book you are looking for, you know for sure the University guarantees access to this article (UBUlink | Utrecht University (uu.nl)). Another way to check the availability of an article is the Lean Library browser extension that has been developed by the UU. With this extension, you can quickly check if the article you are looking for is available through a UU-license ([Online access via Lean Library | Utrecht University \(uu.nl\)](#)).

2.3 How to judge scientific literature

An important part of reading scientific literature is to evaluate the scientific quality of an article. There are 3 checks that ensure the quality of a publication:

1. Before publication

Depending on the journal or publisher, a publication has to go through several checks before it is published. These checks give a journal its status. For example, peer reviewed journals often have good quality articles. As a reader of an article, you can assess the quality of an article by looking at the following aspects:

- **Editors** – Scientific journals have an editorial board that checks the scientific quality of an article before it's published, in contrast to most non-scientific journals.
- **Publishers** - there are publishers that only publish high-quality scientific books.
- **Peer review** - some journals only accept articles that are reviewed by peers to guarantee the quality of the publication.

Search engine - some engines (e.g. Scopus, Web of Science) only include (peer reviewed) scientific journals in their library.

2. After publication

Reviews and the number of citations in a book/article can give a good indication of the quality of the publication. In case of citations, consider the publication dates with regard to the number of citations. An article that is published last year obviously cannot be cited as much as an article published ten years ago. Also check why it is cited: is the article used to support other ideas, or is it mainly used as a detractor?

3. Personal check

Sometimes, mainly for non-scientific sources, you have to carry out a check yourself. Often, these kind of sources are not peer reviewed and thus require extra caution before you can use them in a scientific context. Questions to ask to verify the quality of the source are:

- Are the author, publisher and the date of publication specified?
- What are the affinities of the author/publisher? What is their background, and in which position did they write the article?
- Who is the target audience of the article?
- Is the use of language scientific/professional?

If, after the aforementioned checks, you are still not sure about the quality of your source, it is always a good idea to discuss this with your supervisor or experienced staff member.

For more information, also see:

[Evaluating sources | Utrecht University \(uu.nl\)](#)

[Get going - Evaluating sources - LibGuides at Utrecht University \(uu.nl\)](#)

3 Diving in: Reading literature

During your studies you will often need to make your way through large amounts of academic papers. This could be for compiling a database, providing background knowledge for a research topic, or compiling a literature review.

You don't need to read every paper you come across front to back, since articles often contain much more information than you might need, and there are only so many hours in the day we can spend reading papers.

Learning outcomes

At the end of this chapter you will be able to:

- Quickly and efficiently read an academic article and gather useful information for your own research

Most journals use a similar structure: After the abstract follows an Introduction, Methodology, Results, Discussion and Conclusion. For more detail on what can be found in these sections please see the *Scientific writing* module. A common mistake made when first exploring scientific literature is reading an article like a textbook. You shouldn't plough through a paper from beginning to end without pause. In fact, the most efficient ways of reading scientific articles are often not in chronological order at all.

One simple yet efficient method for reading a paper is the *Three Pass Approach* (see: [How to read a paper](#)). The first pass gives you a general idea of the article, the second pass gives you a better understanding of the content of the article, but not in too much detail, and the third pass is for in-depth understanding. After each pass you can evaluate whether it is necessary to continue to the next, and whether or not the article is relevant for your own work. Of course, if you're only reading a paper to compare e.g. experimental techniques, then focus on those. This guide is to help you read articles when you aren't focussed on one particular aspect of research.

3.1 The first pass

Skim the article. This pass shouldn't take more than 5-10 minutes and is confined to the absolute basics. You may decide not to read further after you've completed this pass, because the paper isn't of use to you, or because the information you gather on the first pass is enough for articles that aren't specifically relevant to your research but might still be useful someday.

1. Quickly glance over the **title, abstract, and introduction**. This should give you a good idea whether the article is relevant to your research.
2. Read the section and sub-section headings only. Ignore the text.
3. Read the **conclusions**.

At this point you should be able to identify the following: What type of paper are you reading (data publication, review paper, research paper, etc.)? What are the paper's main contributions? Which other papers is it related to? Is this research still relevant? In Earth Sciences large changes in the general consensus have occurred in the last few decades, so an article or book on tectonics published around 1960 could have been ground breaking science at the time, but today needs to be taken with a grain of salt.

3.2 The second pass

If you have decided you want to know more about the article, it is time for the second pass. This pass should take about an hour. Read the article again and focus on the main points.

Are there specific parts of the paper you're particularly interested in? What are the main points of the article? With what kind of results do they use to back up these findings? During the second pass, you focus on the following three points:

1. The **figures** in the article. Are axes labelled properly? Is the data presented with error bars? These differences will separate well-written, quality research from sub-par work.
2. Read the **discussion**. What are the main points of the article? Avoid diving into the proofs in too much detail.
3. Check the **references**. Once you've found a number of papers relevant to your research topic you'll notice many overlapping resources, and a few key (review) articles will keep popping up. Mentally tick off the references you've already used, and keep a list of articles you still want to take a look at.

At this point you should be able to shortly summarise the main arguments, with supporting evidence, to someone else. Preferably someone in the same field, your cat or elderly neighbour might be a little lost. After this pass you might notice the paper is badly written or the arguments have poor foundations. In-depth explanations of unfamiliar experimental techniques, acronyms, or one-too-many late nights could also be responsible for you struggling to understand the article. You may choose to stop reading here, or come back to the paper another time. Otherwise, go forth to the third pass.

3.3 The third pass

The third pass helps you fully understand a paper, and is especially important for reviewers. Beginners would need 4-5 hours to run through the steps fully, while experienced readers will only need about an hour (see: [How to read a paper](#)). The more papers you read, the faster this will go. The aim of this stage is *virtually re-implementing* the article. In other words: try using the same base-line results and logic as the authors, and see if you reach the same arguments and conclusions. Re-create the work, but with less sweat and tears. Comparing your reasoning with that of the author will make it easier to spot hidden failings and assumptions, but also point out the novelties/sparkly new ideas. Pay great attention to detail during this pass.

1. Begin with the **results**. How do they impact/influence your research? What are the direct consequences of the results in the article you're reading, and are they all mentioned in the paper?
2. Read the **discussion**. Identify and challenge every assumption. How would you present a particular idea? This link between proof and presentation is a useful tool to practice for your own writing.
3. Keep a list of ideas for future work.

At the end of this section you should be able to recreate the entire structure of the paper from memory. Sparring with a research partner or colleague throughout this pass helps. Try to walk them through the steps. Identify the paper's strengths and weaknesses; e.g. implicit assumptions, missing citations to relevant work, and potential issues with experimental or analytical techniques (see: [How to read a paper](#)).

3.4 Reviewing papers

When writing a literature review, use search engines and some well-chosen keywords (see Section A) to find three to five recent papers in your chosen field of research. Do a quick pass of each paper to get a general idea of the article, then read over the references. Note common references that pop up in various papers, and use the search engine tools to find papers that have cited key papers and researchers since then. If you're lucky your topic has a recent survey or "review" paper, in which case your job will be a lot easier.

The authors and publications in the references of your article pool that keep repeating are important papers and researchers to your research topic, and often the fundamental, "original" hypotheses are discussed or built upon in these publications. Once you've found these key papers, see if you can find the most recent publications or conference presentations by the same authors. Lastly, scan over the website of some of those conferences; you will find the most recent high-quality work within your field of research. Make two passes (described above) through all your collected papers, and look out for more key papers you may not have found already. These steps will establish the first sweep of important articles for your literature review.

4 Citing and plagiarism

Learning outcomes

At the end of this chapter you will be able to:

- Responsibly use and cite scientific literature
- Make a dynamic up-to-date bibliography and/or catalogue of all your references

4.1 Paraphrasing and citation methods/referencing

Using work done in the past is essential for the progress of science. Obviously, you don't have to reinvent the wheel every time again. There are two ways to cite other sources in your own work:

1. Paraphrasing - if you want to use ideas/results/conclusions from other texts but you write them down in your own words, you are paraphrasing. Paraphrasing is a very useful way to summarize other work(s) in a condensed manner. It is the most often used method in Earth Sciences to refer to previous work. There are three conditions that should be met for a good paraphrase:

- The source is known and referred to correctly (for referencing, see below).
- The paraphrased text is really in your own words (and not just the word order mixed). If you want to copy the exact words of a text, you should quote (see below) rather than paraphrase.
- Make sure that it is clear where you paraphrase another text and where your own ideas are stated.

2. Quoting – when you want to use the same words or sentences from another source, you must quote these words by putting quotation marks at the beginning and end. Although not very common in geosciences, it is still very important to know the conditions that should be met to quote correctly:

- The source is known and referred to correctly (for referencing, see below)
- The quote is literally copied from the source text - you cannot change words or the word order. Sections can be omitted using [...] in-between if the integrity of the quoted idea is maintained.
- A quote can only be a small part of your text. Although there are no strict rules on how large a quote may be, a rule of thumb is that for each sentence you quote, you have to write two sentences yourself to elaborate on the quote used.
- Don't take a quote out its context. For example, a quote from an ironic text cannot be used as a serious argument in your own text.

See [Using sources - Citing - LibGuides at Utrecht University \(uu.nl\)](#) for more information.

4.2 Citing

The sources you use for your work must be traceable for the reader. To ensure this, a few rules on how to refer properly to the source you have used. To keep a text readable, the full source information should be listed at the end of your essay/article. This is called the reference list or bibliography. The information that must be provided in this list slightly depends on the kind of source you use:

1. Article from a journal

- Name of the author(s)
- Title of the article
- Title of the journal

- Year of publication
- Volume and/or issue
- Page number

2. Book

- Name of author(s)
- Title of book
- Year of publication
- Place of publication
- Publisher

3. Online source (e.g. webpage)

- Digital Object Identifier (DOI), or
- Uniform Resource Locator (URL)

For more information, see [Referring to your sources - Citing - LibGuides at Utrecht University \(uu.nl\)](#).

There are different styles to cite sources within the text in use, varying from journal to journal. In general, geoscientific texts use the APA-style ([Using sources - Citing - LibGuides at Utrecht University \(uu.nl\)](#)). This implies that in the text, you mention the author(s) and year of publication. These two things are enough to link the citation with the correct reference in your bibliography. If your source only has one or two authors, you mention both names in text. If there are more than two authors, you mention only the first author and add the abbreviation '*et al.*'.

4.3 Citation managers

To help you correctly implement your citations, create good reference lists, and stimulate efficient workflow, a citation manager may be useful. Keep in mind to always check whether the information is correct and complete when importing them to the manager. A useful tip is to do this check directly after you imported a reference. This will save you a lot of work later on when you make the full reference list.

There are different citation managers, such as:

- EndNote (licensed by UU)
- Mendeley (free download available)
- RefWorks (licensed by UU)
- Zotero (open source)

See [Introduction - Reference management - LibGuides at Utrecht University \(uu.nl\)](#) for more information on the different managers.

4.4 Plagiarism

If you do not cite your sources properly, or not even at all, you are conducting plagiarism. Plagiarism is one of the biggest crimes a scientist can commit. It undermines the very foundation of science and its credibility. There are various shades of plagiarism, ranging from consciously committing plagiarism to unconsciously. Here are some examples:

- Copying text without citing the source
- Directly copying text from the source without using quotation marks
- Paraphrasing without citing the source
- Using imagery, videos, figures, tables etc. without citing the source
- Not mentioning all authors of a publication in your bibliography
- Using ideas from your personal previous work without citing, i.e. self-plagiarism
- Misusing the required citation style
- Giving the wrong reference with a paraphrase and/or quote

The consequences of conducting plagiarism can vary per case. In the worst case for a student one can be expelled from the study program.

See the following links for more information on plagiarism and how to prevent it:

[Using sources - Citing - LibGuides at Utrecht University \(uu.nl\)](#)

[Plagiarism FAQs // Purdue Writing Lab](#)

[Fraud and Plagiarism - Students | Universiteit Utrecht \(uu.nl\)](#)