(An experience) writing an EGS master's thesis

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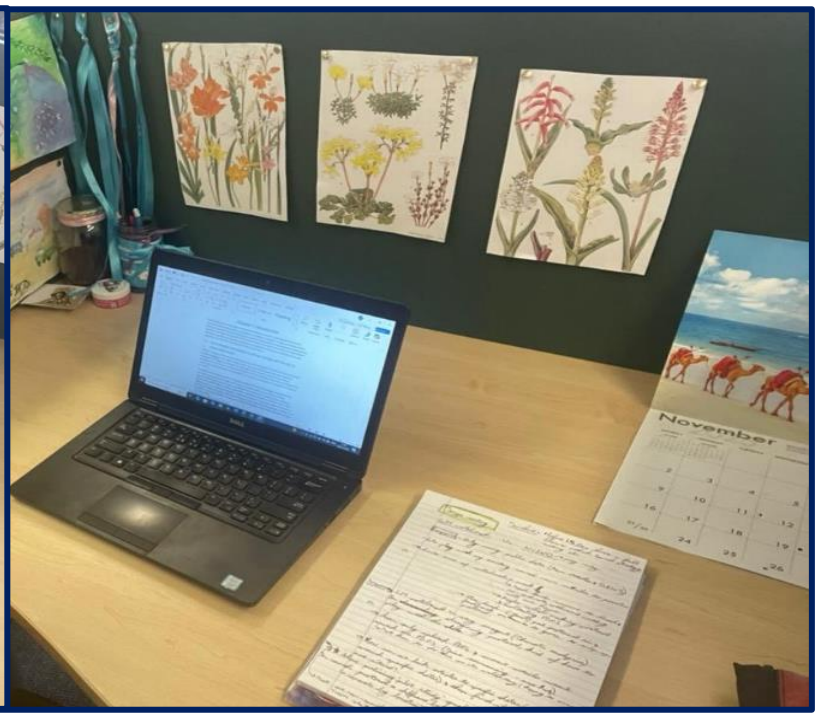


Starting your postgraduate studies and unsure what to expect from research? I have written a personal piece about the intellectual and emotional process in writing my masters (by dissertation). It follows my journey from start to (almost) finish delving into the struggles, successes and emotions that this experience brought me. I hope this helps people understand what to expect and prepare for when starting research for the first time. I am proud to share an insight into what I have had the privilege of working on these last 2 years.

What am I doing?(!)

I was a traveler skiing the snowy peaks of the USA, bathing on the sunbaked beaches of Bali and exploring the bustling city of London, working hard as a waitress to achieve it all. However, I grew tired, and longed to return to academia. My honors degree in Environmental Science (focusing on adaptation to climate change) at UCT sparked a fire of passion which inspired a master's degree.

On returning to university, I was once again reminded of the grandeur that academia holds. After sweeping floors and carrying dishes, it was a pleasant surprise to return to a place where I felt respected and professional. It was daunting and exciting to begin the 2-year journey of my master's thesis by dissertation. I had no idea what to expect, having never done anything like this before. I struggled to understand how I would be working on the same topic every day for two years.

Very quickly, the romance of my return to study gave way to the more confronting reality of choosing a research path. This was a far more complex process than simply loving a subject. As such, I naturally asked for advice. Voicing such concerns frequently sparked a common series of questions from my surrounding superiors. "What are your research interests?" they would say, "Where do you want to go with your research?".

Coming from a background in Environmental and Geographic Science (EGS) and Biology, I felt at least somewhat certain how to answer. "Climate change adaptation" I would say confidently, "mitigating vulnerability!". I was frequently reminded enthusiastically about the great beginning to any research journey being to simply "ask the right question". But there is a difference between reality and my broad-brush research interests. As for the mystical question, I had absolutely no idea what this meant in a practical research project setting.

Luckily, I had the help of my two wonderful supervisors who guided and supported me in these initial murky stages. I was encouraged to investigate 'climate change' and 'water', hot topics in the current research scene. And so, I began. I don't think my supervisors truly realized how daunting it was. Fortunately, my issue was not freezing in the face of the quantity of work but diving in headfirst with a ferocity that led to hours of dedicated effort.

I remember my first meeting with my lead supervisor (for which I made ample preparation). After about 5 minutes he cut me off and drew my attention to my deep dive of water with absolutely no mention of climate change. It felt like all my efforts had heeded no real results. What I had initially (and somewhat subconsciously) considered 'climate change' and 'water', I began to realize was 'climate change AND water', a key distinction which I had unfortunately missed in the initial fleeting verbal communication – and one of the many lessons in academia: The pedantics of language use.

Lessons learnt:

- **Don't panic about the panic: The nature of research is finding things out, so if you still haven't found a topic 3 months into your 2-year master's do not let the worry overwhelm you. Ask for help and keep reading.**
- **Routine is your friend. 'Endless' time and no direction can be a procrastination trap that even the most diligent fall into. Work every day. Write goals for the week. Keep in mind what you're trying to do, and you will do it.**
- **Just start: It's daunting. There is no right place to start. You will feel like you are wasting your time. Don't plan everything. Just do it.**
- **Dead ends are part of the process. Finding out what doesn't work is just as useful as finding avenues of success. You are mastering your field which includes understanding the shortfalls, and what does and doesn't work.**

After some time (and with ample guidance) I found that groundwater in Cape Town is an up-and-coming water source. Cape Town's water supply is distinctly limited, especially considering its rapid population growth and naturally dry environment. This reality was felt deeply in the close shave of the 2016-2018 'Day Zero' drought where the City almost became the first major city in the world to completely run out of water.

In response the City of Cape Town initiated the 'New Water Program' in which it explicitly aims to diversify its water sources beyond the saturated surface water supply system to alternative sources, for which groundwater is one of the most important. However, considering the newness of this approach, groundwater systems do not have the same extensive and established management practices that surface water enjoys.

Groundwater is far more complex. It is a dynamic system that is at risk to more than merely 'running out'. It is vulnerable to contamination, saltwater intrusion and pollution. People also struggle to accurately model and measure the current water quantities down there (let alone what will happen under changing future climate).

Gold. My first gold research strike. A context of importance. Something people would see as relevant.

My second gold research strike was a direct comment from my supervisor: "Why don't you look at the alignment between the groundwater context and climate change information". And that was that! The beginning of my long research road started with a question: *What is the alignment between the current groundwater context and climate change information* (although more like: "what the heck am I actually doing").

I don't know what I'm doing but I'm doing it...

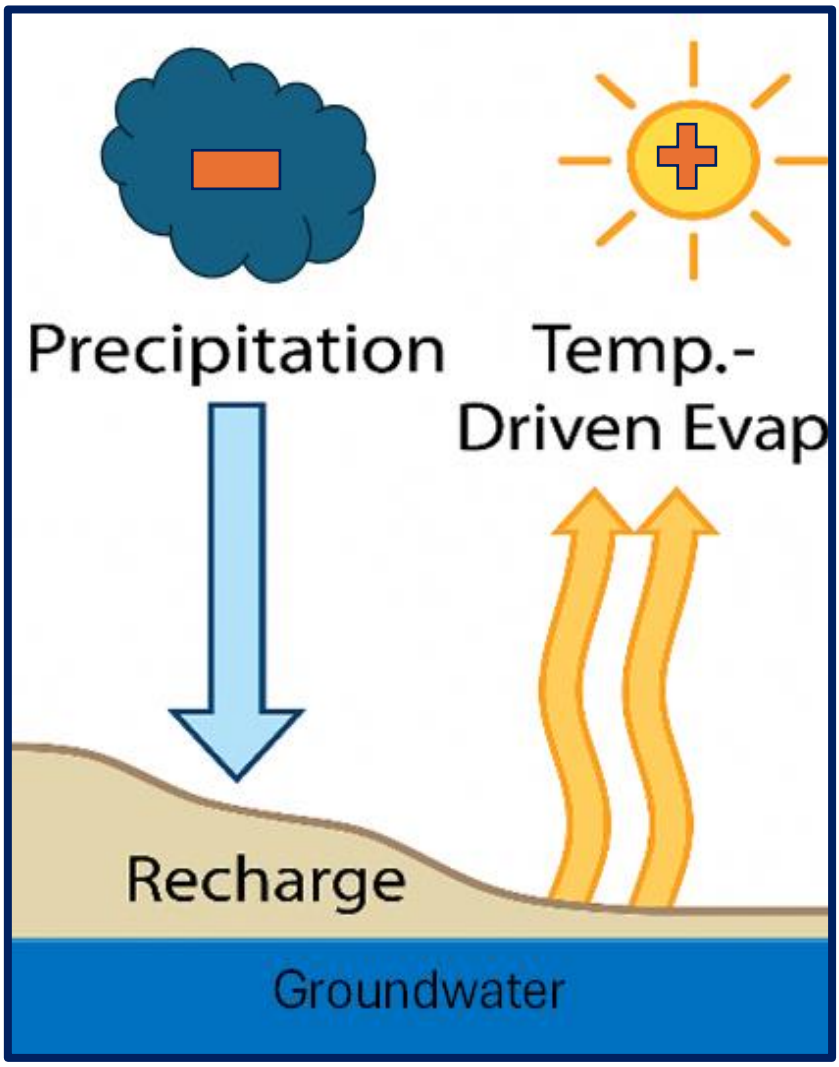
From many directionless readings I stumbled upon a scandal. Elements of the current groundwater management of the Cape Flats Aquifer (CFA) (a key groundwater source for Cape Town) seem to use outdated climate change projections.

Climate change is predicted to reduce the water in the Cape Flats Aquifer. This is particularly worrying because reducing water levels makes it vulnerable to contamination. So therefore, the use of outdated climate information is worrying because managers cannot accurately prepare for the future, despite the potential of contamination.

Aquifers (particularly coastal) are not vulnerable in the same way that dams are. The worst thing that can happen to a dam is that it runs out of water. For aquafers, on the other hand, if groundwater levels drop it causes a vacancy which can initiate saltwater intrusion and aquifer contamination from the ocean (a real threat to the CFA with its large coastal boundary).

The largely developed overground of the CFA makes it particularly vulnerable to contamination from human pollutants, which will increase in concentration if groundwater levels drop. Therefore, the CFA running out is a major concern, but prior to its depletion there is a very serious risk of contamination.

In terms of my research, so far so good because this was making sense. I could get my head around groundwater as vulnerable to climate change.



The link between groundwater and climate change: Climate change will decrease precipitation and increase temperature induced evaporation. This lowers aquifer recharge and subsequently groundwater levels.

Unfortunately, this was not the sole focus of my work, and I had to tackle technical climate change information. This mysterious and technically intimidating element had thus far warranted few ventures with quick retreat while I basked in respective simplicity of groundwater management.

I had yet to discover what 'climate change information' I was referring to and what this data would look like. Was I to be modelling actual climate projections (which I had never done) and/ or use secondary climate information (whatever that may be)? Additionally, my supervisor kept pressing the issue of the 'robustness' of climate change information which is a deeply disputed concept even amongst the most experienced.

I had no idea, but I started reading. My head hurt and my heart pounded because engaging with this part of my thesis brought on an overwhelming bout of imposter syndrome. The thoughts came thick and fast "I am and will never be fit to do this masters!" "What am I thinking?! I am never going to be able to work with this technical side of climate change information" "I should drop out now - at least then I won't have wasted too much of my life…".

I pushed back. I would find something! And something I did find. Existing climate change projection studies. A proudly self-identified source of climate change information and one that I could (somewhat) understand. The messages were saying warming and drying in Cape Town's future and were based on climate change models, downscaling and for various future scenarios and timeframes (I had heard of those!).

Now all I needed to do was clearly and articulately link the robustness of these climate change projections and groundwater (No easy task). Methods assessing the use of climate change information in groundwater management documents seemed relatively established. Measuring the quality and relevance of the climate change projections, however, seemed an impossible task. There seemed to be no established and broadly accepted method in which to do this…

I spent hours, which turned into days, and alarmingly months, reading and rereading my selection of climate projection studies and groundwater management documents. I would write tables of connection and then never look at them again. I would find some nuanced analysis and try desperately to apply it to my data. Sometimes, bright-eyed and bushy tailed, I would have great ideas, while often my eyes would gloss over and nothing would make sense or penetrate any form of meaning.

This was a dark and lonely time for me and my thesis. I wasn't sure where it was going and felt like I was working into a vacuum. It was impossible to tell if I was making progress or going in circles. I hated the inefficiency of the process and couldn't shake the gloomy feeling that I was wasting my time. I would often call on my supervisors for help, but instead of narrowing my scope and giving direction, I would inadvertently identify numerous other avenues (and hours) of exploration.

What pulled me out of my predicament was a presentation. The practice of summarizing the essence of my work to present to a crowd helped me understand what I was actually trying to do… So, with that, I forced myself to put something together, and that something remains the basis of my thesis to this day.

As it turned out, I was in the process of developing a unique robustness evaluation framework for climate change projections. No wonder I was struggling. I was creating something novel. Something which could not be fully supported methodologically by scientific literature. Once I understood this, I relaxed. It was not possible for me to follow the literature to the T, because I was making something new.

Lessons learnt:

- **Imposter syndrome: Everyone's got it. Try not to let it get to you.**
- **When the thesis gloom hits, hit back. It's natural to feel like your work is useless and will never be complete. I promise you you're wrong.**
- **Research can be inefficient and VERY time consuming. As a practical person that loves systematic processes, I really struggled with this element of research.**
- **Company helps: Find other students, talk to your friends and family or fellow workers. Seek people who understand.**
- **Sometimes doing something is good for your understanding, even if it never goes in your thesis. Numerous hours of work will never appear in my thesis, but they were critical to help me make connections to get my work to where it is today.**

Write, right? Wrong.

What people sometimes don't realize is that a thesis is a book. 110 pages, 35000+ words of technical and coherent writing. Something that is stated on page 5 needs to be aligned with the things said on page 105. I was suddenly starting to understand how a thesis can take 2 years (something I thought impossible when I began).

Every day I would prepare for battle. My bullets: the keys on my laptop. The guns, my fingers. All at war with my own mind, power of concentration and the blank page before me. Although I had been writing sections from the beginning, officially working on the thesis was another thing altogether. I would sit for hours until the words started swimming across the page with my muscles stiff from inactivity. However, I was fueled by the newfound energy of light at the end of the tunnel. I could suddenly see the finish line of this long, long journey and I desperately wanted to get there.

With a few back and forth, ups and downs and inside outs, I was getting my bearings on what I had been working on for 1.5 years and it was beginning to make sense. The satisfaction of seeing this work come together was truly liberating. As it turns out, I had a project and I had not completely wasted my time. I basked in the coherence of my work and was enthralled by what I had found. Separated from the stress and anxiety interwoven with the process of doing a master's I was able to experience my work from an outside eye.

At a theoretical level, my thesis aimed to produce some initial avenues to evaluate the robustness of climate change information (something which does not seem to have been done before). 'Robustness', as an adjective used to describe the quality of information and consequently justify its use, is often understood ambiguously between different groups. I created a unique initial evaluation system for its evaluation tailored to the groundwater context in Cape Town. Although specific to Cape Town, this evaluation could be translated to other critical climate change contexts.

Then, from the Cape Flats Aquifer context, I assessed the level of active inclusion of- and regulatory requirement for- climate change information in current management.

And this is what I found:

(1) Groundwater management in South Africa seems to be underdeveloped in its incorporation of- and regulatory requirement for- climate change information.
(2) Existing climate change information (climate projections) do not seem to be fit for the purpose or robust for decision making in groundwater management for the Cape Flats Aquifer.
(3) The implications hint at the possible unsustainable management of groundwater (a key water source for Cape Town) in the face of climate change.

These findings are truly relevant to Cape Town. They highlight a key gap between scientific climate change information and a groundwater management context. Although local, similar science-policy gaps are common around the world. These findings therefore highlight the necessity of taking action to address these gaps. Fortunately, there are several practical ways to do this. After this tremulous and emotional master's journey it is a pleasure to share them with you.

It is essential that climate change information is produced in a way that it is actionable, as well as ensuring that management processes consider climate change. Scientists and groundwater managers need to improve their co-ordination and communication so that climate change projections are produced relevant to this context (co-production of knowledge), and to ensure groundwater managers understand the limits of science (what climate projections can realistically project).

I am not quite at the end of the road although I have completed a draft. I am busy playing thesis tennis with my supervisors aiming desperately to finish my revisions and get the go-ahead for a February 2026 thesis submission.

With the finish line in sight, I am beginning to feel sentimental. I find myself wondering what all the worry was about. It all turned out alright in the end. I am so grateful for this intellectual (and emotional) journey. I thank my supervisors, family, friends and incredible UCT EGS department and CSAG group for helping me get through this. Your endless support was not unnoticed.

In hindsight, there are a million things I could have done more efficiently. But this is the process. A master's is a degree, and you are supposed to learn, not go in knowing. No, this was not a passion project I felt drawn to my whole life. No, at the start I did not feel like groundwater management was my calling. No, I did not even know one single thing about groundwater before beginning. But through this degree I became deeply invested in this fascinating and relevant topic.

Lessons learnt:

- **Writing is a form of thinking. Very few sit down and write from start to finish. It involves numerous versions, comments and iterations. There are large sections necessary to write which you will eventually leave out of a thesis.**
- **You are learning up until the final edit: I am constantly fine tuning my concepts as I write. Edits are so much more than fixing grammar, and they take time and effort.**
- **Some people do a master's they have thought about for years before starting. Some people don't and that's okay.**

THANK YOU 😊