Research guidelines for PhD students

# Sample timeline:

Adapted from Treseder lab at UC Irvine

Year 1

* Read broadly and deeply in area of interest
* Apply for fellowships and student-oriented grants
* Develop plan for summer project
* Perform field or lab project in summer

Year 2

* Apply for fellowships and student-oriented grants
* Develop idea for dissertation research and begin writing dissertation proposal (by spring in 2nd year)
* Identify dissertation committee, arrange first meeting in spring
* Use knowledge gained in first year, complete formal literature review, meta-analysis, proof-of-method, or proof-of concept related to dissertation idea or first project (by end of Spring)
* Submit manuscript from above study (by end of summer)
* Perform field or lab project in summer

Year 3

* Submit dissertation proposal to committee (by end of September)
* Preliminary exam (Y3 or Y4)
* Submit NSF DDIG proposal (October)
* Perform field or lab research
* Submit manuscript for completed lab or field work (by end of summer)

Year 4

* Preliminary exam (Y3 or Y4)
* Perform field or lab research
* Submit manuscript for completed lab or field work (by end of summer)

Year 5-6

* Complete remaining field and lab work
* Apply for postdoctoral positions and funding
* Finish writing dissertation
* Defend dissertation and submit final version (by end of Spring Quarter)
* Submit manuscript for completed lab or field work

# What is a dissertation and how does it relate to publications?

A dissertation generally consists of 3 (minimum) or 4 (ideally) data chapters, an introduction and a conclusion (plus abstract, acknowledgements). This is what you should have in mind while writing your dissertation proposal. Each chapter generally is a first-author publication that you have led from the beginning and written the paper.

Caveats: 1) not all data in your dissertation may “make it” to the (generally more abbreviated) publication 2) sometimes there are side-projects that are publications, but not in your dissertation because you have enough for a dissertation or it just does not fit well. 3) you may have other papers you are not lead-author on, but these are not publications that you are second or third author on and not in your dissertation.

Bottom line: A dissertation is needed to graduate. Papers are needed to succeed in research-oriented careers. Aim to have all chapters of your dissertation submitted by the time you defend, and AT LEAST one fully published.

# What you need to be competitive in a faculty position

(*For those aiming for academia*, warning: not sugar-coated)

Faculty positions are extremely competitive in ecology (and most other fields). It is not uncommon for 200+ people to apply for one opening. Most of these applicants are qualified, so if you want a faculty position you must establish a truly exceptional record. Here are some goals to reach if you would like to be competitive for a position in a top-100 department. For a top-10 department, the objectives are much higher. It’s best to start planning to meet these objectives when you start your graduate career, if not earlier.

As a PhD student:

* 3–6 first-authored papers
* Ideally at least one in a high-profile journal (e.g., Science, Nature, PNAS, ISMEJ, Ecology Letters). All should be solidly “mid-tier” peer-reviewed journals known in our field (Ecology, Soil Biology and Biochemistry, ISMEJ, Biogeosciences, etc.)
* Junior-authored papers (not first author) (optional)
* NOTE: no number of junior-authored papers can replace a single first-authored paper
* Very strong letter from PhD advisor
* Very strong letter from postdoc advisor
* Very strong letter from a third faculty member, usually a committee member (in some cases this can be an undergraduate research advisor)
* Demonstration of ability to obtain independent funding, like fellowships or smaller grants (optional, but highly recommended)
* Teaching experience (for teaching universities)

# Non-academic jobs

As you are being trained at a research university, you come away with the most knowledge about what it is like to work at a research university, as an academic that focuses on research. Plenty of other options exist, but you generally have to be pro-active about learning the ins and outs of these positions. Many will look for the same qualifications as academia (and those listed first are nearly identical) – strong letters, products like presentations and papers, independence, and good writing and critical thinking skills. Here is a non-exhaustive list

* Researcher at a department of energy national laboratory, e.g. Oak Ridge National Lab, Pacific Northwest National Lab
* Professor at a Non-R1 university, e.g. CalState Univ system or Western Michigan University. Many have higher teaching loads and some have Masters students only.
* Professor at a teaching or liberal arts college that focuses on undergraduate education (will look for teaching experience, can be obtained in a postdoc as well)
* Government agency work, such as USDA ARS, USGS or the Park Service
* Other national government agency, e.g. USAID, EPA, or policy-oriented job, which may be facilitated by specialized postdocs like AAAS Science Policy postdoc.
* State government agency, Michigan Department of Environmental Quality
* Industry job that involves research. E.g. Zoetis develops vaccines for animals, others might concentrate on products for bioremediation or improving environmental health.
* Job at a smaller company or startup, e.g. developing carbon sequestration technologies, medical microbiome treatments or soil microbial innocula.
* University administration, e.g. working in a Grants office or job related to academic or curriculum development
* Job at a natural history museum, field station, environmental center, or other organization that focuses more on outreach and education
* Working for a nonprofit like the Nature Conservancy or the Wildlife Society
* Full-time editor for a major journal like Science
* Grant funding officer, e.g. a program officer at NSF or DOE.

# Some common characteristics of high impact publications in ecology

* Solidifying emerging perceptions in a concept, opinion, or review paper
* Developing a conceptual framework
* Synthesizing ideas and knowledge from multiple disciplines
* Overturning a common assumption
* Developing a widely-applicable tool (e.g., a primer set or informatics pipeline)
* Conducting a highly novel experiment (important element of scientific progress, but not always highly-cited)
* Quantifying widespread effects from previously-published papers (i.e., meta-analysis)

# What do you need to be a successful researcher?

**Passion for science and research**

* By far, this is the most important. It will help you maintain your motivation even during challenging times in your career (which will be more frequent than you’ll expect). One way to protect your passion for your research is to select research topics that are important to you. They should also be important to your field, your lab, and your colleagues, but they absolutely must be important to you as well.

**Receptivity to constructive criticism**

* Criticism is pervasive and unavoidable in academia. It is inherent in the scientific method. In addition, no study can perfectly address all issues, so there is always room for criticism.
* Keep in mind that criticism is important for the field, because it allows us to re-assess and improve our knowledge.
* Constructive criticism is also important for you, because it will help you identify weaknesses to improve upon and strengths to depend upon.
* Remember that criticism is usually meant to be helpful. It shows that the evaluator is interested enough in your research to help you improve it. It demonstrates that they are thinking about your work carefully.
* Criticism is hard on everyone, so it is important to develop coping strategies. These include:
* Thoughtfully addressing the criticism.
* Remembering that criticism can be beneficial.
* Remembering that it is not personal. The criticism addresses the manuscript (or talk, proposal, etc.), and is not a reflection on your self-worth.
* Actively maintaining your well-being and self-identity by pursuing other hobbies (so you don’t over-identify yourself with your work), relying on a social support network, and protecting your health.

**Hard work**

* All successful researchers work hard. Nevertheless, there is no need to overwork yourself just for the sake of working. I think that ~50 hours/week of *focused*work should be sufficient, on average. (Time on Facebook etc doesn’t count.) Sometimes you’ll have to work more, and sometimes you can work less. The important thing is to work as much as necessary to maintain your productivity. Consider that it is difficult to work efficiently, effectively, and creatively if you are working 60+ hours a week for an extended period of time. Almost everyone will get burned out with that schedule. If you find that you are working long (60+) hours but not maintaining your productivity, try cutting back on your hours to see if your productivity improves.

**Time management**

* Say “no” to tasks that are not substantially beneficial to you (and others). If necessary, select a “cause” or two that are really important to you, and focus your efforts there.
* Schedule activities mindfully.
* Consider your most- & least-productive times during the day, and schedule your activities accordingly.
* Write at least one hour per work day, during your most-productive times.
* Perform busywork and paperwork during your least-productive times.
* Plan ahead so you are not scrambling to finish tasks at the last minute. If possible, finish tasks ahead of time so you are not vulnerable to unexpected events like illness or family emergencies. Plan for ~2 week turnaround times from advisors, co-authors, and other colleagues who are reviewing your manuscripts etc.
* Take regular time-off to recharge and maintain your well-being. Schedule time-off in advance if necessary, and protect that time!
* Prioritize activities that make you happy. Try to do something fun every day. Schedule that time in if you have to, so it’s protected. Hire a cleaning service, unless for some reason you really like to do housework.