

Hunting versus Mapping Expeditions

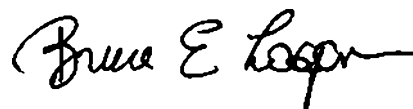
One of the great joys of research in academia is meeting new people every year and helping to plan the direction of their research. The people that join my group are always full of energy and eager to make contributions to the fields of environmental science and engineering. They have different ideas, hopes, and visions of where they will go, and it is my job to provide the best assistance and advice to help them get there. When I sit down to discuss research plans with new graduate students or postdocs, the first thing we discuss is what they hope to achieve when they leave. Are they looking to go to consulting, industry, or a federal laboratory? Do they hope to become a professor at a teaching or research-based university? Are they set in this plan, or are they still considering the different options? That conversation helps me to guide their participation in a research project in a way that allows them to develop the skills needed to meet their goals while at the same time meeting the requirements of the project that funds their work. Usually the second thing we discuss, as we consider different research topics, is about how choices in research directions have analogies with hunting and mapping expeditions.

When you go on a mapping expedition, you are sure to return with data. You are probably going out to an area that someone has already walked around in, and now it is up to you to do the hard work of mapping out the details. In research, this means that your professor (or a previous researcher in that group) came up with an idea and perhaps obtained "preliminary data". The project was described in sufficient detail in a proposal to have convinced reviewers it was worth funding. Now that work needs to be done to meet the project objectives in a way that was mapped out in the proposal. Mapping expedition research projects are ideal for new graduate students who have not previously conducted research, such as students in environmental engineering looking for Master of Science (M.S.) degrees. They can also be great for new Ph.D. students or postdocs who have not previously worked in this specific research area. As researchers begin their work and gain a better understanding of the field, these mapping expeditions help them to come up with new ideas that they can further explore. There is little risk of failure in a mapping expedition. The objectives were well thought out and described in a proposal, so usually data are collected, the hypothesis is proven, and the thesis and journal papers are written.

The hunting expedition is a far different excursion because you are often going into unmapped territory. When you go hunting, you may come back hungry. If you want to be relatively safe and assured of something to eat, you can hunt in these new areas for smaller game. The bigger the game, the more territory you will probably have to explore, and you are more likely to come back empty-handed. This situation is a useful analogy for highly creative and novel research. Oftentimes when you come up with a wild and crazy new idea, you have to cover a lot of "territory" to carry it out. You may need to learn a new field or collaborate with someone in a

field you barely understand only to find out that your original idea will not work, or it cannot be done. As you move into an unknown territory, you have to ask questions that likely will sound foolish to those in these different fields you are exploring. That is a problem, as few researchers (especially professors) like to sound foolish. So why go after "big game" in unfamiliar territories? Because risky hunting expeditions are the most likely to produce the greatest rewards. When you go off on your own to explore a new area, it can be a lonely and perhaps frustrating journey. But when you come back with your academic big catch (your discovery), you get to enjoy the rewards: accolades of your peers, publication of your work in a top-tier journal like *Environmental Science & Technology Letters*, and maybe a few speaking invitations. But most importantly, your greatest reward is the joy of discovering something totally new and breaking into a new area of research. Now, instead of being the lonely hunter, you might lead hunting parties in new areas that will produce many additional discoveries.

When I discuss specific topics with new researchers, I usually present them with a series of hypotheses or objectives, discussing each within the framework of being relatively safe (mapping expedition) to highly risky (big game hunting expedition). M.S. students are best served by relatively safe projects because they need to develop their research abilities, learn the landscape, and complete the work in a short period of time. Ph.D. students should have a mix of both mapping and hunting expeditions. They should start with a couple of hypotheses or objectives that can lead to nice solid contributions via mapping-type expeditions, so that they can develop and prove their research abilities. Ph.D. students must also formulate their own interesting and challenging questions that will take them on hunting expeditions, because that is the main doorway to new discoveries. I have enjoyed working with both kinds of projects because it is exciting to discover new things, but it is also equally satisfying (as an engineer) to see your ideas take shape in the form of a new treatment process or method of renewable energy production. Whatever your own field of research, I hope that your field (and your funding agency) allows you to pioneer new research directions and create new things, through mapping and hunting expeditions.



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■ AUTHOR INFORMATION

Notes

Views expressed in this editorial are those of the author and not necessarily the views of the ACS.

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