22 CHOOSING AN EXPEDITION RESEARCH PROJECT AND PUTTING IT INTO PRACTICE

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CHOOSING YOUR RESEARCH PROJECT

Choosing your research project is certainly difficult and challenging but it is not the Everest of a task that it often appears at the beginning. The advice I often give to undergraduates thinking of planning their research is fourfold:

1. Think small rather than big – a well thought-out and properly executed small contribution is of immensely greater value than an over-ambitious, poor-quality flop.
2. Projects do not come out of thin air. All research builds on earlier studies and it is most important that any research is firmly rooted in the context of previous studies. This context not only prevents needless repetition, but also provides a background for comparison and evaluation of your work, and allows you to slot your work into a research niche. Most ideas for future studies stem from a good understanding of earlier work.
3. Help is usually at hand from a tutor, lecturer or someone recommended by them. But help will be much more forthcoming if you have some ideas about what you want to study, where you will be going, and if you can demonstrate that you have done some reading before seeking the advice of a tutor. Turning up one month before departure asking plaintively “What can I do in X?” will rarely elicit a favourable response.
4. Leave yourself plenty of time to develop your project.

FOCUSING IN

Why am I doing a scientific research project?

Understanding why you are doing a scientific research project, and its importance in terms of the expedition as a whole, can help when choosing the type of project

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because it gives a guide to levels of interest and commitment. There are several reasons why you may be involved in a scientific project:

1. Science is a passion and you are fascinated by the idea of undertaking original research in order to further our knowledge about the world in which we live.
2. Science is interesting, but more to the point you have a dissertation to do for your degree course. Dissertations are there to give students experience in the skill of designing and undertaking research; they are not intended to be scientific masterpieces.
3. You want to participate in an expedition for a number of different reasons (e.g. travel, leadership skills, etc.), and you are taking the opportunity to do your dissertation at the same time.
4. You want to participate in an expedition for personal and social reasons, but you feel that you would like to spend some of your spare time doing something useful.
5. The expedition is primarily for adventure, but you feel that a scientific component will help you to attain funding.

If you fall into the first category then the whole expedition will revolve around the research project, and you may well chose your expedition area to fit around the research aims. For the other categories the research component becomes of decreasing importance, and the scientific aims are less and less likely to exert much influence on the choice of expedition area. The question changes from “Where shall I go to do X research?” to “I really want to go to Y. What research can I do there?” In short, the first two categories have research as a main aim of the expedition, whereas the last three have research as the supporting objective. In the fifth category it is worth thinking seriously about whether research is sensible, because a grant-awarding body can generally see when research has been tacked on to the expedition to give it respectability.

Clearly, these statements are over-simplified, and different members of an expedition team may have different research expectations and motivations. However, it is worth clarifying the standing of the research within the overall expedition plan because this will affect the scale of your research project and the type of research project(s) that is most appropriate to your circumstances. All levels can, of course, contribute valuable information.

What type of research project?

How motivated you are to undertake original research is just one of several factors that help to determine the most appropriate type of field research project(s) that you might undertake. Before considering these other factors it is probably worth describing some different types of project.

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Classification and mapping

Classification and mapping projects are often the most straightforward to plan and undertake. These involve identifying the existence, and sometimes mapping the distribution, of objects or features. They can be applied as an overview of areas not previously studied, as a detailed investigation of one particular feature/object not previously studied in that area, or as a follow-on study to evaluate change over the period of time since a former study. Every discipline involved in field science has examples of this type of project, including geological and geomorphological mapping, distribution of fauna and flora, and ground "truthing" for remotely sensed imagery. They can be ideally suited, at a simple level, to those for whom research is a secondary aim of the expedition.

Adoption and adaptation

Adoption and adaptation make direct use of earlier research through the application of the same research aims and hypotheses to a different area, or the same area at a later time (adoption), or through adaptation of one or more parts of an earlier study to a new setting. This group of projects includes the applications and testing of models in new field settings. The same field and laboratory methodology can often be followed as in the earlier research, and comparisons of results with earlier research can provide a good basis for the discussion. This type of project is often employed effectively in dissertations.

Impact evaluation

This involves evaluation of the effect of a change in one parameter – often a human factor – on other aspects of the environment and/or social system. Although such projects may seem conceptually easy, they can be very difficult to undertake in the field, and at worst they lead to vague and inconclusive generalisations. In particular, there may be problems in establishing and proving the causal links, and in obtaining reliable information on the conditions before the change.

Research frontiers

This is the most challenging type of project, best suited to those with a passion for research because it usually requires more effort, dedication and insight than other types of projects. Earlier work forms the building blocks on which this new research adds the small next step. Clues about useful avenues to follow may be found at the end of some research papers and monographs.

The type of research project and, indeed, the specific aims of the research depend not only on the motivation of the expedition members. There are two other areas of consideration. First, there are the wider needs of the research communities, which can fall into any of the project type categories just mentioned, but are more likely to be pushing forward research frontiers. These

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needs are examined in more detail for specific environments later in this section. Second, and equally important, are a number of personal and logistical constraints, which will affect the particular research projects that you can do within each of the project type groups. The following are the most important constraints:

- research skills of the members: including training in field monitoring, description and measurement techniques, and laboratory analysis and data handling
- availability of specific field equipment and laboratory facilities, and where these facilities are located
- ability and ease with which samples can be transported, exported and imported
- levels of practical and intellectual ability of members of the group
- compatibility of research interests within the expedition members; and whether each individual is engaged in one project; if so, whether the projects are designed to dovetail
- time and manpower in the field
- environmental constraints: access, altitude, weather conditions
- timing of the expedition: particularly important for projects that require specific weather conditions
- communication skills (language) if your research project involves local people

After developing a clearer idea of the personal and logistical constraints that face your group – the levels of motivation, the types of project that can be done, the possible research area and important research needs in that area (see below) – you then have the challenge of defining your precise research objectives or hypotheses. At this stage reading and secondary sources of information are vital components. Examine maps, aerial photos and satellite imagery if available, and seek out reports of past expeditions, published articles in journals and people who have been to the area before. Read about the chosen area, the research field that interests you (including research methodology) and the research that has been done in the area. It is then time to see your tutor and get some feedback on what you intend to do.

To sum up, a good research project is one that lies within the constraints imposed by personal characteristics and logistical problems, is appropriate to the levels of motivation within the group, has a clear set of objectives, can relate those clear objectives to the wider research context, and does not attempt to do too much!

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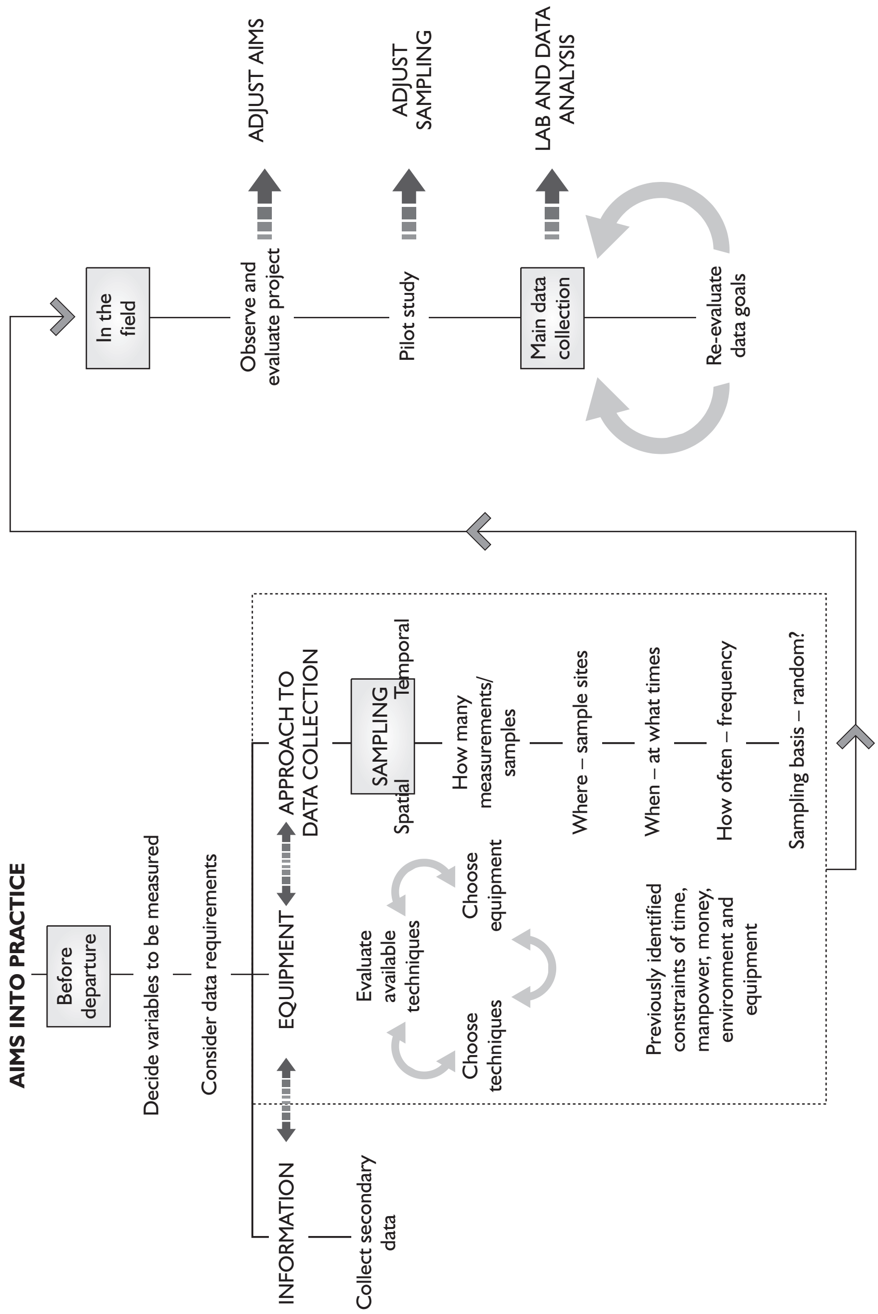

Figure 22.1 *Putting your research project into practice*

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PUTTING YOUR PROJECT INTO PRACTICE

After putting a great deal of effort and thought into the logistics, fund-raising and formulation of the scientific objectives of their expedition, many small scientific expeditions forget that putting these ideas into practice actually starts before you go into the field. Then 2 weeks before departure, often just after the end of exams, there is a frantic rush to assemble the necessary equipment; photocopiers are worked day and night to assemble articles on use of equipment and reports of earlier studies; and any polite enquiry such as "Have you thought about your sampling design?" is guaranteed to elicit a response close to hysteria.

Reference to the flow chart in Figure 22.1 will show that putting your research project into practice can be divided into two parts: before departure and in the field.

Before departure

You should already have a good idea of what variables (characteristics) you will want to measure in the field, because these lead directly from the aims of the project. However, there are a number of decisions to be made, or at least considered, that relate to these variables.

The first point to be considered is the likely nature of the data that you will be collecting and your sources of data about the variables. Are the data being derived solely from field measurements, monitoring or questionnaires? Do they involve the collection of samples for subsequent laboratory analysis and, if so, what analyses? In what form will the data be collected, e.g. as frequencies of occurrence within predefined categories (i.e. nominal data scale), as actual measured values on an interval scale or as open-ended questions? What methods of data presentation and analysis do you wish to use? How many data do you need to test your hypotheses? All of these issues relating to the likely data will partly affect the two key areas about which decisions have to be made – namely field equipment and field-sampling strategy. It must be remembered that equipment needs, sampling strategy and data characteristics are interlinked, and decisions in one area will affect the others.

If you plan to collect samples for analysis in the UK, it is essential that the regulations for export of different types of samples from the research area and their import into the UK be investigated at an early stage. The restrictions on importing soil, for example, may well necessitate reconsideration of the aims of the project, or of the logistics, to enable analyses to be undertaken in the host country.

Sampling strategy

The first decision concerns sampling strategy. You know what you want to measure and what information and samples to collect, but of course you cannot measure or collect continuously from all areas and at all times. Thus, you need to consider your strategy for sampling in both space and time.

In simple terms this is the "How many, where, when and how often?" question.

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How many measurements/collections/interviews do you need to make to test your hypothesis? Over what area? At what time intervals? From exactly where? How often? And at what specific times of day? For most scientific projects some of these questions, if not all, will need to be answered.

Although you will not be able to answer them definitively before seeing the field area, careful thought about the needs of the project, the sampling options and the development of a likely strategy is strongly recommended, not least because it can affect your decision about equipment and, in the case of "human projects", the formulation of the questionnaire design. The simplest way to approach this minefield is first to consult a good textbook on sampling for field studies, and then to evaluate what other people have done for similar research projects. This is usually quite easy if you have chosen a project that is adopting or adapting earlier research. However, this does not relieve you of the responsibility of still assessing the feasibility of the approach under your (different) circumstances.

Sampling framework

The role of the sampling framework is to gain as representative, unbiased and accurate a set of measurements as possible of the variable being studied, while at the same time keeping within cost and time constraints. The sampling strategy will depend not only on the distribution but also on the spatial and temporal variability of what is being measured. In general, the greater the level of (spatial or temporal) variability, the larger the number of samples required to gain an accurate record of that variability; the shorter the time over which the variability occurs, the more closely spaced in time the sample collection should be, e.g. measuring discharge and sediment yield from flashy and highly responsive gully systems during and after storms will need measurements of water level and collection of water samples every few minutes, and several gullies would need to be studied in order to determine the typical behaviour. On the other hand, a perennial stream would tend to respond more slowly and over a longer period to rainfall, and thus measurements could be spaced out more widely over time.

Ideally a pilot study should be carried out to determine the levels of variability and hence to enable an efficient sampling strategy to be planned. However, this is a luxury that very few small, scientific expeditions can afford or even manage practically. In this respect (and others) the collection of secondary data is most important – data from other studies about the characteristics and responses of similar natural and human systems elsewhere, and as much appropriate information as possible about your precise field area (meteorological information, maps, air photos and even satellite images for an overview). This information is invaluable in putting your aims into practice before departure. First, it helps you to think about the size of area in which you might work. Second, it helps you to determine the likely variability. Third, it will enable you to think about probable sampling locations. Fourth, it will help

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with the choice of equipment for measuring/collecting your field information. A discussion at this point with researchers who know the area well can be invaluable.

Equipment

The second decision, and one that clearly follows from the first, concerns equipment. Typically there are several different methods for collecting any set of field data, be it physical collection of insects, mapping of geology or measurement of river discharge. The methods will probably vary in their sophistication, accuracy, ease of use and physical equipment characteristics (portability, cost, power needs, availability, etc.). An evaluation of the methods is important, because an understanding of the limitations posed by the methods and the likely practical problems can save a great deal of embarrassment in the field and during the project write-up. You should be able to justify your choice of techniques – a justification that will be based on compromise between availability/cost of equipment and efficiency/accuracy of method, and which will take into account the field conditions, manpower and the level of sophistication of the aims of the project. As a general rule, simple but reliable low-technology equipment has many advantages for small scientific expeditions, especially in relatively remote areas. There are now a number of specialised books that deal with field methods and types of equipment, and it is well worthwhile investing in a good one. It is most important that the equipment and spare parts are checked before departure, and that the research team are trained in using the equipment

To sum up, the successful completion of your project depends in large part on the groundwork that you do before departure. Without this you will probably be faced with an environment that is larger than expected, looks different from that imagined and is infinitely more complex than shown in any textbook, and one where you simply do not know where to start. Even if your deliberations before departure have not come up with any hard decisions about sampling strategy, the simple act of thinking carefully about the issues will have prepared you for coping with them in the field.

In the field

The first task in the field is to observe. Although a week spent walking around the field area, observing the features relating to your project, may seem like a luxury given the time available, it is almost certainly time very well spent. It is at this stage that you have the opportunity to evaluate your project objectively and to confirm that it is fully appropriate for the field setting. In most cases, if the initial formulation of the project aims and the subsequent preparations before departure were undertaken carefully and conscientiously, it is unlikely that you will need to rethink the project. However, no matter how thorough your preparation beforehand, there is always a chance that conditions may have changed since the last report or map was produced, or that unforeseen difficulties – such as roads destroyed by landslides – are present. If you feel that the aims are not achievable, for whatever reason, it takes great

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courage to set about changing or modifying them at the last minute, but it is better to try to do this than to plough on regardless with a project that you, deep down, feel will not work.

Far more common is the need to adjust your planned sampling framework once you have examined the field setting in detail. It may not be possible, for example, to gain access at the point where you hoped to collect your samples, or the variability may prove to be much greater than expected, in which case you may decide to sample fewer areas or variables but each in more detail. If you have time and resources for a formal pilot study, this will help greatly in the formulation of an effective strategy. If not, the few days of careful observation, combined with some preliminary measurements if appropriate, is the next best approach, e.g. if you are comparing surface run-off under forest and agricultural land uses, a set of measurements of slope angles, percentage vegetation cover, aspect and simple evaluation of soil types will help you in choosing the locations. You will probably want, in this case, to control for slope angles, so your choice of areas with "typical" slope angles and, of course, similar slope angles is important. The observation and preliminary simple evaluation of the characteristics in your field area relevant to your project will therefore provide you with the context needed to finalise your sampling framework.

At last you reach the stage of collecting the data, which after all the preparation is something of a relief! Data collection should be straightforward. If you are using sophisticated field equipment, a few trial runs are usually worthwhile to build up confidence, and field calibration may be needed. Checks on the reproducibility of results may also be useful for some projects. On a simpler note, take care to collect enough samples for the subsequent analyses, to label sample bags indelibly with name, date, site and sample identifier, and to take detailed field notes on any topic/measurement/sample that may be of relevance. There is much to be said for recording as much detail as possible – in retrospect, aspects that seemed relatively unimportant at the time may prove to be vital later. For some analyses, undisturbed samples and samples with a known orientation may be required. All samples need to be treated carefully to avoid contamination. Unlike projects based in your home country, you often have only one chance with scientific expeditions abroad and the set of observations that you omitted to note down may just prove to be the vital ones.

It is useful to evaluate your progress with data collection as you go along, especially if there is limited time in the field. If it is taking much longer than anticipated, you may need to reassess your "data goals" and even to reassess and shrink the project aims. It is much better for many projects to collect a sufficient number of samples/field measurements to answer one question well, than to collect a few samples from many different locations in order to try to answer several research questions and to find instead that you have insufficient information to solve any of the questions, e.g. five samples from each of ten large moraines will allow very little in the way of comparison of the soils developed on the moraines, and there will be

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insufficient data for a sensible statistical analysis of the results. On the other hand, 25 samples from each of two moraines would allow a reasonable comparison to be made between them, provided that the sampling design was carefully chosen.

If you are collecting specimens or sediment/water samples, you need to consider their requirements for sample storage and, if necessary, safe transport to the UK. All samples have some special requirements. For water samples collected for chemical analysis, filtration is important to remove possible polluting substances during storage, and the prevention of bacterial growth (or quick analysis before bacterial growth) is essential for samples that are not from pure water sources. Furthermore, gaseous losses may affect the water chemistry. Soil samples can also suffer from problems of bacterial and fungal growth, and they are best air-dried on site if possible (it cuts down weight too!). Biological specimens may need preservation and will certainly need careful packing.

Lastly, just as each sample is unique, so are written data-sets. Field notes, whether habitat descriptions, survey measurements or questionnaire results, are essential for the expedition to produce results, and should be protected from the rigours of the field and transit. Indelible pens, notebooks with tough paper and bindings, and waterproof notebooks can all be used in the field. If possible, make photocopies before leaving the field area, and send one copy back by post or with another person. Likewise, ensure that duplicate copies are kept on return. Electronically stored data are more sensitive, and the same principles apply to them.

FURTHER INFORMATION

RGS–IBG World Register of Field Centres

If you are looking for a location to do field research, check out the growing number of sites on the World Register of Field Centres. Searchable from the website, it provides information on established field centres, in environments from the high Arctic to the Sahara desert. The centres range from small independent field camps to large, long-term international facilities. The only criterion for inclusion is that centres welcome international visitors, be they scientists, students or teachers (www.rgs.org/fieldcentres).