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Part I

Getting Curious About Nature

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1 · *Fieldwork and Nature: Observing, Experimenting and Thinking*

TIM BURT AND DES THOMPSON

> A love for this subject began to revive; fresh ideas were awakened in men's minds, and a new spirit of exploration and enquiry was abroad.

At the beginning of the first chapter of the first of the Collins New Naturalist Library books, *Butterflies* (1945), E. B. Ford reflects on the history of British butterfly collecting. Ford is referring to the spread of the Renaissance, and thereby our access to the science of the Greeks, including their work on natural history.

1.1 Introduction

Fieldwork has the ingredients of intellectual curiosity, passion, rigour and engagement with the outdoor world – to name just a few. We may be simply noting what we see around us, making detailed records, employing sophisticated techniques, carrying out an experiment or, quite possibly, collaborating with a large international group of scientists. All of this and much more amounts to fieldwork.

We adopt a wide definition of what we consider to be fieldwork. We are concerned mainly with the environmental spheres of study, but we do stray into the social and human sciences where subjects like human geography and archaeology also rely on 'fieldwork', broadly defined as the collection of data beyond the laboratory, library or workplace, i.e. in the *field*. We include 'marine' fieldwork; intertidal, near-shore and further out into the deep ocean; we retain the title 'fieldwork' for these studies although there might be a case (Michael Usher, personal communication) for inventing 'seawork' to cover these studies! Some of the basic components of fieldwork are shown in Figure 1.1.

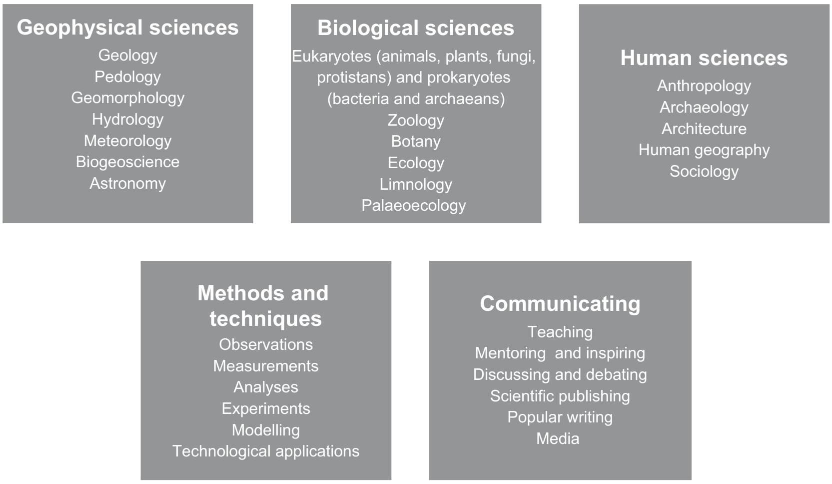

Figure 1.1 The basic components of fieldwork

One of the most important books setting out the rationale for environmental fieldwork, and its wider importance, is an obscure, 84-page book, *The Global Challenge for Field Science* (1990), published by Earthwatch and based on a seminar hosted by Earthwatch Europe and the Royal Society on 17 February 1989. What is so remarkable is the calibre of contributors and the clear sense of emerging importance attached to carrying out fieldwork. The President of the Royal Society, Sir George Porter, opened proceedings remarking: 'Field sciences and the earth sciences in general are undergoing explosive development at present . . . this is important because, more than ever before, we need to understand our environment better, so that we can take some action about it. It is an interdisciplinary subject and it has another advantage I think, in that so many people can participate – even people who are not professional scientists in any way.'

In his preface to the book, Max Nicholson was typically prescient, commenting: 'International concern over ozone depletion, global climate change, environmental degradation, and the sustainable use of natural resources foreshadowed a vastly expanded demand for programmed field research. Such international initiatives as the International Geosphere–Biosphere Programme, impending major changes in the European Community linked to the year 1992, and the pressing environmental concerns of eastern Europe, pointed to the advisability of starting without further delay to create a working programme of field science dedicated to global environmental monitoring and the sustainable use of biological and cultural resources.' If that were not enough, leading ecologist Sir Richard Southwood wrote a short essay on the role and contribution of field science, remarking: 'The point is that in physical, as well as biological sciences, fieldwork is important in the formats of hypothesis that help us to understand the natural world. There is very little in modern biology that cannot be traced back to some field observations.' In detailing the importance of experimental work, long-term field studies and field stations, he urged further that: '. . . students must see how biology functions in the field'.

There are hundreds of thousands of books and scientific papers employing fieldwork, and in each of these it is likely that at least one of the contributors will have had his or her curiosity aroused over the workings of nature. That is what places fieldwork apart from other methods or settings for research, and it is, we believe, what is at the heart of the enduring appeal of fieldwork.

In this introduction, we explore aspects of the curious mind of the fieldworker, provide some background information on the basic equipment used, reflect on some field studies which, for us, reflect the diversity of outstanding studies and the outstanding fieldworkers who carried out those studies. Finally, we offer some perspectives on what it is to be curious about the world around us.

1.2 Curiosity

> Curiosity is the very basis of education and if you tell me that curiosity killed the cat, I say only the cat died nobly.
>
> Arnold Edinborough (Canadian writer and broadcaster)

> Curiosity (noun): an eager wish to know or learn about something.
>
> Cambridge English Dictionary

In the Introduction to his book *Curiosity*, Alberto Manguel starts by reminding us that one of the first words we learn as a child is 'Why?' (Manguel, 2015, p. 1). Initially, we want to understand what the boundaries to our behaviour are, but soon we develop an interest in how we fit into the world around us and what the nature of this mysterious world is

Figure 1.2 Why have we brought you here? Andrew Goudie and Tim Burt always used to start their Dorset coast field trip with this simple question. On this photo, Andrew is talking to students at Durdle Dor (Tim Burt). A black and white version of this figure will appear in some formats. For the colour version, please refer to the plate section.

all about. Manguel adds that we feel an ancestral need to engage with other inhabitants of this world, giving us the ability not only to understand the here and now but to speculate about the there and then, of understanding the uncharted territory ahead, as Manguel puts it. Having started to ask questions, we never stop. We soon find out that curiosity is seldom rewarded with satisfying answers but rather the starting point for asking more questions.

According to Richard Dawkins (quoted in Manguel, 2015, p. 3), human imagination is a survival mechanism. In order to stay alive, *Homo sapiens* developed the ability to reconstruct reality in the mind and to conceive situations that it might confront before actually doing so. We imagine in order to exist and we are curious in order to feed our imaginative desire (Manguel, 2015, p. 3). What we need to know and what we can imagine are therefore two sides of the same coin; in relation to the natural world, this has immediate resonance with a combination of awe and wonder, perhaps the sight of a ferocious animal in close proximity or a forbidding landscape as we travel towards it. Questions are more important than answers; answers are rarely satisfactory, more questions inevitably follow. This is curiosity's inherent paradox (Manguel, 2015, p. 42).

Curious humans want to know and understand the world around them. However this knowledge is acquired, the process is likely to be hesitant and faltering. This is not the place for a detailed elaboration of scientific method, but a brief digression into this subject area allows us to see how curiosity, conjecture, observation and explanation go together. Being curious, we speculate about the world around us, and it is observation that allows us to test our ideas. When we ask 'Why?', we look to see if what we see accords with what we think. Very often, our ideas prove imperfect, leading to more questions. Manguel describes this as 'enlightened failure', quoting Samuel Beckett's aphorism: 'Fail. Try again. Fail better' (Manguel, 2015, p. 3). There are two conflicting models of scientific endeavour: induction and deduction; in both schemes the role of observation is critical.

In the inductive method, empirical generalisations are derived from observation of reality: recording of facts leads to hypothesis formulation; confident understanding grows via the accumulation of further observations. While induction is largely out of favour these days, new hypotheses have to come from somewhere, and the refinement of existing theory often relies on an essentially inductive process whereby fresh observations raise questions about existing ideas, leading on to an improved explanation: 'enlightened failure', once again. In the deductive scientific method, theory precedes observation, data are collected which can then be used to corroborate theory. The data collection is mainly achieved through formal experimentation but less-formal observational programmes often characterise the early stages of any scientific investigation. Through a circular process of conjecture and falsification, hypotheses are gradually improved and false ideas eliminated: what Karl Popper would have regarded as a process of trial and error elimination. No theory is ever proved 'true': as Popper wrote, the degree of corroboration is a guide to the preference between two theories at a certain stage of discussion with respect to their apparent approximation to the truth. But it tells us only that one of the theories offered seems – in the light of discussion – the one nearer the truth (Popper, 1972, quoted in Haines-Young and Petch, 1986).

A brief discussion of scientific method is relevant here because of the centrality of observation in fieldwork. In Part II, a wide range of fieldwork is described, but in every case, whether casual surveillance or

Figure 1.3 How come there are periglacial deposits on top of this hill? Oxford students carefully examine stony subsoil material at Stonebarrow on the Dorset coast near Charmouth (Tim Burt).

formal experiment, there is an attempt to better understand the world around us through the medium of observation. Setting aside the myriad issues associated with philosophical perspectives on scientific observation, we are content here to take a simple view: (field) observations are crucial if we are better to understand the world around us. Our perspective is largely about the natural world, but the approach is no different where the human-dominated landscape is concerned (see, for example, the essays by Carrick and Corbridge in Part II).

A brief look at perhaps the greatest fieldworker of them all, Charles Darwin, illustrates the difficulty in separating the inductive and deductive routes to scientific explanation. Darwin was naturally curious and asked the question 'Why?', wherever he travelled. Much of his initial work was necessarily inductive and he began to develop ideas from what he had observed in the field, such as: silicified trees and marine shells in rock high up in the Andean mountains; the distribution of animals on the different Galapagos Islands; coral reefs and atolls. Ayala (2009) argues that the inductive process fails to account for the actual methodology of science since no scientist works without any preconceived plan as to what kinds of phenomena to observe. But Darwin had no preconceived plan beyond being curious. No doubt some questions were of more interest to him than others but his scope was enormously wide-ranging. Partly, he claimed to work inductively to avoid being accused of subjective bias in the evaluation of empirical evidence (Ayala, 2009). However, it is clear that his major achievements were all deductive, theory-led, to which he marshalled his observations to test and refine his ideas. For example, in the case of coral reefs:

> The theory which I would offer, is simply, that as the land with the attached reefs subsides very gradually from the action of subterranean causes, the coral-building polypi soon raise again their solid masses to the level of the water: but not so with the land; each inch lost is irreclaimably gone; as the whole gradually sinks, the water gains foot by foot on the shore, till the last and highest peak is finally submerged. [Darwin (1839), ch. XXll, p. 557]

Darwin goes on to set out his ideas on the formation of the Cocos (Keeling) Islands. These consist of two atolls made up of 27 coral islands, and they were discovered in 1609 by Captain William Keeling of the East India Company.

> Hence we must consider this island [Keeling Island] as the summit of a lofty mountain; to how great a depth or thickness the work of the Coral animal extends is quite uncertain. If the opinion that the rock-making Polypi continue to build upwards, as the foundation of the island from volcanic agency, after intervals gradually subsides, is granted to be true; then probably the coral limestone must be of great thickness . . . Hence if we imagine such an island to subside a few feet, in a manner similar, but with a movement opposite to the continent of S. America; the coral would be continued upwards, rising from the foundation of the encircling reef. In time the central land would sink beneath the level of the sea and disappear, but the coral would have completed its circular wall. [Charles Darwin's Beagle Diary. Edited by R. D. Keynes, 2001, p. 418. Entry for 12 April 1835]

Darwin distinguished between what he described as the three great classes: atolls, barrier and fringing reefs. His theory enabled him to speculate about coral reefs, as yet unseen, and to explain why there were not reefs on the South American coast or atolls in the West Indies. He was unable to provide direct evidence of ocean-floor subsidence but it is clear that his observations of uplift in the Andes were influential in convincing him that Earth's crust was anything but stable. The very long timescales involved, and the very gradual rate of formation, he drew directly from Charles Lyell's doctrine of uniformitarianism.

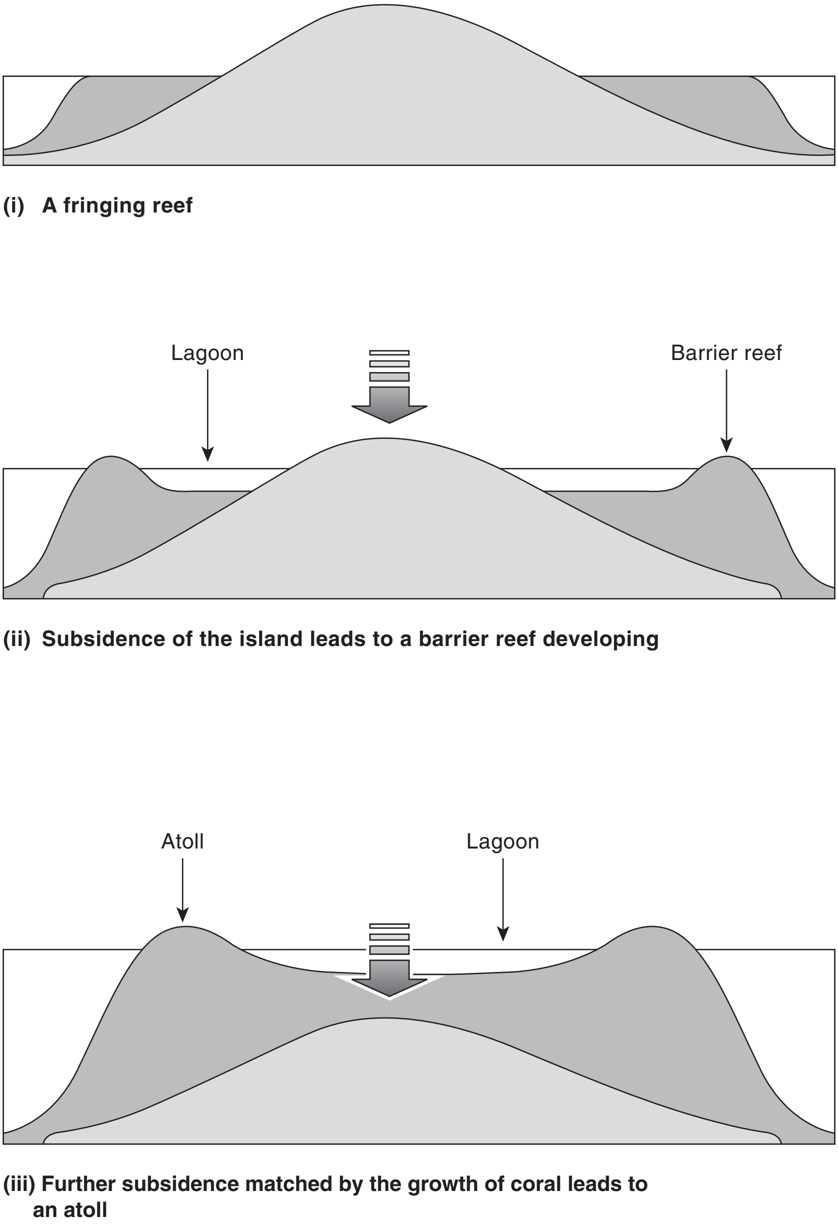

Figure 1.4 Charles Darwin's theory of the transition from barrier reef to atoll (redrawn from Darwin, 1839)