Modes of Lay Environmental Monitoring: Towards a Sociology of Environmental Monitoring

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Abstract

Through the analysis of three cases in the field of environmental monitoring which come from different countries and organisational contexts, this thesis considers the chief theoretical, conceptual and methodological lines that lead towards a general framework for the sociology of environmental monitoring and, to a certain extent, the sociology of monitoring more broadly.

More precisely, the thesis explores the processes through which lay environmental monitoring occurs. In this sense, the study documents the ways that citizen groups or individuals can engage with environmental monitoring. It explores potential clashes between citizens' own understanding of the purposes of monitoring and the objectives endorsed by official agencies. It also shows how new technologies have been introduced into citizens' monitoring activities and reveals some of the unintended consequences of public engagement with such novel techniques.

Drawing on theoretical work pertaining to the sociology of the environment, social studies of science and general social theory, the thesis argues that monitoring has been overlooked by sociological thought and empirical research and attempts to place the topic of monitoring in the sociological debate with two main aims in mind:

a) to show that environmental monitoring is in fact central to many forms of environmental activity and intervention which are routinely discussed by sociological (and related) authors, even though they do not really attend to the topic of monitoring;

b) to indicate how the broader sociological literature (including studies in the sociology of science and in the sociology of surveillance) can aid an understanding and appreciation of the practice and role of monitoring.

The thesis proposes the notion of modes of lay environmental monitoring, using each of the three case studies as the grounds for the three modes considered. It concludes that environmental monitoring is a field opened up for lay participation and involvement through multiple processes giving shape to distinct modes of lay monitoring which, in turn, have implications for the understanding of monitoring itself.

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Having thanked so many people, I must point out that none of them is responsible for any of the shortcomings that this thesis still exhibits. Sad to say, these are all down to me.

Chapter One
Introduction

This thesis is about environmental monitoring.

From a sociological perspective, environmental monitoring is, perhaps, one of those subjects that raises a few eyebrows, wondering about the relevance of such a topic for the general advancement of sociological knowledge.

Yet, it does not require a great deal of research skills to realise that monitoring – environmental monitoring – is one of the topical issues in contemporary societies. Climate change is, obviously, the immediate example that comes to mind when thinking of the social significance of the subject. The scope is broader, however, and I will attempt at demonstrating in this thesis that there are many reasons that can be put forward in order to justify the choice of the theme and its sociological relevance as well.

Furthermore, monitoring itself does not seem to be part of the research interests of sociologists in general. Even if it were admissible to consider environmental monitoring the exclusive subject of the sociology of the environment (a view I would not myself endorse), one still has to view monitoring as a subject of general sociology. Yet that is not the case. Not even in those subject areas where, in principle, monitoring would be a likely topic due to the conceptual proximity or empirical relation. I'm thinking of, for instance, surveillance and governmentality studies. After the fundamental work of Foucault (1979, 1991, 2002), many authors proceeded along this line of inquiry but none, to my knowledge, diverted from the main route into the secondary road of monitoring. Recently, surveillance has seen a resurgence of interest (for instance, Lyon 2001, 2006) much due to the fears raised by notions such as 'surveillance society', 'CCTV society' or the 'vigilant State'. But even under such favourable conditions, monitoring received no more than the place usually reserved for minor players. To a lesser extent, I want to draw attention to the topicality of monitoring to sociology broadly considered.

I intend to do so by focusing my research on the analysis of processes of lay environmental monitoring. This is a key distinction and one that follows the tradition of the social studies of science. I am referring to the distinction lay/expert or lay/technical knowledge (Irwin, 1995, 2001; Irwin and Wynne, 1996; Jasanoff, 1990; Yearley, 2000, among others). I will not, in fact, be studying official or formal systems of monitoring. Rather, I will concentrate on the processes by which lay monitoring occurs in different settings and in different contexts. More

precisely, my point of interest will be that of analysing processes of lay monitoring in practice, that is, instead of looking into the set of wider social factors that condition the appearance and formation of those processes, I will investigate existing examples – cases – of lay monitoring. I am interested in the range of social practices and perceptions through which lay environmental monitoring takes shape and occurs. Moreover, I will be looking into the ways lay monitoring develops and whether it impacts the notions and understandings lay actors hold about the environment, nature and monitoring itself. Ultimately, I will aim at proposing what I have labelled 'modes of lay environmental monitoring'. These will be particularly important – and discussed – in Chapter Six, but I can briefly say that the modes of lay environmental monitoring are a set of dispositions made up of the interaction of various factors that contribute to the organisation and practice of monitoring.

1.1 - Key starting propositions and research questions

In terms of research my departure point was a set of propositions that I thought would make good guidelines throughout the investigation. I was not aiming at demonstrating these propositions, I was establishing some reference points for my own orientation. I will display those briefly.

- Monitoring is the neglected and overlooked accompaniment to recent interest in the sociology of the environment and risk. To be actively interested in the risk from something one has to monitor that thing. And yet, sociologists have typically taken the monitoring activity for granted and been interested only in the 'risk consciousness'.
- However, monitoring is not a straightforward activity. Doing monitoring 'properly' requires skills and commitment, and there may be all kinds of disputes about the 'right' way to monitor the environment. There are often complicated protocols to follow. Accordingly, there is a sociology of monitoring.
- There is also a complex relationship between monitoring and environmental performance. It is a well known phenomenon that if some activity is used as an index of something else and if that activity is monitored, then actors will tend to concentrate on improving the performance in the index irrespective of its impact on the broader goal. Those familiar with UK universities need only think of the impact of the Research Assessment Exercise on the amount of publishing undertaken. Similarly, environmental monitoring may lead to an improvement in just

the phenomena monitored, though this need not imply that environmental performance as a whole will increase. Air quality in urban areas in the UK is assessed by measuring a small number of pollutants. Just because these decrease that does not guarantee that 'urban air quality' as a whole improves.

- Citizens may be good at monitoring because they are widely spread through an area and, in principle, motivated to monitor; this raises the possibility that lay monitoring may be assisted by 'democratising technologies' that allow them to monitor systematically (hand-held devices and so on), coordinate their monitoring (through the web or through wireless devices) and systematise and record their observations.
- There is an additional area of study to do with the ability of people in the physiological and biological sense to operate as monitors. This was one of the motivating questions behind one of my case studies.
- There is a sixth connection between this sense of monitoring and the topic of surveillance, which sociologists have approached with greater enthusiasm. However, in this sense monitoring/surveillance is often more to do with agencies that monitor the public than with the public's monitoring of private firms and the state.

Apart from these, I had my own interest in this theme. I was attracted to this topic even before I registered for my PhD research in York because I had learned of an innovative venture in Portugal known as 'Senses@Watch'; this project (the focus of Chapter Five) amounted to an experiment aimed at improving environmental monitoring in Portugal by building on the observational abilities of lay people. The idea was to find out, for the human senses of hearing, sight, taste and smell, whether systems of environmental monitoring could be developed that depended on input from ordinary members of the public. People would not need complex instruments; instead they could even contribute to environmental regulation through their senses alone. I recognised that this attempt to use lay monitoring for environmental management purposes depended on a number of assumptions about monitoring – for example, that good monitoring was important to successful environmental governance, that contemporary information and communication technologies could help to develop new kinds of monitoring networks, and that people's everyday sensing or sensorial skills could be refined into tools for systematic environmental monitoring. This recognition led me to develop a more general interest in the topic of monitoring.

Clearly, for a sociologist the idea of monitoring calls to mind not only the observation of environmental conditions but other celebrated themes – themes of surveillance (already pointed out) and the panoptic gaze, the notions of reflexive self-monitoring and the disciplining of the self, and Latourian ideas about the roles of humans and non-humans in observational practices. At the same time, I was aware that there was a strong connection to work done on observations, data and evidence in the sociology and philosophy of science. I began to realise that there could be a promising line of research focusing on the sociology of environmental monitoring – a line of enquiry extending beyond the simple study of the Senses@Watch case.

From the combination of the initial propositions, which are mainly theoretical, and the already described research interests and focus of the investigation, I was able to outline those that would be, at a later stage, my research questions. In an abridged way these can be systematised as follows:

1. What are the key sociological dimensions of environmental monitoring activities?
2. Can one assume that environmental monitoring can be socially organised in distinctively different ways and, if so, does the form of social organisation adopted impact on how that task is performed?
3. If environmental monitoring can be organised in different and contrasting ways, can one identify characteristic modes or 'ideal types' of the social organisation of environmental monitoring?

1.2 - The structure of the thesis

My research thus developed in an iterative way. I explored more about the Portuguese case and then began developing my ideas about what could be called the sociology of monitoring, before returning to identify other cases which might usefully be compared with Senses@Watch. This iterative manner of working is not however reflected in the way I have chosen to present this thesis. Iteration and repetition are often confusing or annoying for the reader and I have opted for a more linear presentation.

After this short Introduction – Chapter One – outlining the focus of the thesis and its general foundations, there follows, in Chapter Two, an overview of sociological work on monitoring and of topics in environmental studies that relate to this theme. In this chapter I will be considering some of the propositions that have, as I said above, instigated this study. For this purpose, I will look into the theoretical contributions of the sociology of the environment but, as well, of

authors from the social studies of science and general social theory, whose topics of analyses may support my own (I'm referring, mostly, to studies in the area of surveillance, risk, governance, expertise and lay relations, public participation and so on).

The subsequent Chapter Three offers an introduction to the case study sites as well as the justification of this methodological option, displays the research questions in a slightly more refined and complete way and includes details of the methodological considerations in this analysis.

There then follow the two principal empirical analyses. Chapter Four deals with a case study of a form of bottom-up, citizen-oriented environmental monitoring. This case – known as PURE – is located in the north-east of England and deals, so to speak, with some performative aspects of monitoring in environmental management; it deals with the way that a community-based environmental management scheme developed its own practices and culture of monitoring. It is a detailed analysis of one of the processes of putting lay monitoring into practice.

This case contrasts with the Portuguese Senses@Watch study which is discussed in detail in Chapter Five (and was briefly introduced above).

Chapter Six draws on the published literature to introduce one further, contrasting case (this time from the USA, the Environmental Protection Agency's Volunteer Water Monitoring Programme), and then develops an analytical framework for considering these three ventures in environmental monitoring and governance.

In Chapter Seven, the Conclusion, I put forward some more general conclusions and develop the implications of my work for social scientific work on monitoring and monitoring programmes, for the practices of environmental monitoring, and for environmental sociology in the broadest sense.

Chapter Two

Locating environmental monitoring: an overview of sociological and environmental studies analyses of monitoring

Monitoring as a topic for environmental sociology

As I suggested in the introductory chapter, one can readily imagine the links between environmental monitoring and many recurring interests of sociology. This makes it all the more surprising that, despite the continuing strong growth in recent years of sociological publishing on environmental subjects, monitoring has hardly appeared as an explicit topic. One symptom of this growth in environmental sociology has been the recent publication of at least three large handbooks on the topic (Redclift and Woodgate, 1997; Dunlap and Michelson, 2002 and Pretty et al, 2008). But these texts ironically give support to my claim since it is only in the last of these that there is a chapter dealing with environmental monitoring (Pfeffer and Wagenet, 2008). Furthermore, that chapter itself cites no sociological work specifically on environmental monitoring but mainly draws on more general works in sociology and on environmental professionals' publications on monitoring topics (including one reference to the Portuguese Senses@Watch work with which my own research started (Gouveia et al, 2004) and which is the focus of Chapter Five).

To compensate for this neglect, this chapter sets out with two chief aims:

a) to show that environmental monitoring is in fact central to many forms of environmental activity and intervention which are routinely discussed by sociological (and related) authors, even though they do not really attend to the topic of monitoring;

b) to indicate how the broader sociological literature (including studies in the sociology of science and in the sociology of surveillance) can aid an understanding and appreciation of the practice and role of monitoring.

I shall start by establishing the centrality of monitoring to many themes prioritised in environmental sociology.

2.1 - The unacknowledged centrality of monitoring: monitoring is pervasive and fundamental

As an illustration of my contention about the centrality of monitoring, I shall first consider the topic of risk. Thanks to Beck and Giddens and a host of other authors (Douglas and Wildavsky, 1982; Jasanoff, 1986; Beck, 1992; Douglas,

1992; Giddens, 2002), all sociologists are now familiar with the notion of environmental risk, risk management and risk reduction. But, though it is easy to focus on the primacy of risks, I want to suggest that the establishing and management of risks is inevitably tied to practices of monitoring. Without environmental monitoring there can be no risk calculations (even though these may be highly contingent and provisional). The irony is that all sociological attention has focused on the risks and none on the monitoring. I shall then go on to propose that this applies to a very wide range of environmental phenomena.

We all know about risks. Indeed, under the spell of Beck sociologists are often inclined to treat environmental problems as though they were about nothing but risks (see Yearley, 2006). But one cannot have knowledge of risks without monitoring. This is both a contingent and a logical point. It is a logical matter because it is inherent in the meaning of a risk that the condition of the risky thing is, or must have been, in some sense observed or checked. Without monitoring or checking having taken place, it is hard to see how estimates of risks can be arrived at. For example, the highly contentious question of whether it is risky to store high-level nuclear waste in underground repositories depends at least on the condition of the waste being checked, to ensure that there are no earth movements to threaten the storage chamber, nor corrosion and deterioration of the storage vessels, notwithstanding the wider societal question of whether such risks should be accepted in the first place. The risk calculations depend on assumptions about the performance of materials and systems, and those assumptions can only be checked through monitoring. In his well known contribution to this area, Wynne (1992) distinguishes between risks – where one knows the likelihoods of various outcomes arising – and various other forms of not-knowing including what he terms ignorance and indeterminacy. Ignorance refers to cases where one does not know what one does not know, for example an unexpected and unpredictable weakness in the safety systems; this form of not-knowing was later made famous by US Secretary of Defense Donald Rumsfeld who spoke of ‘unknown unknowns’. Not knowing can only be addressed (though, of course, not entirely overcome) through monitoring.

Wynne also describes indeterminacy which arises from the ways that technical systems with their associated uncertainties are deployed within ‘live’ social contexts. As Wynne and his co-author Irwin remind us, science “offers a framework which is unavoidably social as well as technical since in public domains scientific knowledge embodies implicit models or assumptions about the social world” (Irwin and Wynne 1996: 2-3, original emphasis). With regard to

indeterminacy therefore the connection between risks and monitoring is also empirical. There are always questions about the additional contingent, social facts of the case – about how well, industriously, attentively and so on the monitoring is being done – that affect the actual risks and indeed their changing definition over time. These factors will not have been taken into account in the original risk calculation – indeed, they cannot all be – but they contribute to risk outcomes. Again, an understanding of monitoring and the way it is practised is indispensable to an accurate appreciation of risks.

But my argument is not simply about risks; risks are just an example. I want to suggest that many of the environmental issues which cannot easily be conceptualised in terms of risks also have an intimate connection to monitoring. For example, threats to biodiversity, trends in species numbers and bird migration patterns are all environmental problem claims which need to be bolstered and in many ways constructed (see Hannigan, 1995: 32-57). These are typically not questions of risk, except in the loose sense that anything that is endangered could be said to be 'at risk'. But these claims all also depend on monitoring for their maintenance. Birds need to be ringed and tracked, counted and re-counted as they move around from, for example, summer nesting sites to winter feeding grounds. The relative numbers of different species in habitat types have to be recorded using grids or other devices for monitoring their numbers (as described in Latour's celebrated analysis of the forest boundary, 1999: 24-79). In each case, monitoring is indispensable to the recognition or making of the phenomenon.

Even if we take the largest-scale and possibly most dramatic example of current environmental problems, we can see that claims about, and responses to, global warming also depend on monitoring. The 'reality' of global warming – the evidence for its occurrence and the speed at which it is happening – of course rests in part on theoretical understandings in Earth science and on simulations and modelling, but there are pivotal elements of monitoring. At least the following are all monitored as part of the conceptualisation of global climate change:

- glacial and terrestrial polar ice (how thick and how extensive are the ice sheets?);
- marine and atmospheric temperatures;
- deep ocean currents and changes in surface currents;
- climatological events such as 'el Niño';
- the extent of rain forests;
- changes in the sun's energy output and sunspots.

In fact, one could easily make the argument that the initial credibility of ideas about humanly induced climate change came from the atmospheric carbon dioxide records assembled from a monitoring station on a lava flow near the Mauna Loa volcano in Hawaii. This data run, starting from 1958 and showing a continually rising trend for the concentration of atmospheric carbon dioxide, is familiar from all the textbooks and has been pivotal to scientific and policy debates since the 1980s (for examples, see Ross, 1991: 88 and Houghton, 1997: 25; see also Keeling et al, 1976; Boehmer-Christiansen, 2003). This is monitoring in a very straightforward sense since the atmospheric measuring station was not set up to test theories of climate change but to provide general background information about atmospheric composition.

More recently, one celebrated monitoring opportunity has taken a more light-hearted form. In early 1992 around 30,000 plastic ducks, manufactured in China, fell off a container vessel into the Pacific while en route to the USA. Since then the ducks have provided an unprecedented way of tracing currents, with many of the bath toys making it via the Arctic into the Atlantic by the year 2000. People are now being offered a reward for reporting back to scientists in the USA on the ducks' landfall. According to *The Times* in June 2007:

> "Simon Boxall, of the National Oceanography Centre in Southampton, said that the ducks offered a great opportunity for climate change research. 'They are a nice tracer for what the currents are doing as they travel around the world, and currents are what determines our climate, and cycles of carbon'". (http://www.timesonline.co.uk/tol/news/uk/article1996553.ece)

This super-large flock of ducks accidentally facilitated a form of monitoring that scientists had not undertaken before.

To summarise this section then, it is apparent that many and diverse forms of environmental problem claims – including but not restricted to claims about risks – depend on monitoring and observation for their credibility and to affirm and re-affirm their reality. But this dependence has not been highlighted by analysts in environmental sociology.

2.2 - Sociological approaches to monitoring

Up to this point I have argued that monitoring is conceptually and empirically key to environmental practice and policy. And that it has been overlooked. But it might be that monitoring has been overlooked precisely because it is so straightforward as to be seen to be trivial. Monitoring could be

pervasive and integral to the construction of environmental problems and to the specification of risks without there being anything sociologically interesting about it. Were that the case, then neglect would be perfectly reasonable.

But there are strong reasons to think that this triviality idea is not correct. Although monitoring (including environmental monitoring) is a more specific activity than observation in general (as will be considered below), it is clearly in part a form of observation. As such, it is subject to all the complexities associated with observation that are celebrated in the science studies literature and in the philosophy of science. Within post-Kuhnian science studies the problems that arose for simplistic empiricist accounts of observation are well known. Though observation seems as though it should grant the observer straightforward access to knowledge of the world, the last three centuries' work in psychology and philosophy have indicated otherwise. For example, well known perceptual experiments in psychology demonstrate that people are not always good judges of relative size or colour; as will be seen in the Senses@Watch team's experiments described in Chapter Five, similar problems apply to the other senses too.

Furthermore, after Hume's "An Enquiry Concerning Human Understanding" (1999) philosophers have pointed out the logical difficulties in trying to base knowledge exclusively on observation (see for instance Collins, 1992). There is no logical warrant for inductive inferences for example. Worse still, observations are 'theory laden': what one sees depends on pre-existing beliefs and theoretical commitments. One cannot see entirely without prejudice. This point was famously borne out in relation to the kinds of research on global environmental issues mentioned above. In initial estimations of the Antarctic ozone hole, US satellite measurements showing an almost complete absence of ozone were disregarded as being implausible. The satellites could not be recalled for checking and it was assumed that something must have been going wrong with the measuring device on the satellite since the scientists discounted the possibility that ozone depletion could have gone so far as to reduce ozone levels to nearly zero (Christie, 2000). It was only subsequent measurements using a different, terrestrial technique that suggested that the satellite data might have been correct after all and the theoretical assumptions faulty. This was, one might say, a case of theory-saturated observation.

It is thus important to appreciate that observing and monitoring are more than just "seeing" how the world is. In other words, monitoring observations are always interpretable and corrigible. One expects controversies over

environmental values (how much protection should be given to tuna versus how much protection for fishing industries, for example), but this literature from the sociology of science leads one to expect also disagreements over environmental observations. The interpretability and corrigibility of observations allow room for controversy. Though one might expect direct monitoring to resolve issues, for the reasons given above it commonly does not. Instead, environmental disputes can turn into disputes over the observations used in monitoring. This is widely seen even in the case of global warming where – initially at least – observations about higher average temperatures were criticised on the grounds that temperature monitoring stations might be affected by the 'urban heat-island effect'. This is an effect whereby monitoring stations in urban areas record higher temperatures as the years progress, not because the world is getting warmer but because stations that were formerly in rural areas become suburbanised and get swallowed up into the comparative warmth of urban areas. Just 'seeing' temperatures rise was not enough for critics who suggested that it was the monitoring stations – not the atmosphere – that was warming up (Yearley, 2005).

Furthermore, because monitoring consists of observations, these observations may appear democratic in the sense that "anyone" could do it. But people's everyday observations – even of things that one might expect people to perceive quite plainly – are widely known to be corrigible: for example, as one of the Portuguese academics key to Senses@Watch asks in Chapter Five, what colour are rivers and lakes? We tend to think of them as blue, and children and naïve artists paint them that way. But famously – according to this academic – the River Sado is the only blue river in Portugal. Its blueness is even commemorated in folksong. All the others are turbid and grey-brown. The democratic potential of observing is thus, potentially at least, undermined by the fact that people's preconceptions tend adversely to affect their observational abilities. As will be discussed further below, in tune with current policy ideas of boosting public participation and moving participation 'upstream', monitoring looks like a good candidate for participatory treatment. But problems of interpretation and corrigibility are likely to surface quickly – perhaps even more quickly – in such cases given the potential heterogeneity of monitors.

A related theme about everyday actor's engagement in monitoring has been highlighted by Beck. He has famously asserted (1999) that there has been an 'alienation' of the senses. On this view, because characteristically highly-modern risks such as radioactive hazards cannot be felt, the senses are devalued. This is an intriguing assertion, but the study reviewed in Chapter Five

as well as the community practices described in Chapter Four suggest that – on the contrary – the senses are still very much in play in contemporary environmental management. One might even expect disputes over monitoring observations to have declined in significance if the senses had become obsolete; all one would have is the output from black-boxed devices such as Geiger counters. But as will be seen in Chapter Five, even the degree of the senses' obsolescence is disputed. In that study we see that scientists working on the Senses@Watch project are divided: should one re-train citizen monitors to act like machines or count on their holistic abilities to be superior to mere machines? Neither view corresponds exactly with the alienation of the senses, but they represent different ways to try to harness the senses.

Monitoring differs from observation – or is a special subset of observation – because it typically occurs within a regulatory or legal framework. As such it is also surrounded by routines and protocols which typically relate to but which may differ from the laboratory practices described in many STS studies (Latour and Woolgar, 1979; Knorr-Cetina, 1981; Salter, 1988). For instance, one might think it would be simple to monitor water quality. But, as will be seen in both Chapters Four and Five, water has to be sampled in a particular way since contamination of the container or prolonged storage can itself affect water quality. Legal provisions typically state that the significance of water contamination depends on how long the pollution lasts, so the availability of one polluted sample is of limited value. In this way, what one might commonsensically think of as an 'observation' of water quality by an engaged member of the public would not count as a valid observation for regulatory purposes (see the details in Chapter Four and the work of Zeiss which examines the ways in which water quality reflects the play between socio-technical and material aspects of the production and supply of public water supplies (Zeiss, 2004)).

In concluding this section, we can clearly see that there is no justification for sociologists to have overlooked environmental monitoring because of its straightforwardness. On the contrary, as STS studies attest, observation is complex, highly interpretable and corrigible. And the connection between everyday observations using the senses and machine-mediated observations is also complicated. There are good grounds for thinking there should be appropriate sociological acknowledgement of monitoring's role in environmental practices.

2.3 - Monitoring: between observation and surveillance

So far we have seen that one part of what makes monitoring interesting for sociologists arises from its links to observation. But I should not neglect the connection to another topic of current sociological concern: surveillance. As Lyon (2001; 2006) and others have reminded us, monitoring is a key aspect of the surveillance which is today pervasive. The first question I would like to address is whether and how it is possible to distinguish the established field of the sociology of surveillance or governmentality (in which the work of Foucault (1979; 2002) remains as the leading reference) from the 'sociology of monitoring'.

In a recent book Lyon defines surveillance as "any collection and processing of personal data, whether identifiable or not, for the purposes of influencing or managing those whose data have been garnered" (2001: 2). One needs to bear in mind that the context he is referring to is that, in his words, of everyday life. It is, as he says, an activity where individuals are perceived as abstract entities instead of singular beings. Also, he recalls what we have known since the Foucauldian analysis of the panopticon system of Bentham (1979): surveillance involves, in the same process, care and control. As Rousseau rightly pointed when writing about "The Nature of the Social Contract" (1791) the modern world is structured by the principle of exchange: as the state gives security (or, at least, the sense of it – maybe its simulacrum) the citizen's personal freedom is to some extent lost.

This is, in fact, a classical problem of social theory: that is, the issue of the articulation between the state and the social, non-institutional forces of society. As Foucault asserts (1991) surveillance acquires its shape when administrative (or bureaucratic in the Weberian sense) states take the place of feudal societies and the principle of legitimated, universal rule is thought to substitute for the discretionary power of the ruling elites.

In this process a special reference needs to be addressed towards modern science. It was the decisive role of science in the making of technical progress that made also possible the normalization and regulation devices and their integration into the set of disciplinary state institutions[1] (Foucault, 1979). It is a similar process to the one of present-day 'surveillance societies' as technologies (mainly ICTs) are considered to be the source of the main monitoring devices (Lyon, 2001).

[1] Though Rousseau, one of the enlightenment voices of the eighteenth century, gave clear advice about the dangers of modern science as a form of power in the "Discourse on the sciences and the arts" (1968).

As Foucault reminds us, the process of monitoring has an undeniable historical dimension. It has changed its methods, its rationale and its ideology. This idea of transformation through historical episodes is fully compatible with the thought that the panopticon system is still the main reference (and not always only a discursive/ metaphorical one) when discussing these issues. In which episode or moment does one stand now? According to the Foucauldian approach to surveillance the differences are obvious. There is control, there is social regulation, but above all, there is the notion of risk. This is, in my opinion, what makes the key distinction for many Foucauldian authors between surveillance and monitoring. Is not, one can ask, the current demand for monitoring largely a consequence of the contemporary 'obsession' with risk and harms?

Lyon speaks indistinctly of surveillance and monitoring, though it can be argued that in some moments an idea of surveillance as the general process or the rationale, and monitoring as the 'act' or the devices can be perceived in his work. In my opinion, though, there should be more to say about monitoring.

Thus, if current risks are defined as qualitatively different from those of early modern societies (Beck, 1992, 1995; Giddens, 1990, 1998; Lupton, 1999, among many others), in what way do these differences make their presence visible in the monitoring process? A simple exercise may be helpful. Considering the main characteristics generally attributed to risks and those that may be assigned to monitoring in such authors' work, the result is similar to this (these elements are not necessarily fully corresponding nor wholly contrasting, though some can be understood as such):

Table 2.1
Approaching the main characteristics of risks and monitoring

	Risks	**Monitoring**
Main characteristics	globalised	globalised and localised
	pervasive	continuous and/or intensified according to "alerts"
	heterogeneous	routine practices
	abstract	pattern definition using universal knowledge
	irreversible	technologically based
	high seriousness of effects	heterogeneity of monitoring agents: state institutions, private groups, individuals
	less manageable by state	attempt to avert risks
	diverse range of causes	
	anxiety provoking	

Taking into account the characteristics pointed out, monitoring could be defined as a process of gathering information based in routine protocols and procedures which may be conducted on a permanent or irregular basis according to the seriousness of the perceived risk, commonly (though not exclusively) using universal codes, and led by a diverse range of agents with the declared objective of averting or reducing those risks.

In the vast array of subjects that contemporary societies monitor one can highlight at least the following: health, the environment, crime, financial markets (though perhaps not enough it now seems), consumption practices, electoral behaviours, 'everyday life', food standards, quality of life, migratory movements, school and university 'academic success' rates, professional (lack of) success, unemployment levels, potential terrorists, the 'human development', and so on. Indeed, individuals were recently taught to monitor abandoned bags on public transport as these objects may be the ultimate cover for a terrorist attack. Two consequences result from this example: the first demonstrates that the extended range of risks and their mutating nature may have an implication for the status of the objects or issues monitored (a once despicable object such as an abandoned bag can now be seen as an indicator of an enormous risk, relating to its possible detonation). The second puts in the picture other possible actors in the monitoring process: normal, lay individuals acting 'themselves' as monitoring devices.

As is clear from the previous example of bomb scares, though there is a call for public diligence, these efforts are often complemented by scanners and new imaging techniques. In turn these have been met with innovations designed to evade detection, such as 'shoe bombs' and bombs allegedly made up of liquid elements concealed in drinks packages. The technological sophistication is as likely to be on the side of the risks as on the side of detection, at least in this immediate level of monitoring. Naturally, one needs to take into consideration that the context that made this switch-over possible has uncommon elements. It is a context of collective fear, and the proposed solution of turning lay people into a link in the monitoring process may additionally work as a device for reinstating a sense of control over their own lives – apart from being a mechanism of delegation of responsibilities or sharing of the burdens (depending on whether one embraces a pessimistic or optimistic perspective about these issues) as well.

In the course of developing these points, Lyon asserts that the growth of surveillance is equivalent to the rubbing out of the body. Surveillance is, he claims, increasingly mediated via remote systems of cameras or recording. One

may in any event doubt his implied historical trajectory since many contacts in the 18th and 19th centuries were conducted by letter or publication. At least in learned circles, these too were periods of non-bodily interaction. But, there is also the sense in which his claim seems akin to that of Beck about the 'alienation' of the senses. Environmental surveillance may, as shown in the next two chapters, be highly embodied, something that people may be trained to do with their bodies or come to do as part of their everyday practices. It thus appears that Lyon's generalisation is not borne out by these studies.

It is acceptable to conclude, then, that there are several levels of monitoring according to the level of expertise required to assess risk. Is being vigilant, for instance, equivalent to monitoring? That is to say one should ask what the boundaries of monitoring are. The concept I am exploring here is thought to be broad in its nature, that is, in the issues being monitored, in the processes or techniques of monitoring as well as in the agents/actors/'actants' who monitor. This means that the contemporary monitoring processes are as heterogeneous as the fears, concerns and risks that give shape to them.

To conclude this section I would say that the concept of surveillance (of Lyon and others) has a strong connection with the notion of power and social regulation, whereas in the concept of monitoring presented here those notions are diffused and fused with other notions such as (obviously) risk, reflexivity and even subjectivity if we think that the process of categorization of individuals, that is, taking them as abstract entities runs in parallel with its opposite: the search for uniqueness, the singularity of events and identities. Writers on surveillance tend to see monitoring as the state's gaze, though ironically the call in the environmental arena is frequently for more (and more extensive) monitoring. There is also the important topic of monitoring as self-disciplining: the availability of on-line carbon footprints and other daily ways to monitor your 'performance' may be both a help in controlling one's life but also a kind of obligation to exercise that control.

Monitoring promotes self-conscious awareness; but it may generate a form of obligation to use self-disciplining techniques. For that reason it may even come to be resisted, in line with ideas about our reflexive selves. This may give rise to monitoring's unintended consequences. Self-disciplining may not work out as intended; people may follow disciplines erratically. Firms and agencies are driven to follow mandated monitoring but they may follow the letter of the law, not the "spirit" (collecting material for recycling but not actually recycling it; importing biofuels from Indonesian palm oils and ignoring local production of biomass).

Furthermore, as analysts of the role of users in the construction of technologies have recently pointed out (see the essays in Oudshoorn and Pinch, 2003), contemporary technologies and their use depend increasingly upon the active 'work' of users to make them workable. For example, when telecare systems are deployed in home environments, patients themselves have to become active diagnostic agents in cardiac monitoring (see Oudshoorn, 2008). To a degree, responsibility is delegated to the user, often in ways which are hidden and relatively informal.

In other words, monitoring and surveillance cover a range of meanings, from surveillance as a form of disciplining of citizens (either individually or collectively) by the state, through monitoring as an active and very visible process involving enrolment of lay publics, to monitoring as a delegated (but hidden) expectation placed on technology users that requires 'work' on their part, to monitoring as a personal, citizenship-based form of *self*-discipline.

2.4 - Monitoring technologies and public participation in 'late modernity'

A current thought about the way present societies deal with risk is that bigger or more dangerous risks call for an equivalent level of resources, instruments and knowledge to assess and manage those risks. Or, that is to say, to control, regulate and overcome them. Naturally, technologies are said to be one if not the most important resource in this process. They play a decisive role in gathering, regulating and measuring all sorts of information especially having in mind the quest for accountability in Western democracies. The first difficulty emerges, nevertheless, when we bring into consideration the equally decisive role of technologies and science in the process of risk making. Webster states precisely this: "(…) a knowledge-based society rich in new science, information and expertise, simultaneously 'manufactures' new risks in its attempt to resolve the very problems it seeks to address (…)' (2004: 4). The examples are various and diverse whether drawn from health and medicine, environment, food or agriculture.

Still, there have been some innovative attempts to enlist new technologies in innovative monitoring. One graphic example of how monitoring can be assisted by, indeed delegated to, new technologies comes from a report on the BBC World Service (9 Dec 2008, 23.25 GMT). They reported a scheme from Kenya where elephants had been tagged and fitted with SIM cards. Climate change is leading to more conflicts over habitat use between elephants and villagers, and

local people are sometimes surprised and harmed by marauding elephants in the fields around their settlements. Now, when elephants approach villages, their SIM cards are triggered and they automatically send warning texts to appointed monitors in the village and the local people have time to respond and to try to scare elephants away to avoid damage to crops and harms to people and animals alike.

There is also a growing literature on smart devices for environmental monitoring. For instance, it is increasingly proposed that such things as electricity meters should not be hidden away in cupboards but they should be made interactive in order to promote energy efficiency. If meters glowed red when a lot of energy was being used, then they might assist householders and firms in cutting energy-use rather than just count the amount of energy used. In the last two years consumer products have appeared in the UK which are designed to help households in more intuitive or user-friendly ways to monitor their energy usage.

This notion of promoting people's engagement in their household energy use readily leads back to issues of participation. Indeed, the subject of public participation has acquired a rather extraordinary status of late. Not only has it been for some time now a central topic in sociological analysis appearing as a related area of interest when dealing with the subject of the public understanding of science (Irwin, 1995; Irwin and Wynne, 1996; Irwin, 2001; Yearley, 2000, to name but a few) as it, somewhat suddenly, has become an essential issue of public and political debate in the context of accountability, at least, we can say, at the discursive level.

In general, the main concern of public participation researchers emerges out of the question of how to get lay publics more effectively engaged in the processes of decision-making. Not all the processes and not all the issues are amenable to public participation, certainly.

Yet, as Irwin and Wynne (1996) argue, the relationship 'expert knowledge' and 'the public' come out in everyday life only as a part of particular issues. That 'particularity' results chiefly from controversial risk issues presented in the public sphere as decisive for well-being and for citizens' daily lives. Again, uncertainty comes to the surface, this time in the conflicting technical and scientific assessments that are produced in relation to the same theme. The 'scientific evidence' once thought to be universal, irrefutable and unanimous, became subjected to local particularities therefore debatable, questionable and not entirely trustable. In the same process, as science and scientists acquired a

place in the public space for the need to explain the 'right' version of events, their controversies and disagreements turned out to be known. Nonetheless, whatever the examples are, there is a permanent condition central to the topics being analysed in this chapter: in face of contradictory and even absolutely clashing versions of the issue being discussed, public groups and individuals are obliged to respond to the technical/scientific debate, that is, accepting or rejecting any or all the positions at stake in the first instance.

Thinking of the conceptualisation of the public understanding of science, two main different perspectives have been developed. The first to appear sees the public as ignorant both of scientifically qualified knowledge and of those abilities necessary to produce and to understand it (the deficit approach). This approach was part of the social, political and scientific movement toward the promotion of public education in science being therefore one of the elements of the ideological background of contemporary societies (Wynne, 1995).

The other, more recent, is based on the heterogeneity of the publics – and of science itself – in its constitution, in the experiences they mobilise, that is, in the contextual way in which the relationship with that scientific knowledge is produced. The preferred object of study are the processes of interaction found in the overall system of science conceived as an 'open' system, open to the intervention of other social worlds (Wynne, 1995; Irwin, 1995; Nunes, 2000).

Thus, science will be "a diffuse collection of institutions, areas of specialised knowledge and theoretical interpretations whose forms and boundaries are open to negotiation with other social institutions and forms of knowledge." (Irwin and Wynne, 1996: 8). Instead of the dominant 'top-down' model the tone is directed to the interdependence of different forms of science, knowledge and expertise. A more democratic mode of knowledge making, then.

Examples that have environmental issues as their main focus and which follow the second perspective are numerous and diverse. In a recent book, Irwin (2001) discusses "the ways in which people select, interpret and act upon environmental concerns within the particular contexts of everyday life." Problems are actively constructed and in many of the cases he discusses in his book, attention is due to "memories of previous incidents, moral judgements and forms of local knowledge" as an instrument to increase not only the local understandings of that particular issue but its construction as an 'issue' as well. This is the domain of the 'situated knowledge', systematically ignored, refused and kept in its local condition by modern science.

Another area of research within the theme of the public understanding of science and public participation has to do with scenarios and models, and – in particular – with attempts to make citizen participation feasible in contexts where environmental models are tied to policy processes. In a pair of pioneering studies, Yearley together with colleagues at the Stockholm Environment Institute in York (including Cinderby, Bailey and Forrester) examined the scope for citizen engagement with urban air-quality models. In their pilot study in the northern English city of Sheffield, Yearley et al sought to evaluate the main arguments for public participation in such processes. Three main reasons are typically indicated: it is firstly argued that when offered the opportunity to shape policy, the public is more likely to support the eventual policy; secondly, participation in public policies is a right in democratic societies. Publics should, therefore be given a voice as of right. The final argument is closely related with the idea of the 'situated knowledges' previously mentioned. In their words "(…) local people may count as 'technical experts' about aspects of their neighbourhood or they may have insights into specific local processes which give rise to pollution" (Yearley et al, 2003: 247). These researchers aimed to see how these ideas could be put into practice for citizen involvement in air-quality modelling (see also the studies of industrial air pollution by Moffatt and colleagues: for example, Bush et al, 2001).

In the initial study in Sheffield, they used focus-group methods to elicit citizen evaluations of the air-quality monitoring and modelling as carried out by the city's environmental authorities (see Yearley et al, 2001). They discovered that citizens had relatively sophisticated and empirically detailed understandings of the processes that underlay the authorised model: for example citizens had an appreciation of city traffic patterns and cyclist citizens had good insights into the spatial distribution of emissions from public transport vehicles. Accordingly, Yearley et al endorsed the approach, originally proposed by Funtowicz and Ravetz (1991), of seeing citizen participants as 'extended peer reviewers'. That is, citizens may not become experts on modelling but they may make excellent reviewers of the quality of model outputs (see Yearley, 1999). Yearley and colleagues specified in which precise senses citizens might be expected to operate as extended peer reviewers.

In their subsequent study, based in York, Bristol and Sheffield, Yearley et al (2003) aimed to develop this approach by devising techniques for allowing citizens to make their own maps of urban air-quality, maps that could then be superposed onto the outputs from the official computer models to allow spatial

comparisons (see also Yearley, 2006). This technique was regarded as so successful that it was adopted by the City of York Council for its public consultation on the city's Air Quality Management Plan in the early 2000s. This mapping work was subsequently developed by Cinderby, Potts and Forrester among others as a method for taking forward ideas about 'lay epidemiology', that is citizens' investigations into the environmental (and other) sources of differences in health (see for example Potts, 2003).

This focus on lay epidemiology was mirrored by developments around arguments over environmental injustices in urban environmental (including air) quality; especially in the USA, activists and academic analysts became interested in the geographical distribution of environmental "bads". Air pollution was one such issue and the focus switched to the air quality systematically enjoyed by groups from different ethnic and class backgrounds. The mobility of air-pollution led to complications in such assessments (unlike waste disposal sites which were the 'classical' environmental injustice issues), but the idea that disadvantaged communities were often left to cope close to polluting sites became widespread. Local communities even developed techniques for local air-quality sampling in the absence of official measures, developing standardized "buckets" (sealed containers with a valve) which could be evacuated and then filled with local air and sent off for testing. The South African group Groundwork has now adopted this approach and provides the following history (as related in Yearley 2010):

> "The community based "bucket" air sampling system was developed in California in 1994, when local residents living near oil refineries and chemical plants decided to do something to put an end to the pollution in their neighbourhood. These residents sought expert assistance to develop a system of independent monitoring of air pollution. Together they designed a simple air monitoring device, called a "bucket", to take grab air samples. Subsequently, a US NGO, Communities for a Better Environment (CBE), organized a regional effort to provide "buckets" to five industrial communities in the San Francisco Bay area (http://www.groundwork.org.za/Pamphlets/bucketff.asp)."

Groundwork and numerous other community-based groups have followed this approach and are drawing attention to likely inequalities in people's exposure to polluted air.

These studies in public engagement in the politics of urban air quality are of double significance to this thesis since they both provide detailed examples of

how citizen engagement in knowledge-making can work and provide empirically documented examples of citizens involving themselves in the observing and monitoring of urban air conditions.

Moreover, public participation is also about knowledge codification (Rip, 2001). 'Situated knowledges' are, by definition, local knowledges and consequently the tension between lay and expertise is also the tension between the local and the global or universal knowledge. And although one can argue that, for instance, the act of monitoring implies a range of localized *activities* such as collecting the data, there is an evident gap involving the experiences, knowledges and categories lay citizens display and those employed by monitoring systems.

For this reason Kasemir, Jäger and others, argue that the role of public in decision-making "depends on whether science can articulate a comprehensive, complete and unique description of the issues at stake" (2003: 4). In case science fails to meet this purpose a more active role should be attributed to the public since the authors claim that the way public understands and defines the issues being discussed becomes a complementary input to the scientific assessment and to the policy-making process as well. The argument is pushed further as they conclude that "multiple legitimate descriptions makes science change its role" (2003:7). The new announced tasks would be those of providing a variety of plausible assessments and supporting (rather than settling) an informed and pluralistic public debate.

Summing up

This chapter has been both a literature review and a review of the field. In part, my claim has been that there is an absence in the literature most closely related to my empirical focus: the environmental sociology literature. I have shown that there is a lack of work on monitoring and a lack of recognition of the key role of environmental monitoring. To highlight the importance of this gap, I have demonstrated how central environmental monitoring is to many forms of environmental activity and intervention.

Furthermore, I have indicated how the practice and role of monitoring can be beneficially understood with the help of sociological terms relating to other literatures: work from the STS tradition on observation; Foucauldian and related work on surveillance and disciplining; studies of the capacity of ICTs to promote innovative forms of monitoring; and the ever-growing tradition of work on public participation in science and technology governance.

Using the resources of these latter literatures to fill the gaps I have identified in the environmental sociology tradition, I suggest that one can raise several key questions. I shall turn to the issue of how these questions can be investigated in an empirical manner in the next chapter, but the questions can be stated in outline here:

1. Given my assertions about the centrality and indispensability of environmental monitoring to the construction of environmental problem claims, what are the key sociological dimensions of environmental monitoring activities?
2. Given the possible distinctions between monitoring, observation and surveillance, what are some of the distinctively different ways in which the task of environmental monitoring can be socially organised? Does the form of social organisation adopted impact on how that task is performed?
3. If environmental monitoring can be organised in different and contrasting ways (with more or less use of technology, with more or less public participation and so on), can one identify characteristic modes or 'ideal types' of the social organisation of environmental monitoring?

I shall explore these issues in empirical terms in Chapters Four and Five and in the early part of Six, and then return to these themes at an analytical level later in Chapter Six and throughout Chapter Seven. In these last two chapters I shall reflect further on the sociology of monitoring and indicate that the choice of monitoring procedure (whether it is mechanised or dependent on skilled interpretation, whether it is done by professionals or citizen activists and so on) has significant implications, both for the information that monitoring generates and for the whole way in which environmental issues are conceptualised. But for now it is time to turn to the cases and to see how environmental monitoring works out in practice in these two particular contexts.

Chapter Three

Studying environmental monitoring: the case studies and some methodological considerations

3.1 - The case study method and the sociology of environmental monitoring

As I explained in the introduction, my work grew out of my familiarity with a case, the Portuguese Senses@Watch project. It was thus only to be expected that the method I adopted would be that of the case study. But there are of course well known problems and difficulties commonly associated with this approach, principally those of representativeness and generalisability (see Stake, 1995: 7 or Yin's comments, 1989: 21). It was some comfort to me that the case study approach is widely adopted in the science studies literature, one of the leading sources of inspiration for my work. For example, some of the key foundational works in contemporary science studies – such as Collins' celebrated analysis of gravity wave detection experiments (1975) – were detailed case studies. Similarly, Collins' recent book length magnum opus is also essentially case-study based (2004).

Within the sociology of science the methodological argument in favour of the case study approach is quite specific. Case studies offer an effective and valid form of evidence precisely because there is an 'orthodoxy' represented by the philosophy of science and scientists' own mainstream accounts of scientific practice with which the case studies of actual practice or 'laboratory life' can be contrasted. For example, in relation to Collins' famous work on replication in scientific experimentation, there is a canonical account which asserts that scientific knowledge is epistemologically robust and can be trusted precisely because experiments are first done and then replicated by other, independent scientists. Collins uses his case study material to show that what appears to happen in practice is that scientists do not replicate preceding experiments exactly, as the canonical version implies, but change the details slightly in order to try to 'improve' the experiment. The extent to which any later experiments are therefore 'replications' of earlier ones becomes a matter of debate and negotiation (see also Ashmore, 1988). Furthermore, if later experiments fail to detect the phenomenon identified in the first one, this does not necessarily indicate that the original experiment was flawed. There are bound to be some differences between the first experiment and the 'replication'; therefore one does

not know if the first experiment was correct and the second one a failed attempt to repeat the experiment or whether the original one showed a false positive and the second correctly identified the absence of the phenomenon. This is what lies at the heart of what Collins later termed the experimenter's regress (Collins, 1992). The methodological point however is that Collins was able to make a claim of broad relevance and apparent generalisable value on the basis of a case study design because his work was conducted against the background of an accepted orthodoxy and its implicit claims about how science functioned. He made what Yin (1989: 44) helpfully refers to as an 'analytical generalization'.

In practice, matters are not quite as simple as this summary of Collins' work suggests; there is still a question about the generalisability of his findings. Collins wants his argument to apply not just to gravity wave experiments but to replication in physics in general (and in fact in the sciences more broadly) as the sub-title of his 1975 article indicates. Thus he does face the problem of showing that his work is in some sense representative of all physics and not just the sub-field which he studied. But he does this not through drawing a statistically valid sample or any such probabilistic method, but by showing that his case represents a central and well respected bit of physics. He points out that there is nothing out of the ordinary (for physics or physicists) about his case study area: the main protagonists are all respected scientists working in leading university physics departments; they are not pariahs; they are working on experiments derived from Einstein's theories of gravitation. Thus his 'proof' of their representativeness is that they are taken as typical or 'regular' by their peers. His argument would have been less compelling had it drawn on parapsychological practice or other fringe scientific disciplines or even on extraordinary aspects of established physics, such as cold fusion (though of course he was later able to use his arguments to throw light on such cases too – see Collins and Pinch, 1979). He deals with the representativeness question by showing that competent members of the culture he is studying treat his case as though it were ordinary and normal.

My methodological strategy is not quite as neat as that of Collins but it follows a similar line of reasoning. As I showed in the last chapter, many environmental phenomena depend for their realisation on monitoring. For example, the widely discussed topic of risks focuses on risk calculations, but in practice risks can only be known if they are monitored. But the work of monitoring is generally overlooked and, if noticed at all, treated as unproblematic. This forms my background orthodoxy. Against this assumption of the ordinariness and the unproblematic nature of monitoring, my cases are intended to show that there is

much more going on in monitoring than is commonly acknowledged. Monitoring can be carried out in a variety of ways with different consequences for how the results are handled and how the environment is treated. Politics and interests and cultural variations can be manifest at the level of monitoring too.

In this way, just as with Collins' argument, it is logically sufficient for me to show that there is more than one way that monitoring can be done – with different consequences for the resulting knowledge of environmental issues and for their management – in order to demonstrate that an understanding of the sociology of monitoring is important for an appreciation of such higher-level phenomena as risks or biodiversity counts and so on. Of course, one could take this further by studying a wide range of cases of monitoring – perhaps identified in some sampling framework – that could indicate the prevalence of different monitoring approaches and strategies. But to make my initial argument, case studies are sufficient.

I have also been able to use a strategy similar to that employed by Collins to argue for the typical-ness of his cases. Just like his cases, my two cases are accepted as 'adequate' or acceptable by competent figures in the field. Thus the PURE case features a community group whose role as lay monitors and keepers of their local environment is recognised and endorsed by the Environment Agency, as will be shown in Chapter Four. This is not a maverick or fringe activity but one which is accepted by a variety of other actors (including university researchers from the nearby major university, NGOs, local authorities and state officials) as useful and valuable environmental monitoring. In fact, the case was first suggested to me by John Colvin, a senior social scientist at the Environment Agency's national headquarters. Similarly, in the Senses@Watch case, the leading figures involved are well-known academics and environmental actors. One of the project leaders is a renowned and respected scientist whose work has been acclaimed (he has been distinguished with the most important Portuguese prize of its kind) for the wider impacts it has in society at large. Other members of the research team see their work acknowledged either by sitting on European Union advisory boards on environmental issues or by actively taking part in environmental NGOs. Furthermore the project was supported by grants from the relevant ministry (the Ministry of Science and Higher Education through the Foundation for Science and Technology which is the equivalent to the British ESRC).

Though these are just two cases, they are treated as strong – in some sense even exemplary – cases by significant surrounding actors and agencies.

It is further in my favour that one of the cases also has a high degree of methodological self-awareness. As I shall show in Chapter Five, a leading concern of the researchers in the Portuguese Senses@Watch case was to establish precisely the correct approach for giving ordinary citizens the job of monitors of the environment. Without anticipating too much of the discussion that properly belongs to that later chapter, one can say that some researchers in the team wanted to establish the degree to which the typical citizen could sense environmental pollutants and parameters using their normal, everyday senses (of smell or hearing for example). This led to the development of experimental protocols for testing precisely these questions. Other team members, as we shall see, were more interested in using new technologies to empower citizen observers; they were more interested in finding ways to harness the information that citizens could pass on than in testing the average person's monitoring capabilities or in establishing the range of sensorial abilities that are likely to be found in a random sample of the public. Accordingly, within this one case there was a good deal of methodological analysis and self awareness, and I have been able to make use of this attention both as a key part of that case study and also as part of my own exploration of what case studies in the analysis of monitoring can teach us about monitoring at large.

Though I have argued for my methodological strategy from the starting point of the sociology of science, it is clear that this approach is in line with the recommendations of the established sociological literature on the case study. As I set out below, in my approach to these case studies I have conformed to Yin's recommendations (1989: 95-103) to use multiple sources of information for each case, to maintain a collection of notes and documentary materials independent from my interpretations of those data, and to maintain a 'chain of evidence' (1989: 102) by ensuring that my principal claims are closely supported by specific and well-evidenced assertions or statements from my respondents or from details of their practices.

3.2 - Selecting and approaching the cases and specifying the research questions

As explained in Chapter One, the Senses@Watch case had been identified right at the outset of the research. During the first fifteen months of my research I identified several possible comparison cases in Britain, not only the PURE example (which, as mentioned above, was drawn to my attention by a leading figure in the Environment Agency) but also other community initiatives such as

local homeowners involved in water level/flood monitoring in York and various wildlife observing and monitoring groups. These candidate examples were all chosen to contrast with the Portuguese case, not as cross-national comparisons but because they appeared to involve monitoring conducted in a different manner. The Portuguese example focused on trying to use citizens' senses as objective measuring devices for checking the quality of the environment and on using ICTs to link up networks of citizen monitors. Though the focus was on ordinary people's sensing abilities, the study was framed very much in scientific experts' terms. For my second case I was looking for a more 'bottom-up' approach in which the monitoring citizens themselves had a greater input into the design and running or management of the monitoring enterprise, though with the emphasis still very much on monitoring (rather than, say, on campaigning or agitating for a change in the law or fund-raising). That is, I was interested in exploring 'monitoring' as a subject in its own right and for this reason the cases would – preferably – in their distinctiveness pinpoint the diverse meanings, practices and dimensions of monitoring as carried out by the relevant publics. And, if this predictive exercise were to be correct, what would account for that diversity in the first place?

I believe the simplest way I can present the rationale behind the selection of the cases is the following: *the cases need to represent diverse modes of capturing lay monitoring, exercised and displayed in areas that would necessarily enlarge traditional environmental collaborative systems and, most likely, alter the dominant meanings attributed to monitoring.* The initial and rather imprecise question of the "whether and how" lay monitoring takes place had naturally evolved to a more refined questioning of the possible settings and conditions under which lay monitoring can occur alongside expert monitoring.

The final selection of the case was inevitably also based partially on grounds of practicality. For example, the York homeowners were active only at a very localised level and their activities were sporadic; also, the process of negotiation with the Environment Agency over remedial measures for flood protection was likely to persist for several years since flood defences were likely to cost many millions of pounds. This meant that there was likely to be little in the way of outcomes until well beyond the anticipated completion date for my research. This example was thus likely to prove unsuitable and I rejected it early on. I also needed to be able to gain access to the case-study area reasonably easily; this ruled out the possibility of working with wildlife-monitoring groups associated with the Eden Project in Cornwall for example, even though these

looked attractive on other grounds. In the end I accepted the recommendation of John Colvin of the Environment Agency and looked into the PURE Seaton Valley case, based on the northern outskirts of Newcastle-upon-Tyne. This site could be reached by train in only a little over an hour from York and this meant I could attend meetings and arrange to interview people on a flexible and opportunistic basis. This case turned out to have the right characteristics for me and was reasonably accessible.

The identification of the cases was achieved in conjunction with the specification of research questions. Clearly, the study was always intended as an exploration of the social organisation of environmental monitoring. But the following research questions were gradually developed and refined:

4. While it is widely acknowledged that there are sociological influences on the shaping of environmental problem claims, what are the key sociological dimensions of environmental monitoring activities?
5. What are some of the distinctively different ways in which the task of environmental monitoring can be socially organised and does the form of social organisation adopted impact on how that task is performed?
6. If environmental monitoring can be organised in different and contrasting ways, can one identify characteristic modes or 'ideal types' of the social organisation of environmental monitoring?

3.3 - Practical methodological aspects of my approach to the cases

In practical terms, my approach to the two cases was similar. I sought to gain a good understanding of the overall project at the outset by talking to a small number of key informants who were sympathetic to my research interests and who acted to some extent as gatekeepers and intermediaries. I interviewed these people but also talked to them informally. I collected published information (including publicity materials, brochures and working papers) on the projects and tried to familiarise myself with the general purpose and outlook of each project. At this initial stage I also took a detailed approach to all sorts of information available on the website for each case study and on those that, directly or indirectly, related with them, such as the websites of organisations or citizen groups involved in environmental monitoring projects world-wide (in the Senses@Watch case) or the websites of the community groups and wider partners engaged in the PURE case study. The strategy of looking into the broader connections established by the

actors in the case studies themselves granted me access to the less immediate elements that make for the rationale of the selected cases. Such elements are not always spelled out in the interviews or in published documents and yet without them one cannot claim to have gained a full comprehension of a case. In both cases I had access to internal documents as well, and even if the majority of them cannot be displayed throughout the analysis for reasons of confidentiality and research ethics, they were key to the understanding of, for instance, the actors' internal dynamics and perceptions of the various issues at stake.

In the case of PURE (which, as explained in the next chapter, is a part of a European consortium of projects on urban-rural or peri-urban river environments) I attended an open day for the international project team in March 2005, called the PURE Hike, and the following conference day where several of the active actors show-cased their progress and where a workshop about 'community engagement and participation' was enthusiastically attended by participants. Given the presence of other European academics and policy actors there, my participation did not seem so unusual and I was able to establish further personal contacts on those days and to get agreement from some local actors to be interviewed in subsequent weeks. I also took many pictures of the principal environmental features (around a watercourse known as the Seaton Burn) that work both as a vivid memory of the area that local actors monitor and as documentary material.

In the following months I aimed to interview all the relevant actors who would agree to speak to me. I used a semi-structured interview format to ensure that I covered all the topics that I believed were important but in a way that allowed me to respond flexibly to the topics that came to the interviewee's mind. I had developed the interview questions in the light of my interaction with the gatekeepers and the various documents and found that the schedule of questions was suitable for all respondents of the local community groups involved in monitoring. Some local people could not easily make time for a face-to-face interview and after a number of failed attempts to agree on a day and time I conducted a small number of interviews over the phone. Wherever possible, and with the consent of the interviewees, I recorded these interviews, including the telephone ones. I also collected other material that the interviewees offered, for example notes of meetings or digital copies of photographs taken by some respondents. One of the leading figures in the community project also responded enthusiastically to my supervisor's idea that I undertake a walk along the watercourse on my own. He wrote a series of notes to guide my walk and his

comments in these notes – as well as my experience of having done the walk in late 2005, guided by his notes – offered various insights that are used in Chapter Four as well.

In the course of the year I made numerous trips to Newcastle and had the chance to take part, for example, in field visits to the sites included in the water monitoring programme the local group developed. In all, in respect to this case, I conducted 15 interviews. I transcribed the interviews in full and – as I am not a native English speaker and as several respondents had quite strong regional (northeast) accents – I checked the transcripts against the recordings with native English-speaking friends. The people interviewed included local residents directly involved in the PURE initiative, employees of the Environment Agency in the Newcastle office who were involved with the PURE project in its broadest sense (for more details see Chapter Four below) and academics at a local university who had advisory and support roles within the project.

My Portuguese field work was conducted to overlap with the British case despite some exploratory research having been performed even before I took my post-graduate place in York. In this phase I met some of the researchers engaged in the planning and testing of the experiments and even acted as a subject in one of the tests (which would later be dropped by the team). More than seeking an accurate knowledge of the project I was rather aiming at forming an opinion about the virtues of transforming this academic project into a PhD case study.

Senses@Watch is based primarily in Lisbon, at various university centres, though one of the leading researchers is based in Porto (at the Institute of Advanced Studies in Education) which is actually the setting of one of the central studies developed by the team as will be explained in Chapter Five. In this case I was able to gain access to respondents flexibly by arranging to stay with family members in Portugal and I made some visits lasting one or two weeks in 2005 and 2006 to complete these interviews. Senses@Watch is a large project, as I show in Chapter Five, which lasted for several years, and some of the younger researchers were employed only for around one year. I was thus not able to interview everyone involved. Instead I aimed to interview all of the leading figures (essentially, tenured academics with interests in environmental management, systems analysis and geography/Earth sciences) and a series of other researchers identified in a ‘snowball’ style.

As with the PURE case I used a semi-structured interview format and the interviews tended to last between 45 and 90 minutes. Given the size and diversity

of the group I tried to collect reports, reprints and materials from all those I interviewed and in many cases I ended up with a more comprehensive collection of papers than any one researcher in the team possessed. I ceased the interviews once I had spoken to all the figures who were regarded as 'leaders' by my respondents and once the answers to my questions appeared to have reached saturation, in the sense that no new, surprising information was coming out of the interviews. Overall, I interviewed 10 people. Everyone consented to having the interview recorded, and again I transcribed the interviews in full. I kept the materials in Portuguese (though some of the academic publications from the group were in English) and have translated them myself when I quote them in Chapter Five or elsewhere; again I have had the English version checked by a native English speaker who reads Portuguese.

Before ending this section, two already-mentioned issues deserve to be explored in a more detailed manner: the distinction between face-to-face and phone interviews and possible implications for the data gathered and, secondly, the role of the ethics in the present study.

In relation to the first, the decision was made from the start in favour of semi-structured, face-to-face interviews. The advantages and shortfalls of this technique of social research are well established in the methods literature (Finch, 1984; Denzin and Lincoln, 1994; Miller and Dingwall, 1997; Holstein and Gubrium, 2003; Rubin, 2005); I will predominantly discuss some of the issues I have faced when doing face-to-face and phone interviews.

Face-to-face interviews allow not only for non-spoken elements to be taken into account when doing the interview (facial expressions, discomfort expressed through body posture, etc.) giving the opportunity for the interviewer to respond accordingly. They also help set up a reciprocal relationship on account of the fuller interaction that takes place between the actors involved in the situation. That is, face-to-face interaction will contribute, in principle, to a reinforced bond being established throughout the process of interviewing and, admittedly, for higher levels of trust and reassurance to be likely to emerge. Still, as Dingwall points:

> "[An interview] is a situation in which respondents are required to demonstrate their competence in the role in which the interview casts them." (Dingwall, 1997:58)

This means, in practice, that the interviewee will be put in the spotlight and will feel the need to respond in a way that matches what is expected of him or

her. This kind of pressure is certainly at its highest point in face-to-face interaction. In these circumstances there is no escape for the anxious respondent.

Such a constraint can be clearly reduced when the interview is mediated and the interaction less physical as happens with phone interviews. Hence when several of the identified interviewees were not responding to the suggestions for face-to-face interviews or were being evasive and not committing in a definite way to the interview, the offer of a phone interview seemed an alternative worth trying. The result was immediate and extremely positive: all of those who were resisting meeting face-to-face accepted at once and without objection the phone interview. Agreeing on a day and a time was an equally easy aspect to solve and soon I was achieving the results I had aimed for.

From this there are some points worth making. The 'neutral' space that most times is suggested for the location of the interviews, may fail to correspond to the notion held by the interviewee, leading him/ her to feel intimidated and apprehensive. A phone interview can be taken in the comfort of the interviewee's home, at his/ her most convenient time (in my case the majority opted for a time in the evening, after a day's work). The role of the researcher is less conspicuous and even the recorder remains unseen to the eyes of the interviewee once the consent to record is obtained. Therefore, phone interviews seem to provide the respondent with a stronger sense of being in control of the situation than in face-to-face interviews which may conceivably lead to them being more at ease and confident when answering the questions.

On the other side, from the point of view of the interviewer and the information gathered, one can plausibly think that once released from the obligations of face-to-face interaction, the researcher will be able to attend to what is actually being said rather than on the non-discursive signs emitted by the interviewee. Furthermore, an experienced interviewer will be capable of getting very similar information from the hesitations, the tone, etc., of the interviewee's discourse to that observed in face-to-face interaction. Finally, when comparing the contents and data obtained from face-to-face interviews and phone ones, I could conclude that the results were identical and no loss of information had happened in connection to the type of interview carried out.

In regard to the role of ethics in this study, the first point I would like to address is that the nature of the research did not require a formal approval from the University or departmental research ethics committee. Indeed none of the issues covered deal with intimate or personal matters nor do they relate with

sensitive areas of the persons or the organisations referred to in the thesis. Quite the opposite: the two main case studies are or have been publicised on widely available media such as the internet and are part of scientific or other kinds of publications open to a general audience. All the organisations contacted and the persons closely involved in this research were keen to take part without further considerations. Yet, bearing this in mind, consent was always sought in what relates to the usage of documents, recording of interviews and citation of interview's data. In addition, anonymity and confidentially was guaranteed to respondents and the interviews coded in order to protect their identity.

Despite these procedures it is not possible to assure that anonymity is fully attained throughout the thesis. I have already pointed that both the main case studies are part of the public domain in one way or the other. Apart from this unquestionable obstacle to have unidentified respondents, the fact that the case studies are representative of a rather limited area of knowledge and social practice in each of the contexts (Portugal/UK) makes it possible for individuals to be recognised by other members of that same or related areas. There are also published outputs (reports, scientific articles and so on) of each of the projects that I use in the analysis as documentary materials. How these sorts of documents could be dealt with differently when the academic researcher has, to the same extent, the ethical obligation of acknowledging other fellow researchers' work, does not bear a straightforward answer.

At another level, and as is often the case, the researcher can face a situation where several documents or elements provided during the interviews cannot be treated as 'normal' material due to either an explicit request or an 'off the record' comment on the part of the interviewee. In both case studies I had similar situations to these and in both cases I had to drop potentially interesting research lines. Nonetheless, the underlying question in this respect refers to the status of the information that is shared by the respondent but only on condition that it is not shared further. Declaring it as 'non-normal' material does not define what it is, simply what it is not. But one can even ask whether it is ethically acceptable to understand those elements to be part of the 'material' of the research. From the moment it is named as 'material' one is accepting it as part of the research and in this case the discussion turns into one about the acceptability of using information that is supplied under the confidential, private or secret label. As I said above, various documents supplied and even comments made 'off the record' or under the condition of not being reproduced were important for piecing together the internal relations of the actors of each case study which, in turn, are

a central element in the way the project (i.e. S@W and PURE) unfolded. I have not used those aspects as 'material' but I have used them as fragments of the knowledge which I bring to the study and which helps to pin it together. They are only undetectable to the reader since they form the intangible structure of the research corpus together with many other components. The usability of such aspects is unquestionable and their rightness assured as long as they are reserved a place in the incorporeal body of knowledge assembled by the researcher.

3.4 - Interpreting the cases

After completing the two case studies I had a similar collection of materials for each: a roughly comparable number of transcribed interviews and a large collection of supporting information in the form of internet material, maps, reports, visual images and fieldwork notes. I opted not to use coding software (though I was familiar with it from the methods training course I took at York) since I realised I had become familiar with key issues just from doing the preliminary research, reading the materials and doing – and then transcribing – the interviews. I had already identified numerous key topics and I felt able to adopt a more informal approach to coding.

My confidence in my interpretations was also boosted by the fact that I had the chance to make presentations on the case studies on a number of occasions: at an International Sociological Association (ISA) RC24 (Research Committee on the Sociology of the Environment) event in France in summer 2005 during the research, then again at an RC24 meeting in summer 2006 in South Africa (when the key points of Chapter Four were worked out), as well as at meetings of EASST in 2006 and of ANPPAS (National Association of Research in Environment and Society) in Brasilia and of a Portuguese meeting on environmental science in early 2008. These meetings were attended by leading figures in environmental sociology and science studies from around the world and they, along with internal seminars at SATSU, provided sounding boards for my interpretations and the evidence that I had to support them, and helped me to become confident of the robustness of my arguments.

During these presentations I found it best to supply information about the context of the cases at the same time as analysing the case materials themselves, and I have chosen to follow that strategy here too. For this reason I give details about the locations of the studies, the characteristics of the participants, and other background information (which might otherwise feature in

the methodology chapter) in the substantive chapters. As those chapters deal with one case each, there are conclusions at the level of the cases themselves at the end of each chapter. But I save the more explicitly comparative analysis for Chapter Six.

In Chapter Six I use a comparative approach to try to draw some conclusions about what I term 'modes' of lay monitoring: that is distinct ways in which citizen monitoring can be organised and practised. To support this discussion I introduce material from one further 'case', though this is a case that is supported entirely by secondary analysis of the published literature. During my research I became aware of the Volunteer Water Monitoring Programme (VWMP) supported by the EPA (Environmental Protection Agency) in the USA; basically a network of volunteer monitors spread throughout the country focused on water environments. As summarised by the EPA, this scheme runs as follows:

> "Across the country, trained citizen volunteers are monitoring the condition of their local streams, lakes, estuaries, and wetlands. EPA encourages all citizens to learn about their water resources and supports volunteer monitoring because of its many benefits. Volunteer monitors build awareness of pollution problems, become trained in pollution prevention, help clean up problem sites, provide data for waters that may otherwise be unassessed, and increase the amount of water quality information available to decision makers at all levels of government."
>
> (EPA site www.epa.gov/owow/monitoring/volunteer/).

As will be explained in Chapter Six, this is a top-down approach to citizen engagement in monitoring with a very different organising principle from Senses@Watch. It seeks not to build on people's 'native' sensing abilities but to train them to become 'quasi-professionals'. As the quote above shows, the value of volunteer participation is ranked highly in the Agency's discourse. However, the programme makes a point of providing the 'right' tools to assure that collected data are valid in terms of, for instance, procedures, protocols, and comparability. Interestingly the VWMP exists mainly as an online programme (see http://www.epa.gov/OWOW/monitoring/volunteer/) so one can, in principle, assume that volunteer groups are given a certain degree of flexibility in their practices despite the highly formalised and broad set of technical manuals and guides through which this EPA programme takes concrete shape. The clear contrasting elements with both PURE and Senses@Watch, and the sense that it could provide the constitutive elements for a third 'mode' of lay monitoring, made

the VWMP suitable for a third case component, even if of a rather different standing to the other two.

For information on this initiative I use reports on the scheme by the EPA and partner organisations, the handbooks and training materials themselves (which are available on-line), and some secondary analyses published by environmental authors and social scientists. In the remainder of that chapter I seek to use this 'triangle' of cases to establish some generalisations about the ways in which citizen monitoring can be organised.

Chapter Four

PURE Seaton Valley: nature re-enacted through lay monitoring

Preamble

"Circular walk starting and finishing in Holywell Village" – notes on a guided field visit

As I was setting off from York on the morning of the 21st December 2005, I knew that after driving for approximately three hours, I would be given the chance to experience some part of what my interviewees, the lay monitoring actors of Holywell Dene, 'see' on their regular strolls through the Dene.

The main tool for granting me access to their physical and socio-symbolic 'world' was in the backpack together with my notebook, a camera and a detailed map (just in case): three pages that would guide my way but mostly my gaze as I progressed through the fields, the woodland and the river – the Seaton Burn – of Holywell Dene. Undeniably, I was also carrying the images, notions and meanings that had been portrayed both in the interviews and in previous accompanied visits to the site, along with the information afforded by all sorts of materials that I had been reading about this particular place and its surroundings, the Seaton Valley.

Just like the document that the chairman of the Friends of Holywell Dene (FHD) had very kindly put together following my request for help, my walk in the Dene had been planned to have two types of 'rhythm': the straightforward one, where my pace would be that of the route directions; and that rather more sinuous one of the socio-historical and environmental path I should not miss. The emphasis of the italics as opposed to the discretion of the normal typeface in the original text is very expressive:

> "Walk along this track and soon the houses stop and you have the primary School playing fields on your left. The track turns sharp right *where there is a sign for Holywell Pond Nature Reserve.* Keep going on what is now a footpath and on your left you will see a public bird hide *have a look to see what birds are about – if no birds there will, no doubt, be some nasty graffiti not to read.* Back on the footpath, it turns left and then quickly right and you continue on until you reach a small gate." ("Circular walk ...", FHD chairman, original emphases here and below)

I was being initiated into 'observing' the Dene and, as in any other ritual, the learning process is key to the unfolding and accomplishment of each phase. One does not relate with a place in the same way after finding out through a system of classification and categorisation that that place is distinctive. The change resides in the evaluative dimension that the gaze entails from that moment onwards, itself altered by the information intake. Classifications work at different levels though and the lay actors in Holywell Dene developed a system of sorting their local environment in a way that separates what is 'in place' from what is 'out of place'. That, too, I was being taught: see the birds, avoid or ignore the graffiti. This system of classification operates at the core of their monitoring practices.

> "*You are now pointing east and standing on the Seaton Sluice wagonway which used to bring coal to Seaton Sluice harbour for export. It was in use from the early 1700s until 1866 when the last coal was shipped from Seaton Sluice."* ("Circular walk ...")

Local history, which acts in the background reinforcing the bonds of community identity, is of no less significance to the monitoring process; the wider cultural meanings attributed to the area draw from it, and I was being offered the possibility of engaging with slices of that past in order to form the 'local actor's' frame of mind or, let us say, a proxy for it. It is important, thus, that I can "read" the landscape, be engrossed in its socio-environmental entirety so as to know it and act upon it.

At any moment I had new elements of this script for Holywell Dene to combine and relate to:

> *"*(...) *looking north towards Seaton Sluice is the Seaton Burn estuary. This is an SSSI*[*] *because the vegetation you see on either side of the Burn has adapted to being covered by salt water at the very high tides throughout the year.* (...) *Although not particularly attractive* [the harbour] *it is fascinating when you consider that for over 100 years it was the major coal exporting port on the NE coast. There are some instructional information boards."* ("Circular walk ...")

Coal mining is, many decades after the closure of the mines, nearly as central as it was for local communities when the harbour was in full swing. It permeates all the layers that make for the space, even if in a less tangible way:

[*] Site of Special Scientific Interest.

instruction is available for me in a non-oppressive way; what I see today has to be informed by the past.

As I had been told from early on, cows are forbidden in the Dene, a ban that very much resembles the religious prohibitions which regulate the separation between cleanliness and dirt as famously analysed in terms of Purity and Danger (2005) by Mary Douglas. Cows interfere with the order that the FHD have created in the Dene; they are 'out of place', barriers were erected to stop them entering into the protected places the monitoring actors aimed for:

> "Continue on the path until you reach a rather attractive stone bridge with a water gate underneath *to stop the cows getting into the Dene when the water is low.* Go over the stile onto the farm road and (...)." ("Circular walk ...")

How was I doing? Had I been able to notice something remarkable, worth taking note of and passing on? Where were the beefsteak fungi that J. pointed out to me in the interview? What about the logs that according to P. were allegedly rotting down "quite happily without being too obtrusive" (P11:7)? In which category do they fall: 'out of place', 'in place', neither?

Perhaps anticipating some of the anxiety I could experience, my guide was providing me further instructions as to where to direct my gaze:

> "You will now have entered woodland and continue for some considerable distance on the only path on that side of the stream until you reach a wooden bridge across the stream. *Things you might notice as you are walking on this stretch is* [sic] *an attractive waterfall on your left (if it has been raining). Opposite on the other side of the stream are the trees planted by FoHD some 5 years ago. Then on your left you will see the fenced off remains of the well from which the occupants of the Dene drew their water until the 1950s. Then a further waterfall on your left followed, hopefully, by a view of the stepping stones (provided water level is not too high) which is the site of the old corn mill which stopped operating in the 1930s.*" ("Circular walk ...")

I did eventually identify beefsteak fungus in the woods, which rewarded the research effort I had been making in preparation for the visit. However, even if my observation could encompass the attractiveness of the waterfalls or the growth of the planted trees, it failed to place the observed within a set of regular, continued observations which I, obviously, did not have and which the script I was carrying

could not have granted me. Judging whether the colour of water, its odour or the vigour of trees were ‘normal’ or ‘abnormal’ was an impossible task for me. Entering and seeing Holywell Dene does not equate to knowing Holywell Dene. As a monitoring actor I lacked the basic condition of the ‘localness’ that would have transformed this expedition into more than a one-off sensorial experience. Without the features that locate an actor in his or her context, even the ‘monitoring tools’ I had with me (camera, notebook) were plain ‘objects’. Beefsteak fungi make good pictures though.

Introduction

PURE stands for 'Planning for Urban-Rural River Environments'. It is a transnational, European funded project, looking at water management issues specific to or arising from urban-rural contexts. As for the Seaton Valley, it is an area geographically located in the Northeast of England, named after the main river that flows through it, the Seaton Burn. Neither one (PURE) nor the other (Seaton Valley) is, nonetheless, merely what one learns through the formal structure that ties them together.

In this chapter I will aim to show that the PURE Seaton Valley (henceforth PSV) is – through the process by which it seeks to meet its planning objectives – primarily the setting for the formation and exercise of a distinctive conception of lay environmental monitoring. Lay actors in the PSV case are closely concerned with purity in nature, and they have evolved a compelling and unexpected way of monitoring and reinforcing the quality of their environment. The balance between the autonomy of action and collaboration with local authorities and environmental bodies or the way local actors manage to implement their notion of the 'natural environment' are just two of the various aspects that confer to their monitoring practices a unique character.

In the PSV, the local community actively engages in managing the local environment in a multidimensional way, reflected in the range of management practices they carry out. Monitoring the environment is one of these dimensions. Significantly, the group's close involvement with the local environment – understood to include the natural and also the social and cultural context as well – was in place before PURE came into being. Central to the understanding of PSV as the locus for the emergence of an independent and distinctive notion of lay monitoring is the realisation that its socio-cultural foundations and, indeed, basic practices pre-existed the framework provided by PURE[2].

PURE's own framework and objectives have, on the other hand, been shaped to a large extent by the European Union's (EU) commitment towards public engagement and participation in governance practices and decision-making. The EU's political intention to increase the number, type and methods of participation in relevant but diverse policy areas is one of the foundational facets of the international side of the project. Also stemming from European regulatory trends is the growing importance attached to water planning and its general

[2] For example, the community organisation Friends of Holywell Dene was set up in 1999 and thus pre-dated PURE (which ran from 2002 to 2006) by three years.

sustainability. In addition to the widely acknowledged problems of water scarcity and pollution, within the EU water has been increasingly valued as a cultural asset worth preserving.

Water quality, planning and participation thus constitute some of PURE's main focal points for investigation which, by extension, are to be found in the PSV as well. The following statement, extracted from the initial PSV webpage nicely captures all of those dimensions:

> "The Pure Seaton Valley project is a community-led project covering the whole of the Seaton Burn catchment. The aim of the project is to develop and implement sustainable solutions for the problems of flooding, dehydration and poor water quality within the Seaton Burn. The project has improved footpaths and the local habitat, as well as opening up areas for public recreation. It has also enhanced and highlighted local cultural and historical identity by setting up research groups to publish a report and a book on their findings."
>
> (http://www.pure.seatonvalley.org/)

The PSV is therefore a project about a local community's commitment towards its local environment, just as much as it is a project about policy "planning in urban-rural river environments" or about stakeholder involvement and participation in catchment area management. It can even be seen as a project about reinforcing local identities. These different meanings will come to the fore throughout the analysis of this case study, as the notion of environmental monitoring I want to explore will be captured through understanding how those meanings are woven together. It is relevant to stress this analytical intricacy at this point since, from a methodological point of view, it is only by following the actors in their diverse contexts that this story about meanings and monitoring practices can be put together.

And so once the background aspects of the PSV (from the large scale transnational project to the local setting) are in place, the chapter will turn to analysing the tangled local, 'situational' features. It is essential that these are captured; as I hope to demonstrate, it is from the continuous presence and engagement of the actors in the local geographical area that a particular relation to, and conception of, monitoring, the environment and nature will emerge. Moreover, I shall argue that it is this close-knit relationship with this place in its past and present 'reality' that allows these actors to classify and re-classify that same place in order to provide it with a future. Environmental monitoring is

indispensable in this process. Environmental monitoring itself results from – and produces – a sense of belonging that is key to the existence of an overall conception or what I shall call in this chapter a 'model' of the 'natural environment' in this locality.

It is this model of the natural environment that the local lay actors, through PSV, perform[3] in various locations throughout the Seaton Valley. Whether their monitoring is done in the context of a newly created wetland area in order to chart the recovery of re-introduced wildlife, or over an ancient woodland area going through reforestation using native species, it is a specific idea of nature that is being enacted. Equally, whenever a suspicious sign is observed in the watercourse and an alert is passed on, or the sighting of an unfamiliar butterfly noted down and its meaning discussed, it is that idea of nature that is being deployed – and indeed reinforced and reproduced. It is, finally, this very same model, and the guidelines it entails, that allows for these local lay actors to dispute, at times, the knowledge and expertise of environmental officials and with it the formal, regulatory notion of the environment and nature and of their management.

Crucially, the description of this approach as a 'model' – a categorisation that will be discussed in detail later on in this chapter – demands that one investigates the degree to which it is an autonomous, stable entity. One can say that the more this model is shared and accepted, the more it is deployed and therefore the more it stands as a legitimised frame of action. So far, the idea that this model results from a process that blends numerous, and sometimes contrasting, elements is, perhaps, its most visible feature. It is deeply rooted in the community's relationship with the rich socio-cultural and physical context and yet is not completely immune to institutional or policy influence exerted via PURE. The model relies on the actors' ability to interpret information which is mostly of a sensorial nature, but formal procedures and a diverse set of technological artefacts are frequently a resource for them as well. Furthermore, these lay actors seek to complement their system of knowledge by resorting to expert knowledge, but they do this in a selective fashion – retaining autonomy of action and decision-making as one of their guiding principles. There is, accordingly, a problem that relates to the way different, conflicting elements are combined and negotiated throughout in order to produce – or not – a model of/for the local environment.

[3] On performance and performativity in environmental social science see the discussions in Szerszynski et al, 2003.

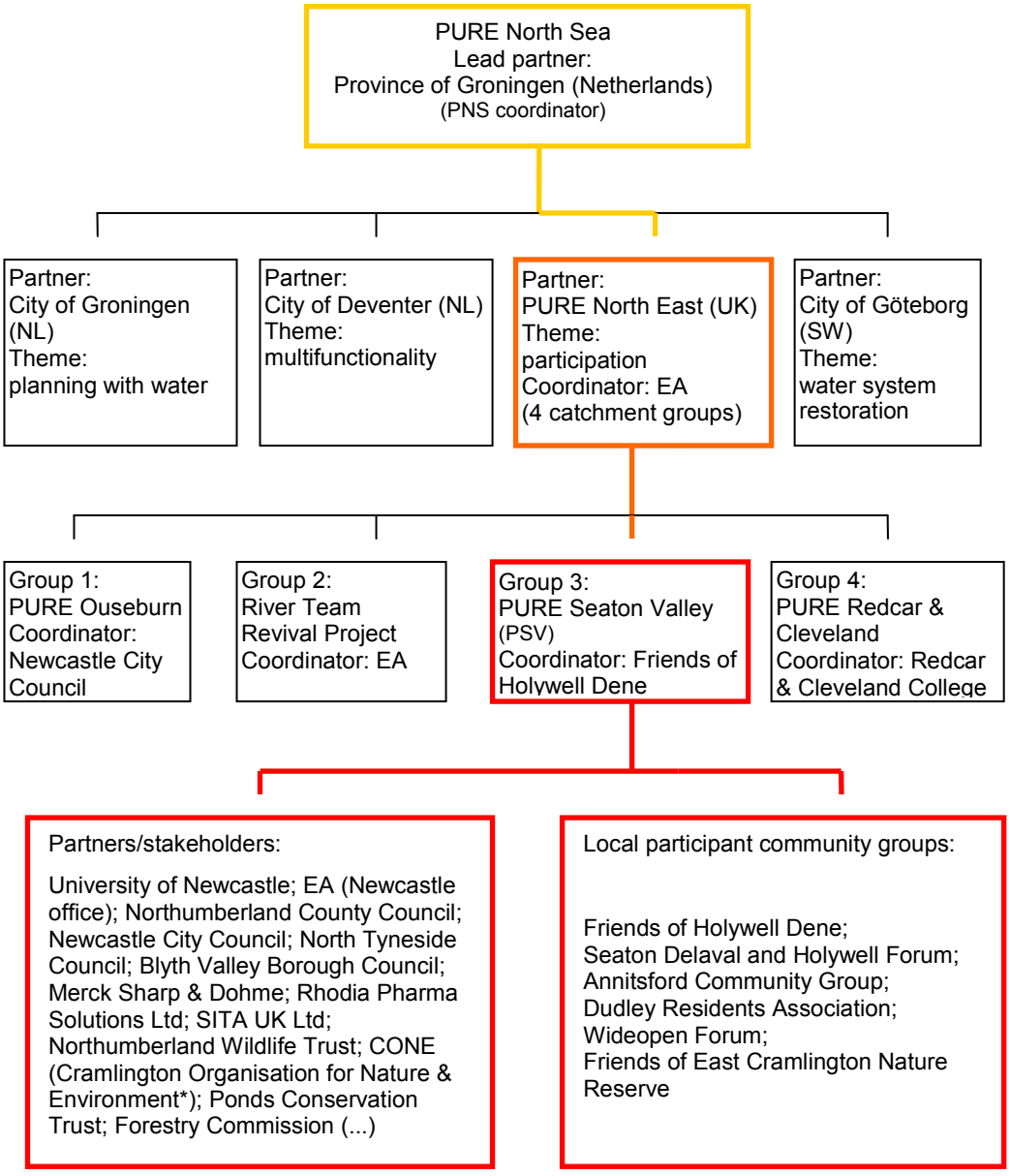
PSV or, in the words of the website, this “community-led project” is, one can say, very much sustained in a delicate balance between categories such as the new and the old; innovation and tradition; lay and expert; contextual and formal knowledge or, more broadly, between conservative and progressive views of the world. It is in local actors’ attempts to balance or manage the interplay of those categories that many of the underlying questions in this chapter lie. For example, within the Seaton Valley the translation of observations into meaningful information relies as much on a system based on the differentiated status of specific members of the local community seen as trustworthy[4] as on the use of technological devices capable of validating the observed and of formalising the language thereof; or – indeed – on the summoning of experts charged with the task of producing data from information previously collected and assuring it complies with regulatory standards.

As an acronym ‘PURE’ is open to flexible interpretations, in addition to the ‘authorised’ meaning tied to the individual initial letters in the official definition. There is, firstly, the common association between pureness and water. In its ‘natural’ state, fresh water is clean and unpolluted, and thus transparent. Secondly, PURE also suggests that there is still a chance of regaining some of that idealised state, in spite of human interference, by re-directing human action through appropriate management and planning. But, mostly, PURE fully translates the project embraced by local community groups: the restitution of a ‘primeval’ condition to their local environment, invoking an idea of its ‘original’ state and aesthetics. In this sense, local actors have granted a new identity to the place, where humans are perceived as the bearers and guardians of that identity and its performance. It is therefore in this sense that lay environmental monitoring can be seen as a tool allowing a higher-order theory of the environment and of nature to emerge.

[4] Much in the sense of the analysis of the role of the honour of the gentleman in the construction of reliable observations provided by Shapin and Schaffer, 1985.

Figure 4.1

At-a-glance I: Narrowing down the object
PURE North Sea structure & lay environmental monitoring



(compiled from various project documents)

*Cone is Blyth Valley Borough Council's environmental initiative for Cramlington.

4.1 - PURE North Sea or 'how to be PURE' on a large scale

4.1.1 - PURE rationale and the idea of spatial quality

Planning for Urban-Rural River Environments (PURE) is a transnational partnership involving three countries positioned around the North Sea, four main partners and a myriad of smaller collaborations, like those in the North East Region, the British partner. The other major partners are the city of Deventer (the Netherlands), the city of Groningen (also in the Netherlands) and the city of Göteborg (Sweden) (see Figure 4.2, below). It was a project funded within the Interreg IIIB North Sea Programme and it ran from 2002 to 2006.

Such a level of information would presumably suffice from a formal point of view, considering that the foundation from which lay-monitoring will develop corresponds to only a tiny fraction of the whole project. Yet, it is analytically relevant that further detail is sought even if at a background level. As I mentioned previously, wider policy and political trends are inscribed in PURE, from the larger project to the small-scale environmental monitoring practices. I will be turning to those now while aiming also to provide a comprehensive description of the project's rationale as a whole.

Figure 4.2
Map of PURE partners

(http://www.purenorthsea.com/basisframe.htm)

Water is PURE's main domain but it is not water alone that forms PURE's field of action. In the final reports of the project (named 'Guidebooks'[5]) one can read the following:

> "The aim of PURE North Sea is to develop and implement sustainable solutions for the problems of flooding, dehydration, poor water quality and the lack of spatial quality and identity in the rural-urban fringe zone."
> (The PURE Guidebook to Multifunctionality, February 2006: 2)

The idea that good water quality and enhanced water systems are a valid mechanism through which an improved general quality of a specific social and physical environment can be attained, seems to have inspired more precise objectives among project partners. PURE researchers refer to this notion of the general quality of a specific environment as the 'spatial quality' of the rural-urban zone. Within PURE, rural-urban areas are defined as having a mixed nature due to the intrusion of the 'urban' into the 'rural' in terms of land use and pressure. Such areas are seen as unbalanced, unsustainable and with little quality to offer to those that either live there (a broad category that accommodates several ways of 'living' in an area) or to those city dwellers who visit them for various recreational purposes or in search of 'nature'. These areas are, thus, viewed as hybrid entities, with mixed and messy identities.

It is worth attending to the notion of spatial quality adopted by PURE, a term that plays a central role in the consortium's approach. In spite of the fact that there is not an immediate and obvious definition provided in the project documents, the PURE authors supply an ostensive indication of its meaning. This notion is primarily examined within the theme of 'multifunctionality' (see scheme page 52), a theme led by the city of Deventer. I propose that through the analysis of the concept of spatial quality and isolation of its smaller units – which I call attributes – access can be gained to PURE's principal cross-cutting topics and, more importantly, to some of the aspects that are fundamental in defining the action (and the motivation for it in the first place) of the local groups we are going to meet in PSV. The leading characteristics of the Deventer team's conceptualisation of spatial quality are indicated in Table 4.1.

[5] Overall, six thematic Guidebooks were produced, one for each of the main "Themes" (Multifunctionality; Participation; Planning with Water; Water Systems Restoration) and two others that detail a) the project's appraisal and peer review system, entitled "The PURE Check Guidebook" and b) the project's approach to what is called spatial planning and water management, entitled "The PURE Guidebook 'Water Connects'". All the guidebooks are available for download at http://www.purenorthsea.com/basisframe.htm.

Table 4.1
PURE's notion of Spatial Quality

Characteristics conferring high spatial quality	Typical problems at the urban-rural fringe	Main attribute indicative of spatial quality
Spatial diversity (making the difference between urban & rural landscapes visible)	Urban & rural are indistinguishable; "clutterly mixed" (sic)	Landscape distinctiveness
High functionality (successfully combining economic & social functions)	Farming activities in decline, reducing economic activity & compromising the maintenance of landscape	Vibrant economic & social activities
Cultural diversity (making local history & identity visible)	Urbanization is a menace to rural landscape, history & identity	Consciousness of history and identity
Accessibility (access open to all social groups)	Difficulties for city residents to access these areas; visitors may give rise to negative impacts	Reasonable and fair access
Sustainability (combining physical, infrastructural & socio-economic levels)	Defective functioning of water leads to problems at other levels; need to solve water problems before urbanisation	Healthy and sustainable water systems
Attractiveness (importance of design & creative solutions, down to small-scale decisions over land-use)	Unattractiveness (absence of local solutions to conflicts over land-use)	Land use regulated to promote aesthetic attractiveness
Compatibility with the human scale	The local infrastructure has developed to promote transport through the area, not visits to it; thus, attractive local features are not readily accessible to a broader public.	A space accessible and appealing to visitors

(adapted and expanded from "Analysis of spatial quality in the urban fringe zone", The PURE Guidebook to Multifunctionality: 21)

The approach is broad, all-encompassing and has a view to foresight activities focusing on future developmental needs in fringe areas (PURE's preferred way of referring to its research units). PURE embraces the multidimensionality of the quality of the general environment much in accordance with current mainstream policy recommendations and regulatory instruments[6]

[6] Recent examples in the international context that bring cities and the environment broadly considered to the forefront of sustainable policy making include the report "Liveable Cities – The Benefits of Urban Environmental Planning", published in 2007 by The Cities Alliance (available in http://www.unep.org/urban_environment/PDFs/LiveableCities.pdf) or the UNFPA's "State of World Population 2007: Unleashing the Potential of Urban Growth (available in http://www.unfpa.org/swp/). At the European level the reference goes to the Thematic Strategy on the Urban Environment, adopted by the EU Commission in 2006 (available in

that call for the integration and inclusion of all relevant features (whether social, economic, historical or physical) and actors regardless of their technical preparedness. The proposal is that enhanced quality can be achieved in areas that have suffered from uncontrolled urban expansion if planning creates the conditions for a multiplicity of valued attributes to exist. Thus, the idea is not so much for the rural and the urban to fuse (and for the former to disappear in that process) but more for the maintenance of their distinctiveness in relation to the landscape, economic activities, social practices and representations – given that it is these that make for the attractiveness of these peripheral areas in ecological, environmental or wider social terms. The objective is, in a way, to organise these hybrid entities both in their physical and social attributes so that their condition works to ameliorate local problems and meet regulatory standards. Consequently, one can say that PURE aims at recognising and promoting some degree of authenticity for the hybridism of these urban-rural areas; to elevate an unclassifiable entity to a category that is valued for its mixed nature. Hence the emphasis on the "search" for the local history and identity of fringe zones.

Planning instruments are, ultimately, political tools. Their outcomes are political in that they regulate the use of space, its functional and social distribution, resource allocation or even who gets to access it and how. So, it is not just that urban planning or, in PURE's case, urban-rural planning can be the frontrunner of urban sustainability. Rather, urban-rural planning is a socio-technical object and as such one that is open for contestation and debate, and for which a novel approach is needed.

With this broad scope in mind, the PURE partners set out to define "themes" that, though detectable in all the sub-projects, were each taken up by one specific partner (as outlined in the scheme on page 52) in order to be more fully investigated. A brief summary of each of these themes can now be given:

- *Multifunctionality*: managed by the city of Deventer, analysed the multiple ways in which people value a specific area and how those values can be integrated in urban planning. As the authors put it "the heart of this multifunctional approach is to achieve a shared understanding of the values stakeholders attach to the area" and to translate values into "proposals for multiple land use" (The PURE Guidebook to Multifunctionality: 1-4). A methodology was developed consisting of three

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http://ec.europa.eu/environment/urban/pdf/com_2005_0718_en.pdf) where the role of cities in the realisation of the objectives of the European Sustainable Development Strategy is clearly stated.

basic steps: 1) value mapping; 2) inventing ideas for multiple land use and 3) reality check.

- *Planning with water*: run by the city of Groningen, looked into ways to give water a central place in the planning process. Its main claim is that "appealing plans should demonstrate the attractiveness of making water play an important role in design and use, management and maintenance of urban landscapes." (The PURE Guidebook on Planning with Water: 8). It produced a toolkit with a number of "guidance models" ready for planners to use: urbanisation models; catchment models; models for local (re)development and models for 'crossings'[7].
- *Participation*: administered by the North East Region (UK) provides a review and evaluation of the strategies followed by the partners in general but those adopted in the North East in particular. While offering to share their "knowledge and experience on participation in water management and spatial planning", the authors also make a point of saying that "the guidebook is not intended to be prescriptive or provide a definitive method which sets out how 'to do' participation" (The PURE Guidebook on Participation: 1). So, instead of models or proposals, the Participation Guidebook, offers a sort of reflection on their own experience organised under headings such as: initiating participation processes; approaches and techniques; outcomes and effects; and managing participation process.
- *Water system restoration*: supervised by the city of Göteborg, this theme is specifically directed at "decision makers and professionals working in the field of water system restoration" (The PURE Guidebook on Water System Restoration: 1). Drawing on the measures implemented within PURE in order to remediate water systems and rivers (in a "broad spectrum of problems (...) surface water management, over-fertilisation, flooding/droughts and the creation of attractive areas for both recreation and biological diversity" (The PURE Guidebook on Water System Restoration: 3)), it provides an evaluation of those measures and sets out a series of recommendations: a catchment scale approach, the production of a water structure plan and building ecological corridors, amongst others.

[7] This is PURE's terminology; it refers to crossing points between water courses and the road/ rail network.

4.1.2 - Planning through water

PURE assumes water as the basic infrastructure on which a whole development strategy can be supported. Water is seen as having the capacity to bring together heterogeneous groups, accommodating the diverse and often conflicting uses and meanings that those groups attribute to water by virtue of negotiation and joint planning. That is, as an object, water allows for an array of flexible interpretations to be put forward simultaneously: as an economic resource or a symbolic one, as a source of biodiversity or of aesthetic value, as the setting for recreational or technical regulatory activities. It is this flexibility that grants it a sort of plasticity that makes it adaptable – too – to PURE's objectives and the re-conceptualisation PURE aims for in the urban-rural zone.

Furthermore, water is the unifying element in this comprehensive approach to reinstating quality in urban-rural transition areas that PURE has called "Water Connects". Water is perceived as working both at the physical/material and cultural/immaterial levels, connecting urban and rural systems in multiple ways. As outlined in one of the guidebooks:

> "(...) water is the agent of change as it: physically connects water systems of the urban and rural areas; gives coherence to other spatial functions; provides a shared reference point to participants in decision making about spatial quality and identity, water quality and quantity; connects people and stakeholders and improves their mutual co-operation; connects theory and practice."
>
> (The PURE Guidebook 'Water Connects': 8)

In this process of becoming a key "player", water not only regulates but it is also regulated. The Water Framework Directive (WFD) (D2000/60/EC)[8] is, in this context, central to the unfolding of the project's foundations. Such an influence is mainly visible – and acknowledged – in the UK side of the project. For instance, the Guidebook on Participation (run by the British group) undoubtedly references it:

> "Plan production was informed by the experience of transnational partners but was also guided by the intraregional PURE planners' sub group that

[8] The Water Framework Directive (WFD) came into force on the 22nd December 2000 and is in the process of being implemented by European countries with the objective of delivering good chemical and ecological status in inland and coastal waters by 2015. The full text of the Directive can be consulted in http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2000:327:0001:0072:EN:PDF.

explored the relationship of these documents in the context of the changing English planning system and the impending Water Framework Directive."
(The PURE Guidebook on Participation: 13)

What makes this particular piece of European legislation such a forceful ruling? Its implications are felt broadly and thoroughly: in the status and value granted to water, in the defined quality standards, in the management and planning procedures[9], and in the types and range of actors called on to participate.

It was, too, the demand for participation within the WFD[10] that influenced PURE's research design. One of my interviewees who was directly involved in the process, explains the WFD's role in the following way:

"Right, the issue is why you seek participation from the communities; there's a requirement under the forthcoming Water Framework Directive to seek active participation to some extent and there's a recognition, I think, within the EA [Environment Agency] that as an organisation it's not something which we've done to a great degree. Perhaps, maybe not very successfully, it's generally been contentious issues where, sort of, broader participation has happened. So, yeah, there's a legislative driver, erm, there's also the sort of pre-emption of conflict I suppose (...)" (P14:9)

It is worth noting some aspects of this extract. The allusion to the 'legislative driver' is relevant since it refers, ultimately, to a top-down policy instrument aimed at implementing bottom-up practices; these instruments and the associated attempt to prevail over the reluctance of local regulatory bodies (as affirmed by my interviewee) to adopt participatory methods is perhaps the most efficient way of breaking down institutional obstacles to public participation. On the other side, if the 'pre-emption of conflict' is a seriously important political outcome that policy organisations obviously need to consider, no less significant is the possibility of it

[9] The river basin is the planning unit which very often implies the national restructuring of water management bodies. In the Directive's definition river basin "means the area of land from which all surface run-off flows through a sequence of streams, rivers and, possibly, lakes into the sea at a single river mouth, estuary or delta." (article 2, 13.).

[10] Among the many possible examples, I have chosen the following from the preamble: "To ensure the participation of the general public including users of water in the establishment and updating of river basin management plans, it is necessary to provide proper information of planned measures and to report on progress with their implementation with a view to the involvement of the general public before final decisions on the necessary measures are adopted." (46). In line with this European requirement, the EA (Environment Agency) has defined a set of guiding principles for stakeholder involvement: "Water for Life and Livelihoods: a strategy for river basin planning. A framework for stakeholder engagement." (EA: 2005).

becoming the main motivation for public engagement initiatives, avoiding confrontation or controversy, but ruling out earlier ideas about a broader public input into policy-making.

These very same background questions are analysed in a recently published article by EA researchers:

> "In the UK, over the past 30 years there has been a gradual intensification of stakeholder and particularly public involvement in water related issues, prompted in part by public fears and concerns and in part by wider changes in patterns of governance. With the introduction of more integrated approaches to water management as a result of the Water Framework Directive, the role of the stakeholders in water management is undergoing further changes." (Orr et al, 2007: 331).

In this context, PURE North Sea[11] was understood within the EA as an opportunity for testing participatory mechanisms. And, particularly since several models could be experimented with in each of the four partnerships built up in north-east England (as summarized on page 62), the scope for experimentation was an extra element to be taken into account:

> "Yeah… The EA has to deliver environmental outcomes and improving water quality/ land quality/ air quality and it realises that planning activity is often separate from the community and so the PURE project is trialling, piloting different approaches as well as achieving them. So, yeah, I mean we're appraising the success of that pilot activity." (P14: 3)

Despite the enthusiasm generated among social scientists[12], the turn to participation has essentially been received by policy actors as a sort of imposed obligation, in which inexperience, institutional inaptitude and the apparent gulf between technical and lay knowledge systems come across as reasonable justifications for their slowness in actually doing participation.

Still, the increasing familiarity with such procedures on both sides appears to be producing interesting outcomes. In relation to PURE, there seems to be some degree of correspondence between its objectives (as outlined a few pages

[11] Several other projects were supported by the EA with the objective of trialling different public participation approaches: the SMURF (Sustainable Management of Urban Rivers and Floodplains); Water4All (Sustainable management of groundwater through spatial planning), etc.. For an account of these see Orr, P. et al, 2007.

[12] Public participation, public engagement and governance studies have seen a huge development in recent years among sociology in general and STS in particular. A small and random sample is provided: Bailey et al, 1999; Rowe & Frewer, 2000, 2004 & 2005, Kasemir et al, 2003; Yearley et al, 2003; Irwin, 2006; Horlick-Jones et al (2007).

back) and the tangible results of PSV as evaluated by one of the principal members of the leading local community group, the Friends of Holywell Dene. It is an episode prompted by the final moments of the 'PURE Hike Seaton Valley'[13]. At the end of the tour through Holywell Dene, the group (which included visitors from the other international PURE partners as well as members from the four North East partnerships) gathered on a platform "for local children" over a "man-made" pond; this setting, the group was told, had been built – the platform – and dug out – the pond, formerly choked by weeds – with PURE funding. The day of hiking through numerous places along the Seaton Burn catchment was coming to a close and the group was encouraged to make comments or to ask questions. When challenged to single out a surprising outcome resulting from the group's work, the local group leader answered as follows:

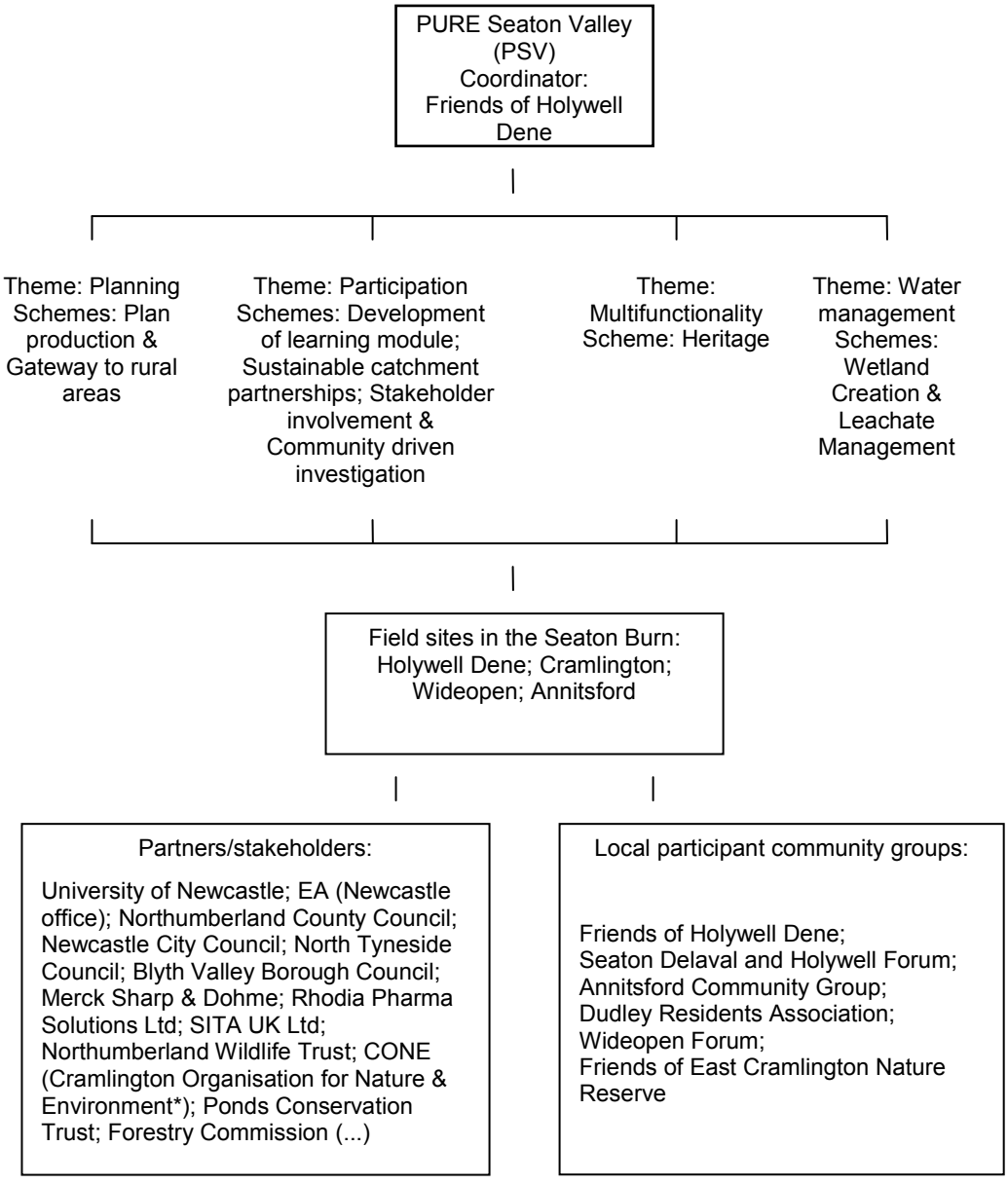
> "(...) as far as I'm concerned it's what we've achieved in these years, it's beyond my wildest dreams (...) wildlife, to have dippers actually nesting last year and bringing up their young chicks. And visitors very often are coming from Newcastle, from Gateshead and so on. I mean, Holywell Dene is now somewhere where they can go and walk through. And if you think about it, if you walk through Holywell Dene it is just another, what, 600 yards or so – half a mile – to the sea and then you can walk along the beach and then back up, and back up to Newcastle. It is a lovely combination of walks."
> (fieldwork notes, the PURE Hike, 5th March 2005)

"A lovely combination of walks" indeed as I could testify myself, but Holywell Dene as enacted by the local community group is also about achieving a good balance between the rural and the urban, between nature restoration and making it accessible to people, between improving biodiversity scores and opening up those areas to recreational uses. And this is what PURE is.

[13] PURE working methods included the 'PURE Hike', field visits made during the transnational meetings held at the various project locations in order to familiarise all the participants with the local settings and projects.

Figure 4.3

At-a-glance II: outline of PURE Seaton Valley
Thematic structure & relevant actors



(compiled from various PSV documents)

*Cone is Blyth Valley Borough Council's environmental initiative for Cramlington.

4.2 - PURE Seaton Valley: contextual grounds and performative practices in lay environmental monitoring

"I mean, Holywell Dene is now somewhere where they can go and walk through."
(Friends of Holywell Dene leader, fieldwork notes, the PURE Hike, 5th March 2005)

This sentence, selected from the preceding passage, is remarkably meaningful in the light of the underlying quest for lay environmental monitoring practices: it signals the transformation of a physical area, Holywell Dene, very clearly. The 'now' at once sets out the differences in time and space that have occurred: to the demarcation point between the present and the past corresponds a wholesale change in the organisation and constitution of the very area, altering its essence and identity. Concurrent with these transformations, Holywell Dene is reconceptualised by the actors who closely engage with it, in a process that redefines interactions and how these are interpreted. The moment to which the sentence refers makes visible two ways of 'being' Holywell Dene; in the transition from one to the other, environmental monitoring emerges.

An explanatory note is now needed before I proceed. For the sake of the clarity of the argument, the reader needs to be introduced to the key actors (from all those listed in the 'At-a-glance II' scheme, on the previous page), which are going to be found in the analysis that follows. There is no straightforward way of specifying those entities: the interplay between them and the various levels to which they are involved acquire a dynamic element that is relevant to the picture. Hence, PSV the institutional "umbrella" (whose most visible outcome within the PURE project is the production of the Seaton Valley catchment plan) is, also, PSV the "community-led" project (www.pure.seatonvalley.org), meaning that it is the local groups who lead the way in the direction and actions of PSV. Thus, 'PSV' and 'local community groups' could at times be used interchangeably. Moreover, among the various groups that take part in the project, the Friends of Holywell Dene (FHD) is the coordinator and allusions to 'local community groups' will mostly be made with the FHD in mind[14].

The composition and organisational culture of the FHD – a group that was set up in 1999 – will be described in the following pages. It will become evident that more than the formal position granted by the project structure, it is the work

[14] As has already been the case up to this point in this chapter.

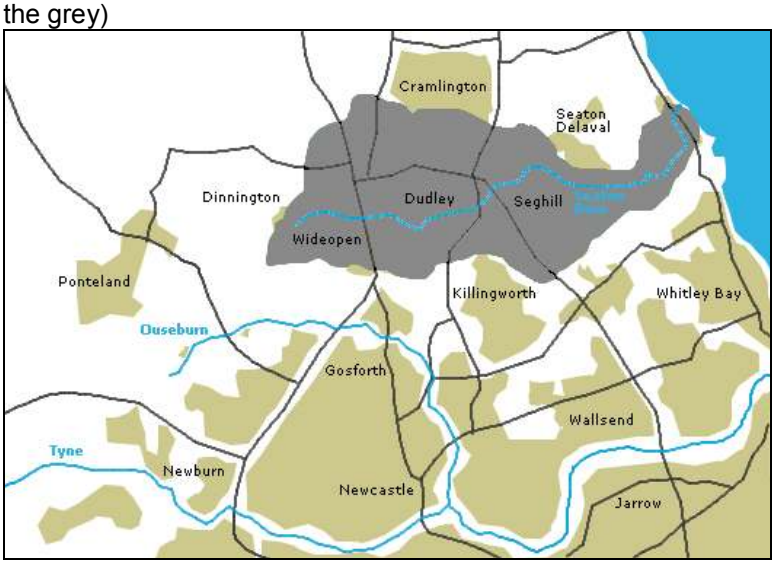
and the role that the FHD have taken upon themselves that have positioned them as the leaders and the major reference point among the other groups. Similarly, in relation to the distinctive physical and geographical features, although larger in size and in meaning, the Seaton Valley may, every so often, be taken to mean just Holywell Dene, a section of the overall valley and the woodland area where the FHD locate their action, and one of the PSV sites. The multiple and overlapping contexts in which the actors and their actions are embedded make for much of the difficulty in offering a single, comprehensive descriptive framework.

4.2.1 - Locating the context, unlocking contextualities

The Seaton Valley is located north/north east of Newcastle; through it runs the Seaton Burn, the nucleus of the catchment area (Figure 4.4, below). The river is described thus in PSV documents:

> "The Seaton Burn flows for approximately 15 km. From its source at Dinnington, 10 km to the North of the centre of Newcastle, through the former mining villages of Seaton Burn, Dudley, Seghill and Seaton Delaval. (...) At the mouth of the Burn lies Seaton Sluice, a small harbour, drained by means of a 300m long, five metres wide cut."
>
> (The Seaton Burn Catchment Plan, *Work-in-progress*, March 2005, no page number).

Figure 4.4
The Pure Seaton Valley Catchment Area
(solid grey area; beige shading indicates built-up areas, some overshadowed by the grey)



(adapted from http://www.pure.seatonvalley.org/plan_production.shtml)

This area falls easily into the urban-rural category from PURE's lexicon. The Seaton Valley is neither too close nor distant enough from Newcastle to have an autonomous identity. If it is not typically urban, it is not typically rural either. Furthermore, the industrial activity that for centuries shaped the landscape and the meanings people ascribed to it, came virtually to an end in the early 70s, when most of the coal mines were closed. Accordingly, the river's main environmental problems reflect the variety of uses made of the space (as described in the PSV website):

> "The Seaton Burn currently suffers pollution from disused mine spoil heaps, storm sewerage overflows, industrial effluents, refuse tipping, domestic washing detergents and agricultural chemicals."
> (http://www.pure.seatonvalley.org/seaton_burn.shtm)

Within PSV, environmental problems are predominantly interpreted within a contextual framework. There are two main reasons for this. The more straightforwardly technical aspect arises from the notion that environmental problems ought to be addressed at source. Therefore, water pollution, for instance, is positioned within the context of, among other things, mine water, leachate from abandoned mining spoil heaps, leachate from disused landfill sites, agricultural chemicals and sewage in the Seaton Valley. The rather more recondite reason is the idea that, by bringing the context to the forefront of environmental problem-solving, the local community is simultaneously acting upon the bonds on which its own identity is supported. The underlying issue can be better apprehended in the form of a question: can a place 'exist' when it is essentially defined by what it 'is not', as is the case with the Seaton Valley (neither urban, nor rural, and no longer a mining area)? The problem is not new and it has propelled all sorts of answers, from the quest for what Anderson (1991) has famously called the 'imagined community' to a revival of cultural traditions held to be original to, and defining of, the identity of a region.

The local groups of the Seaton Valley can be said to have understood from early on that a full grasp of environmental problems, the design and implementation of the 'best' solution, is only possible through an articulated relationship among the social, historical, economic and industrial local conditions. Dimensions such as a forgotten past, an under- or un-valued cultural heritage or a loose sense of place are brought to the front of environmental protection.

The selected "themes" and "schemes" in PSV among which are 'Stakeholder involvement & Community driven investigation' and 'Heritage' (see

scheme At-a-glance II, page 62), certainly illustrate this point. But a more fruitful example is provided by the 'Constitution' of the Friends of Holywell Dene, adopted in March 2000. Point 2 "Aims and Objectives" reads as follows:

> "2.1 To protect, preserve, maintain, restore and improve the natural beauty of the area of ancient woodland known as Holywell Dene by involving volunteers from the local community in all aspects of the Group's work.
> 2.2 To foster a sense of ownership by the local community by improving access to the facilities in and awareness of, the Dene, so that everyone can enjoy the use of this rare area of woodland." (Friends of Holywell Dene Constitution)

Admittedly, these objectives coincide with those of groups like the Seaton Delaval and Holywell Forum, the Wideopen Forum or the Friends of East Cramlington Nature Reserve (Figure 4.5 offers a more comprehensive sense of the area). While I do not have other evidence for this assumption than the insights acquired from the visits to the field and from contacts with members of the various local groups, it seems reasonable to think that their shared basis in the catchment area leads these groups to adopt very similar principles. Local groups do not only share a common industrial past and its environmental legacy. Mining has, at the same time it extracted coal, offered the Seaton Valley a 'cultural heritage', a landscape and a defining economic activity that provided for housing, schools, the local church and the pub.

Figure 4.5
Detailed map of the Seaton Valley area

(Google Maps)

In this regard tragic events, too, may make up part of the local history. The 'New Hartley Pit Disaster' (1862)[15] – as it is known – is a recurrent topic in the narratives that project the past into the present. There are a number of ways through which this objective is achieved: PSV reports; local groups' work-in-progress documents; studies commissioned by the EA; my own interviews when this event is recalled as one whose memory is worth preserving. Such is the case of this member of FHD whose life was in large part lived in close proximity to the place of the accident:

> "(...) because of the pit disaster in New Hartley and the fact that my garden, the garden in the house we used to live in, was only about 30 feet away from where the pit-head was. (...) we had a raised wall built into the front of this memorial garden 'the pit disaster in New Hartley' (...)" (P5: 2)

A less personal but nonetheless impressive account is found in one of the studies commissioned by the EA:

> "Nearby the Hartley New Pit, is remembered for the catastrophe of 1862. The iron beam of an engine used for pumping water snapped in half and fell down the shaft, filling it with rubble down to the workings. This was the only entry to the mine – fresh air was cut off from the men entombed below. The bodies of 206 men and boys were buried in Earsdon churchyard." (Doyle, 2004: 8)

Once the peak of the mining industry was attained[16], an inevitable decline hung over these communities which became more pronounced in the mid-seventies, intensified by Britain's economic turn-down and the shift away from coal in UK energy policy in the 1980s. The villages were collapsing from a social point of view and left with the remains of the mines which included heavy pollution of both soil and water. By retelling past events and erecting a collective memory of the past, community groups aim at reinforcing the capacity to act upon

[15] The 'New Hartley Pit Disaster' is, perhaps, the best known accident of a well documented list of similar events that happened in the area through the years. The social and economic impact of 206 deaths (numbers vary slightly from source to source) in a small community (some documents mention around a hundred miners' cottages in the village) is obvious and the disaster's consequences necessarily wider. In the years that followed, measures were taken to improve miners' safety and the existence of two shafts to access mines was made compulsory (McCutcheon, 1963; 'The Hartley Mining Disaster' in http://www.bbc.co.uk/legacies/work/england/tyne/article_1.shtml [accessed 16 November 2005]).

[16] Various PSV documents point out that, for example, the East Cramlington colliery employed 3901 men in 1909. By the end of the Second World War, there were 70 collieries opened in the whole of Northumberland region, with around 70000 miners (see Doyle, 2004).

current problems. History has, in this sense, a bright side too. The industrial past that brought renown and wealth to the region cannot be wiped out; the Seaton Valley was for centuries a prosperous place; capturing and preserving that image is an important part of the shared sense of belonging within the community. In this process, even the chimney-smoke acquires an unexpected allure:

> "I mean, when I first used to come up to Northumberland when C. and I were first courting, some 30 odd years ago, I mean I can remember walking along the road seeing the tanker engines pulling the coal-trucks backwards and forwards and the smoke in the air from the pits and all the rest of it. Now, we haven't even got a pit in Northumberland." (P5: 10)

Despite the risk of romanticising harsh conditions, glorifying or valuing the local history is also and, perhaps foremost, a mechanism through which the surrounding environment can be brought into teaching and learning, a means through which to inscribe it with renewed meaning. Firstly, this is because the link between the two is evident, as the person in charge of the local history courses[17] outlines:

> "It's a connection with the area, the local history. Here in southeast Northumberland, this was one of the biggest coalfields in England at one time, the whole place is peppered with coal mines. Holywell Dene has probably 50 coal mines up it dating from 16-something. So the whole Dene has got all these holes in it somewhere where you get leaching out of the mines into the stream." (P8: 5)

But, secondly, the educational courses for local people were a fruitful idea in the opinion of one of the leading members of the community groups, because their structure was designed in line with the principle of closely involving the participants with the context:

> "(...) we've done courses on local history (...) which have been very, very popular. (...) we don't sit people down and tell them such and such lived here, we ask them to go out to the different sort of centres and research for themselves, and we're hoping – either at the end of this year or early next year – to put together an exhibition of photographs and we're doing a booklet." (P1: 10)

[17] The FHD organised a series of courses throughout the length of PURE on various subjects, such as local history and water quality, all made possible through PSV funding.

In line with this strategy, it is not uncommon to find references that date back to the twelfth century[18] in documents that compile the history of the Seaton Valley re-addressing it as 'heritage'. Yet, heritage and the local narratives that shape it are much more diverse in their nature than the notion of 'history' usually entails. It goes beyond the 'historical facts' of industrial and economic development to include legends and myths or even simple stories of local ordinary people in clear contrast with the "notorious Delaval family" (Doyle, 2004: 7). The following story, which I have entitled 'The cornmill and the lemonade', was told in one of my visits to the field by one of the FHD leaders:

> "You're standing now on the site of the old cornmill and in fact if you look behind you, you can see the end of the cornmill (...); somehow they got the water all the way down here and turned the wheel and there was a house here next to the mill and old people – not me because I wasn't born in this area, but my wife and all her contemporaries – can all remember riding down here and getting home-made lemonade from this lady who used to live in this house. There was no running water, there was no electricity. There're the stepping stones which unfortunately you can't see which go across there [pointing to the other side of the river], just down on the other side is the remains of the well where they used to go and get their water from and the tenant farmer, B., when he was a boy he used to live much further up on that side in a thing called the pumping house which used to pump water out of one of the mines, and he can remember his father coming down each morning, all the way down there, get the water and take it back up there. So these stepping stones are very, very ancient." (fieldwork notes, the PURE Hike, 5th March 2005)

The cornmill story, which makes up in mundane detail about everyday life for what it may lack in grandeur, is really about capturing and expressing a common idea of the 'normality' of the place. And since there is now no cornmill in the Dene and the likelihood of meeting a lemonade-maker lady is beyond any reasonable expectation, the evidence of a pile of stones is reinforced by the corroboration that 'old people' and the 'tenant farmer' had, indeed, lived those sort of lives in the Dene. It conveys the way in which Holywell Dene is

[18] A few random examples: "Guy de La Val came to England with the Normans. Hubert de La Val, nephew by marriage to William the Conqueror, built the Church of Our Lady in the Manor of Hartley in 1102."; "Hartley was an Anglo Saxon settlement and coal was mined there from 1291." (The Seaton Burn Catchment Plan, *Work-in-progress*, March 2005, no page number).

apprehended by local actors. This story testifies how an unpolluted and pleasant past, located not too far away in time – as demonstrated through its links to the memories of 'contemporaries' – can be given a sense of reality and achievability by means of its narration and performance.

The outcome of confronting the stories and the imagery of the past with the sour environmental inheritance of the Seaton Valley is twofold: it underscores a dimension of longing for an idealised natural environment on the part of local actors, and it simultaneously legitimates a strategy (and its principles) that has 'nature restoration' as its defining characteristic. This course of action has been particularly relevant in contexts where mining activities were prevalent and influential in producing a unique landscape that has spoil heaps as a decisively conspicuous aspect.

The Seaton Valley has, too, been essentially regarded as a region whose potential (re)valuing is conceived as in direct correlation with people's ability to reclaim former environmentally damaged areas to nature. In this light, the restored landscape of the Seaton Valley is described in PSV materials as:

> "Coal mining sites and restored sites, including restored deep mine spoil heaps are a prominent feature. Blocks of mixed and coniferous woodlands dominate the reclaimed colliery sites, and broadleaved woods are found around the steep sides of the Seaton Valley. (...) Areas of open water and wetland, due to subsidence are an important water feature in the restored colliery landscape."
>
> (The Seaton Burn Catchment Plan, *Work-in-progress*, March 2005, no page number).

For the purposes of this chapter, two dimensions matter particularly when restoration is considered: water pollution and the aesthetics of restoration. I shall argue that local groups harbour strong commitments about both these issues – taken broadly to accommodate lay and 'situational' interpretations – and show the grounds on which this claim is sustained. After all, it is these grounds that make up the fabric from which lay monitoring results. Meanwhile, it is worth briefly considering some aspects of those dimensions. In a report prepared for Northumberland County Council about "Water quality assessment and passive remediation options for the East Cramlington coal spoil heap, Northumberland",

the authors[19] summarise the situation in this Seaton Valley site in the following way:

> "The site at East Cramlington has historically been associated with intensive coal mining activity and industries such as clay pits, brickworks, tile-works and wagon-ways. The coal mining activities produced large volumes of colliery spoil and mine waste which were heaped close by the mine workings. Following the closure of the mines the spoil heaps and derelict colliery were reclaimed according to the working practice of that time. This typically involved reshaping and replanting the land and associated spoil heaps, with species such as larch, pine, birch and beech, and the installation of French drains to collect and channel water from the site." (Palmer & Jarvis, 2005:1)

As the authors demonstrate throughout the report, the "point sources" that were investigated (three, which directly or indirectly impact on the overall quality of the Seaton Burn), reveal the typical pollution from coal spoil heap drainage: iron, aluminium and acidity. This combination colours the water with a characteristic orangey / ochre tone as the picture below illustrates. It is a picture taken just after a water sample was collected by one of the experts involved in the study during a visit to the site in which I took part.

Picture 4.1
Pollution in East Cramlington: a stream with V-notch weir

(East Cramlington, 19/05/2005, photograph taken by the author)

[19] These are experts from the University of Newcastle, one of whom established a close collaboration with the Friends of Holywell Dene supporting their water quality monitoring programme (see page 76 onwards for details on FHD's water monitoring).

Despite being indisputably visual and in accordance with the prevalent aesthetic notion (or the 'mental model' as we shall see someone refer to this in the next chapter when explaining why 'rivers are blue') that associates water with purity and transparency, it is not this aspect of the debate about restoration that I want to bring into the analysis here. Rather, the wider connections I intend to establish with the FHD practice of monitoring nature and the environment, will be made in relation to the physical prominence of spoil heaps. Indeed, some concern has been voiced in relation to what restoration has meant for the landscape:

> "The collieries are gone and all the traces of them have been obliterated. The pit head gear is gone and even the spoil heaps are graded, landscaped, grassed and planted with trees." (Parks, 1999: 1)

Though the author is mainly referring to a particular example in Wales, the driver behind restoration is, in his opinion, universal:

> "Excavations, pits, quarries, spoil heaps and tailings ponds are considered ugly, and are 'visual pollution'." (Parks, 1999: 1)

This condition makes them into a 'problem' and explains the attempt to recreate a landscape – an environment – in the image of that which pre-existed the 'workings'. While the author is in favour of cleaning up these areas of pollution, he is critical of the view that they should be returned to some pre-industrial 'natural' state, arguing that what exists there is already natural (in some cases at least); that is, ecosystems may have formed in the meantime and, on the other hand, these landscapes exist in their own right, as the classification of some of them as 'Sites of Special Scientific Interest' (SSSI) illustrates.

Restoration therefore is a contested issue. It is important to be aware of this when exploring the role of lay monitoring in the Seaton Valley area. For instance, what is it that is being restored when a certain idea of nature is pursued and subject to monitoring: nature itself or the ties within and between the community and the space that were severed by virtue of the economic and social disruption that followed mine closures? In this sense, 'nature' is no more than the visible face of a wider cultural reinstatement that has community and identity as its main defining elements. Put differently, nature and culture are indisputably co-produced in the same process. Equally relevant is to investigate what notions of 'nature' are deployed and what mechanisms intervene in the process of opting for one version instead of another. And given that aesthetic considerations usually

give rise to a frame of corresponding practices, it is opportune to ask whether actors (either policy, lay or expert actors) operate with a hierarchy of types of 'being natural'. Do they have a frame of action that decides (beyond ecological and safety standards) that one course of action should be considered more appropriate than another? To use an example provided above, are the wetland areas of Seaton Valley that resulted from mining subsidence in any way less 'natural' than those excavated ponds that seek to replicate an idea of the 'original' environment?

4.2.2 - On the way to producing Holywell Dene

The Seaton Valley is not short of classified natural areas. There are already a number of 'local nature reserves' and even an SSSI[20] and, according to my interviewees' comments, some more places are on their way to being granted a protected status should the local groups succeed in their plans. Restoration in one area encourages new activity elsewhere: once groups triumph in getting local authorities' support, in dealing with paper-work, in gaining a lease over a patch of land, other areas quickly fall into the category of 'neglected environment' in need of being brought into the realm of nature. This is the perspective of the leader of one of the local groups:

> "It would be perhaps quite nice if we could work with the local land owner, (...) get a grant in future years and perhaps restore that. And not only would it be much better for wild life, local people would appreciate it as well because a lot of them just think it's a mess! (...) Also there's other small pieces of land in the area: there's a small piece in the Seaton Burn, that has been neglected (...) for a number of years. It would be wonderful if we could get involved in doing something there for the community before the council decide to do something with it." (P3: 11)

Holywell Dene, too, has been a local nature reserve since 2002. Yet, only three years before such a scenario would have been unthinkable. The "steep sided ancient semi-natural woodland" as it is now publicised in FHD's leaflets had been taken over by the cattle and Dutch Elm disease. As for the river, it could

[20] Such is the case of Big Waters, "one of the largest bodies of open water in SE Northumberland." (The Seaton Burn Catchment Plan, *Work-in-progress*, March 2005, no page number). The pond originated in mining subsidence in 1920's and was later reclaimed by Northumberland County Council under the scientific guidance of the Landscape Department of the University of Newcastle. The SSSI status came in 1985 and the site is currently recognised as part of a "wildlife corridor which stretches from Gosforth Park to East Wideopen" (ibid).

have been described as an open conduit for sewage, coal-mining pollution and refuse tipping, among other substances. The story of the old car that was removed from the stream is widely celebrated among Friends – an anecdote recounted in virtually all the interviews – in a way that makes this episode into a new 'myth', and one to have its strength reinforced by the evidence of pictures (below, as shown on the PSV website).

Picture 4.2
"Part of an abandoned car being removed from the Seaton Burn" (PSV caption)

(http://www.pure.seatonvalley.org/)

Access to the grim past of Holywell Dene is better gained through the accounts of those that have been actively producing the 'new' Dene. This description by one of the leading members of the FHD is rather graphic:

> "(...) you could see sewage and lots of other stuff actually in the water and you could also smell the different smells, it smelled differently at different times (...); a little bit upstream from where we walk regularly there was a pumping station, which had a big grill on it, which had obviously being discharging into the water because you could see all the sewage on the grill." (P1:3)

More details are put in place with another impressive version that includes coal mine dust; I have kept the quote long to preserve the minutiae:

> "If you talk to people of my age who have lived in the Seaton Valley area all their lives, (...) they will tell you (...) you could look at the water and you never knew what colour it was going to be. (...) it was either going to be black or orange or yellow, and the mud at the banks of the Seaton burn were – even I remember this, 20 years ago – were black with coal dust, I mean, you could literally get the coal dust up. And the other thing which used to happen – and this was probably about up to 10 to 12 years ago –

when it rained heavily you used to literally get raw sewage coming down the Seaton burn, you know the pipe – you remember that big pipe you saw with the manhole. The manhole covers used to blow off and all the raw sewage used to come out and flow off down; the smell and the whole thing was horrendous!" (P2: 9)

While the manhole problem was essentially solved after a suitable treatment station was built in Holywell (the village), water pollution remained as one of the central and primary concerns of the FHD when they were set-up in 1999. Indeed it was this underlying preoccupation and the conviction that the stream was key to the whole environment that led to the development of a thorough programme of water quality monitoring within the group (a topic I shall return to later in this chapter).

A reference is now needed to the somewhat unexpected role played by the cows in the FHD's plans for the area. Removing the cows that used to graze and find a shelter for the winter in the Dene is, in fact, viewed within the group as having been one of the indispensable conditions for them to have been able to act. Another one was the 99-year lease that Blyth Valley and North Tyneside councils[21] negotiated with the owner of Holywell Dene. Blyth Valley Council gets to be even more pivotal in bringing the FHD to life: the chairman of the group pinpoints the council's announcement in a local newspaper of a meeting with a view to establishing an organisation with reference to Holywell Dene, as the factor that prompted some locals to get together in the first place. Through this institutional support, others followed which meant some degree of initial funding as well. The Forestry Commission, for example, helped in relation to the cows, as the chairman recalls:

" (...) they gave grants (...) to fence the Dene, erm, to stop the cows coming in and put water gates in as well, you know, to stop them getting up, walking up the streams and so on. It was the lease and the fencing which made me realise that there was a potential there (...) before that there was no point in doing anything, I mean, you know as well as I do, if you put 100 cows into a steep sided valley you can finish, I mean, you might as well go away and let it deteriorate." (P2: 3)

The negative impact of the cattle on the ecological regeneration of the Dene had been felt for years. But the cows came to be responsible for yet another

[21] Administrative arrangements dictate that Holywell Dene – like other places in the Seaton Valley – is shared by two councils.

crucial aspect in redefining the Dene: safety and accessibility. The resemblance between these intentions and some of PURE's notions is self-evident. An important point to retain however is that the group devised an environmental programme prior to PURE's existence. For a brief explanation of the safety and accessibility issue and its relation with the cows, the FHD's Constitution and the objective of making the Dene accessible have to be evoked (as pointed on page 63). The FHD agenda for the Dene involved balancing the dimensions of its naturalness and wildness with those of its organisation and ordering – as ascribed to the Dene by the Friends. Making the Dene a safe and open place for all meant that risks and obstacles had to be minimised if not totally eradicated (the Dene is not a park I was told [P11], a distinction that relates to the existence of competing notions of nature). Excluding the cows from the Dene was the first step in the re-ordering of the space. Then came building or repairing footpaths, opening up new areas, putting in stiles, clearing vegetation. Opening up the Dene is parallel to closing it down, fencing it, defining boundaries and entrance points, excluding what does not belong. Obviously, when one gets to this point, the 'reign of the cattle' is replaced by Holywell Dene 'the ancient woodland', as performed by the FHD. This mutation in the Dene's meaning is captured in the following quote:

> "Well, I think that if you need Wellington boots and this sort of thing to go for a walk in the Dene they are not going to be the slightest bit interested in the surroundings, they will walk along looking where their feet are going and what you want are paths which are not tarmac motorways but a path where you can actually walk along and look around at the same time (...). When we started it up, the FHD, I mean, there were areas (...) virtually inaccessible pure and simply because the paths were in such a bad state, erm, and of course we had the cows and the bulls so, you know, all you had to do was have a bull standing on a footpath and nobody would pass. So, access is the prime thing (...) Just walk along and look around and walk back (...); they don't want to spend their time picking and churning through mud and pushing through nettles and brambles and so on because they won't go and if they don't go you don't see anything and you don't get any reports." (P2: 17)

4.2.2.1 - Who are the 'friends' of FHD?

Surveying the Friends in their socio-economic circumstances is not key to understanding their monitoring practices and it certainly was not one of the central objectives of the research. There are, though, interesting issues arising from some of the 'situational' components of the members of the FHD that concern, for instance, who the FHD actually represent and what the characteristics are that emerge as common among those actively involved with the group's activities. In this attempt to profile FHD members I have used a number of materials: data from the interviews (respondents were questioned about general background elements such as their geographical origins, the amount of their lives they had spent in the Seaton Valley area, their explanation for their interest in the local environment and so on), information from the FHD's newsletter and their website, and various other grey internal documents.

The Friends can either be individual or family members which means paying a £3 or £5 annual fee, respectively. The introduction of the membership fee was a 'reality check' measure since the initial enthusiasm was not followed by a similar level of participation in the activities. After that, numbers stabilised at around 60 members[22]. Still, as ever, membership does not equal active engagement in the daily life of the group for all: ways of being a member vary widely from paying the fee and maybe going to the annual "Family Fun Day"[23] to a participation that involves actual physical work in the Dene, trimming, cleaning, fencing and so on. The 'typical friend' could be described as follows:

> - He or she is a retired or middle-aged professional (volunteer work requires time: "these've got to be jobs which really can be done by people that have time to do it" [P2:12]) and was brought up or moved to the Seaton Burn area after having lived for a period of time in an urban context ("I was born in the area and I went away to work for some years, then I came back" [P12:1]). The 'friend' has long developed an interest in specific issues that they apply to the context they are engaged in, and through which they came across Holywell Dene in a pleasurable way: local history and stories, nature and wildlife, forests, etc ("we like searching out books about our local history here (...) and photographs (...) we have a collection of local maps as well" [P6:1]). Furthermore, this 'friend' occupies his or her free time with

[22] Data provided by the chairman of the FHD in 2005 and confirmed by the most recently published newsletter, already in 2008.

[23] These "days" are annual events organised by and for the families of the Friends. The idea is to have everyone involved, from the production to the actual enjoyment of the displays, games and numerous activities prepared.

activities that lead to them spending long periods “out and about” in Holywell Dene or the in surrounding countryside: walking or dog walking, bird watching, photographing nature or simply observing it (“used to enjoy hugely walking down to the sea through the very varied woodland landscape” [P11:1]). Another typical thing for the ‘friend’ to do is to take part in organisations that loosely reflect FHD interests: the Royal Society for the Protection of Birds (RSPB); the National Trust; the Anglers Conservation Association; the Woodland Trust; Friends of the Earth, among many others (“when I was young I joined things like the YOC, the Young Ornithologists Club, which is a small part of the RSPB, I’m a member of the RSPB” [P13:1]). Finally, in order to further improve their knowledge of the local natural environment, he or she takes part in FHD’s events led by fellow members or people belonging to other organisations (“Spring Flower Walk – a stroll through the Dene to look for and identify the wild plants/flowers”; “Bat Walk and Moth Trapping – (...) an open event as part of Local Nature Reserve Week. There will be a short opening session explaining all about how bats live and catch their food, followed by a walk listening to and identifying bats using bat detectors (...)” [FHD Spring newsletter, 2005]).

This is the ‘Friend’ of Holywell Dene: someone whose life has long been woven together with the space in its multidimensionality. It is this dimension of a deep immersion in the lived area that this interviewee depicts:

> “I think that what underpins my feelings on the subject is that this is the place where I was born, I have a sense of entitlement, I feel as though I own the place and that’s why I don’t like people spoiling it.” (P6:1)

4.3 - Monitoring Holywell Dene: from the mundane to the ‘out of place’

> “they won’t go” “you don’t see” “you don’t get any reports”
> (P2: 17; from the quote on page 73)

There is some sort of deliberate intention behind the words of the FHD chairman that reveals more than the underlying logic of FHD’s management strategy for the Dene. This intention also says that items such as shared responsibilities and broad participation are part of the Friends’ agenda as well. Moreover, much in the spirit of what Mauss has called the logic of exchange

(1967), there is the expectation that whatever is 'seen' in the Dene is passed on, so as to reciprocate the 'gift' constituted by the resurgence of the Dene.

"To go, to see, to report" can thus be taken to represent the general understanding about monitoring and its practice entertained among local community groups. In this way, the act of seeing results from being 'in' the place in order to observe and detect what is 'out of place' (Douglas, 2005), i.e., to report. The straightforwardness of that apparent formula may be deceptive however: these local actors operate with a series of categories and procedures in order to classify and organise what is observed that is far from undemanding. Moreover the object of observation – and the method applied – is itself 'pre-ordered' to an extent by those categories negotiated in social interaction. As Douglas pointed out, eliminating 'dirt' is an effort to organise the environment (2005: 2). Similarly, in deciding what is 'out of place', the FHD are naming and granting a place to that which would not otherwise "fit"; Holywell Dene gains an order and its identity is relatively stabilised (as I will demonstrate, however, negotiation is never completed).

In what follows, I will be disclosing many of the unexpected facets that make for the 'monitoring rationale' and its practice among lay actors. In doing this, a structure will emerge: monitoring operates as a means of making sense of non-immediately visible processes while – at the same time – latently addressing issues of formality, reliability and the usage of the information in official settings. Similarities may be found between the emergent structure and the set of procedures that regulates formal monitoring; whilst it is not vital for the former to replicate the latter (by and large the two work in separate 'worlds'), there are convergent points at times in the general outline (which do not necessarily mean symmetry between the two or even the absence of obstacles to translation).

Hence, I will be focusing on ascertaining what being the "eyes and the ears" (P2: 5) of Holywell Dene means. 'Seeing' may essentially be a mediated process that, as such, requires connection points, mechanisms of control and the exercise of judgement. What and how one sees is not only extensively and socially variable – the 'monitoring gaze' can be taught, induced by training, complemented or defeated by technical artefacts and experts; reporting is preceded by the implicit agreement over a frame of operational categories that sort what is seen, but reporting does not always comply with the 'out of place' reasoning. It is only provisionally, then, that reporting can be accepted as a synonym for the Maussian 'expectation of reciprocity' formulated above.

4.3.1 - The emergence of a mode of monitoring

4. 3.1.1 - The setting

Familiarity is, perhaps, the best way to describe the acquired relation with Holywell Dene thus far, the undeniable setting for monitoring. Some of its defining moments as a reconfigured entity have been put forward, the key actors identified, their broad motivations explained and 'situated' within various contextual dimensions. Still, the study of the FHD's monitoring practices demands that the physical boundaries of the Dene are surpassed on specific occasions. I am referring to the water monitoring programme outlined by the FHD in their early days. Water flows and pollution flows with it, a connection that drew the Friends' attention upstream, downstream and through various tributaries of the Seaton Burn, throughout the whole of the catchment area.

Originally working by themselves with the technical support of the University of Newcastle, their monitoring programme was later incorporated into PSV and expanded in the light of the objective of producing the Seaton Valley Catchment Plan. The initial contact with the University was established making use of the search facilities of the internet and soon after the monitoring programme began. One of the most active Friends in the water monitoring recounts the process in a rather disarming manner:

> "I just got the information off the internet, to be honest, you know, as simple as that. (...) then I also spoke to A. and A. put us in contact and we got some sample bottles from here [reference to the place of the interview, a department in the University of Newcastle]. What we did was, we went out once every fortnight and took water samples and the following day we'd bring them in here and use the labs and their equipment to analyse. We did that (...) until (...) we got into PURE and then we could actually have the funding to buy our own equipment. So we used some of the money we got from PURE to purchase equipment and then we did it all the time". (P1: 3)

Just as the FHD sometimes need to stray outside the Dene to undertake their monitoring, so my analysis will require me from time to time to range beyond the limits of the Dene in order to understand how FHD's work evolved and was actually established in its sampling, testing and analysing dimensions. This is even more important since one of the outcomes of their sampling work took the form of a PSV report: the "Report on Water Quality in the Seaton Valley Catchment" (FHD & Palmer, 2005). The production of – new – knowledge about

the Seaton Burn and Holywell Dene and its materialisation in reports or other kinds of documents is a relevant instrument in producing the aspired-for Dene; as documents they inscribe that aimed-for identity and attempt at replacing the undesired way of 'being' the Dene.

The signboard that fills the picture below is placed at one of the "entrances" to the Dene and it, too, is a decisive 'inscription' (Akrich, 1992) of the reconfigured Dene. I will be coming back to the picture and to the meaning of its various components; it is however pertinent to point out the map located in the bottom hand-right corner: it recommends the 'ideal' walk through Holywell Dene, the one that will allow the visitor to experience its 'points of interest' and partake in a wholesome community. The signboard guides one's steps and eyes, helping to imprint perceptions of what is (to be) sensed[24]. There is in fact a relation established with the place that is built on the assumption of its distinctiveness as a unique and separate entity. Members of the FHD share this understanding; the Dene is not just a clearly identified physical place ("the entrance"; "coming in" are very common expressions among the interviewees), there is, simultaneously, a temporal dimension ascribed to this new Dene.

Picture 4.3
Holywell Dene signboard

(05/03/2005, photograph taken by the author)

It is no surprise that time is structured around the FHD: before FHD there was the pollution and the abandonment; afterwards the Friends, the clear water and the pleasantness of the environment. Photographs were taken to mark the

[24] This was very much similar to what I could experience when taking the "Circular walk starting and finishing in Holywell Village" as described in the 'Preamble' to this chapter.

moment when the transition started: "the initial photographs in Dene" (P5: 2) in the words of an enthusiastic photographer. Like signboards, reports and other instruments, photographs intervene in the narrative of the Dene, shaping it up. But they are, as well, a powerful means of organising and giving meaning to the changeability characteristic of the Dene.

> "[photos collected on] a CD with Autumn 2004, a walk through the Dene that I did with R., where he showed me some of the trees we had planted and I've done one recently with N. in the summer and I expect to do another one next month into the autumn again for this year and another one in the winter time followed up by the spring so that I can end up with having photos of the Dene at least from Seaton Sluice to Holywell in different seasons." (P5: 2)

Pictures can capture all sorts of moments in time, in this case the changeability of seasons, and give them a sense of eternity, of stillness and continuity. The 'initial' photographs taken in the Dene by my interviewee while separating the 'old' and the 'new' Dene are, as well, the beginning of a process of organising and stabilising a *certain idea* of the Dene: the Dene in its constitutively diverse unity.

4.3.1.2 - What counts as monitoring

> "(…) something like the job that a warden would do, he would protect one area, a certain wildlife reserve or something and he'd obviously look out for everything on his patch of land and if there was anything wrong with the environment he'd have to find out why and how, and see what he could do to rectify it." (P13: 3)

This is, perhaps, the most thorough-going understanding of what monitoring may encompass and actually be for my FHD respondents. It was formulated not in response to an explicit question about monitoring, but after an enquiry about the respondent's personal view of the prevalent attitude in relation to the local environment. Analytically interesting, is the fact that monitoring activities are not perceived as such (by and large the lay actors of Holywell Dene do not express their activity as monitoring); it also reveals a conception where monitoring comes enmeshed with routine, mundane activities. It is through the latter that access to the former can be granted, as emerges clearly from the following quote:

> "It's exactly that: having the dog, picking up his mess, noticing people don't pick up their mess, noticing litter, walking the same places, noticing maybe damage that's done, just looking more closely at the environment…" (P7:2)

Monitoring is blurred into daily life, in a juxtaposition of context, time and practices. 'Looking closer' is concurrent to – and dependent on – 'dog walking' in a clear-cut differentiation from official monitoring, whose precise limits are viewed as being one of its most distinctive features. Therefore, 'being' and 'doing' monitoring, for these actors, does not require specialised actions:

> "Erm, (...) other people (...) purely and simply by walking through the Dene will drop a note through my door or telephone me and say 'this has happened' or 'I saw this' or … it's a sort of feedback in, you know, people will ring in and say 'there was a terrible smell from the water in the Dene this morning' (…)." (P2: 4)

Its ordinariness helps to understand why monitoring is identified with pleasure and enjoyment as well. The extract below, which includes my request for clarification, is very explicit:

> "Just observing it and being aware of the changes to it and looking at it every occasionally, not all the time, not every day but just occasionally just checking and just looking to enjoy it.
> **ER:** Looking to enjoy it?
> Yeah, yeah, just having a walk around, if it's a nice place you'd go for a walk on a sunny morning perhaps. A combination of pleasure and monitoring, you don't want to sound like an inspector!" (P12: 11)

Rejecting the idea of the environmental officer and the seriousness that his/her function entails, does not mean downplaying the Friends' own work though; to monitor can be a synonym for being 'observant': seeing, smelling, sensing, where past and present experiences together with local knowledge are blended with miscellaneous technical resources in order to produce relevant information.

What is observed or "captured by the eye" (P4:1) can be seen to be made up of two dimensions of monitoring that co-exist and mutually construct each other: the everyday seeing that is simply part of walking through the Dene is set in a wider monitoring gaze or gestalt that defines the Dene's identity. That is, everyday activities – such as walking through the woodland – articulate with a sense and understanding of the woodland itself as a place for walking. This

relates to the broader 'model' of Holywell Dene, already referred to above, and to which I return in more detail a little later in the chapter. This sense of a broader gestalt or model can be illustrated in the following comment from one of my respondents:

> "(...) perfectly harmless water can look pretty bad. Having said that I think we'd notice if the Dene were to change colour, and we'd want to know why, it has its areas where it's a little bit muddy and turgid and it has its areas where it's crystal clear, erm, and I think, you know, if we saw that something had happened to upset the balance we'd probably observe it over a few cycles of the tide just in case it was that we'd had a very high tide." (P6:5)

People's situational knowledge and the chance to extend one's observation over numerous occurrences are central for the exercise of judgement that deciding over the meaning of a variation in the state of the observed (the colour, in the example above) implies. These elements, which differ in nature, in the degree to which they make themselves visible on each occasion, or even in the particular way they are merged in face of the specificity of the situation are, nonetheless, always deployed and inscribed in the actors' practices therefore defining what monitoring is.

This is a less tangible side of monitoring and yet maintained through very mundane activities indeed. In this case, the blurriness pointed to earlier is itself the foundational ground of monitoring: the more blurred monitoring is within routine activities, the more one can accurately observe the environment. Or appreciate it: lay monitoring also implies the routine deployment of an aesthetic sense – a sense that is mostly, but not solely, visual:

> "(...) we actually created one or two new path ways in the middle stretch which goes down to New Hartley, erm, while a number worked very hard building a very exciting path on the south side of the Dene where it had not previously been an organised path, erm, I mean youths might scramble along but with difficulty, but that is now a very nice rustic path going up and down because that is a much steeper side of the Dene in that part." (P11:2)

The Friends' management decisions and the monitoring that precedes them are presided over by considerations of the pleasantness, the niceness and the (natural) beauty of the place. The aim of "keep(ing) the Dene a nice place to go for a walk in" (P4: 8), of "enhancing [its] natural beauty" (P5: 4), the pleasure drawn from the river banks, "thoroughly enjoy it, thoroughly, it's a lovely little

place" (P6: 2), or the previously mentioned ancient woodland and the efforts to plant trees that are "endemic to the area" (P5: 4), are all unquestionably present in what is seen, observed. Defining environmental standards in Holywell Dene is as much about unpolluted waters or biodiversity as it is about an idea of natural beauty. To monitor is to enact that idea.

Not all the monitoring is opaque though. Several attributes are manifestly visible making it detectable and recognisable irrespective of the degree of specialisation involved. Furthermore, since some are performed through social interaction and exchange, they represent an opportunity for the reinforcement of the conceptions that are being put to work:

> "[there are] people (…) who clearly are monitoring what's going on, they have their binoculars, they stop, as I say, people mention to me or I just mention to them, you know, "have you seen such and such" and they'll say "yes or no, or I haven't seen them for so long", "if you want to see something you go to such and such a place"." (P7: 10)

The shared understanding of what is worth noticing and the common culture of frequent visits to the site are complemented by the practice of noting and reporting. Although interviewees' practices differed, noting or recording is predominantly methodical and aims at capturing regularity and normality, whereas reporting is primarily the upshot of a perceived abnormality in which an effective alert is key to re-establishing the disrupted order and meaning. In the next quote, detail and precision prevail:

> "I've written it all down (...) I've done it for birds, flowers, I record mammals as well. (...) The day, the date, the place, what the weather was like, what time it was: during the day, if it's early in the morning or in the afternoon or in the evening…" (P3: 7)

Recording is archiving, that is, perpetuating a moment in time by granting access to it and to the evidence that backs it up: "that a species is there, evidence of what is there" (P3: 7).

On the other hand, reporting is removing something that is "wrong" or "untoward" as the lay actors commonly refer to it or, at least, done with that expectation. Such is the case below:

> "But if something was wrong, say, with the river I wouldn't just tell other people in the group, I would telephone the EA straight away, because

something needs to be done urgently. And then, if I tell the others they go immediately to look, to find out what's going on." (P4: 10)

Eliminating the harm (and recovering good water quality) was, too, the motive for the Friends' water monitoring programme which undoubtedly places their monitoring within the 'expected' patterns commonly associated with formal monitoring processes. In the context of water monitoring, to monitor is a synonym for establishing collection points, sampling, analysing, interpreting. As the report previously mentioned refers to it:

> "(...) water quality data obtained by the Friends of Holywell Dene during activities involving sampling and analysis of natural waters within the local Seaton Valley catchment. Collection and testing of water samples was carried out by volunteers associated with the Friends of Holywell Dene as part of the PURE SV project. These activities were aimed to enable the group to
>
> - Investigate the water quality of the Seaton Burn
> - Investigate the water quality of the tributaries discharging into the Seaton Burn
> - Identify any potential negative impacts on the overall water quality of the Seaton Burn." (FHD & Palmer, 2005: 2)

There is clearly a higher level of formality and technique involved in the procedures. That, however, did not stop the 'past and present experiences together with local knowledge' from coming into play and exerting their influence:

> "I don't think they [the University of Newcastle] actually told us where to sample, (...) we really decided ourselves because of our knowledge on the ground, you know what I mean? I mean, if you're walking past the river, (...) we have a lot of problems with mine water pollution and also there was a tip (...) very close to the river and also we had this pumping station and various sewer overflow outlets so we tried to focus ourselves in around those areas. I think it worked well, you know?" (P1: 4)

Judging from the comments from both the University and the Environment Agency (EA) in Newcastle praising the detail and extent of the sampling, it did work well. Nonetheless, anticipating a subject to which I will be coming back, validation and reliability are a problem in the collected data. Their soundness is questioned namely by those that would, in principle, benefit from an extensive monitoring network: the EA in this case. The reasons are set out by an EA environmental management team leader:

"In terms of our direct use of that information, I'd have to say that's probably fairly limited, again because we can't be certain that samples have been collected in the right manner, that they're representative of the water quality in that particular area (...)" (P15: 7)

It is as if those lay actors were mimicking procedures, which while able to capture the form, fail to reproduce the substance (they may even adopt the persona of the 'inspector' but they will never be one, in an allusion to the comparison spelled out earlier). In acknowledging their effort but refuting the usability of the data, the EA is emptying the FHD's monitoring performance of its decisive elements, precisely those that confer autonomy and uniqueness to 'what counts as monitoring'.

4.3.1.3 - The rationale

The underlying logic for the practices and meanings that are constitutive of lay monitoring is made up of two main dimensions. Firstly, local community groups operate with a perceived model of nature and the environment that needs to be pursued. Secondly, these groups believe that they cannot only complement official bodies' work but that they can also do better in improving the general quality of the environment, supporting this claim with facts or 'evidence'. I shall analyse each of these attitudes separately.

<u>The perceived model of nature</u>

To speak of a model is necessarily an abstraction, itself a concept aimed at gathering under one name sometimes discrete ways of relating to the landscape, the environment or nature, categories that, although mostly used interchangeably by local actors, are constitutively distinct. This relative messiness in the organising of a frame, that is itself aimed at providing order and meaning, in practice turns out not to be an obstacle to the formation of a common, shared notion of what nature and the environment should be. Its influence is felt as an undeniable normative force acting in the definition of standards as well. As was pointed out before, this 'model' is pervasive, reproduced and enacted through monitoring. Its constitutive elements can be grouped under four main features: wildness, blending in, naturalness and authenticity.

Wildness refers to the attempt to reduce as far as possible the evidence of human intervention and cultivation. Such intervention is needed and welcomed (as discussed in section 2.1, in relation to restoration) but should be kept under

close vigilance so as to avoid it precluding what is wild and natural. References to this dimension are very frequent throughout interviews denoting a strong adherence – and commitment – to the idea of the 'wild' and of nature 'doing its work', and to gauging the right degree of 'wildness':

> "I mean the general thing is that if you've been in it so long you get the natural [feel] of it to more or less say 'this should be like this, this should be like that'." (P13: 4)

The measure of the wild is necessarily defined in relation to the measure of human action, a balance "between the aesthetic and leaving it wild" (P11: 7), which proves itself to be a difficult achievement since it has to be decided in face of specific circumstances. In some cases, local groups define the intervention as a one-off event, to encourage nature's true work:

> "The pond was excavated and after that it was left to nature and it just regenerated itself again. It filled with water (...)" (P3: 4)

Other situations are more demanding in that humans have to ponder how to regulate various 'bits' of nature in relation to each other in order to obtain the best possible overall natural result:

> "(...) because it's obviously a wildlife haven, it's wild! That's the whole point of it. There are certain parts of it that, erm, we've enclosed the site with a new fence and sometimes, I mean, there's a lot of trees in there which could take a lot of wildlife but at the same time it cripples a lot of the grassland and flowers so we've got to make the decisions to cut so much back every time. It's a case of just general grooming but not destroying it." (P13: 4)

The simultaneous demands of wildness and having 'general grooming' as a standard, challenge lay actors to continuously weigh up two intrinsically distinct principles of relating to and 'doing' environmental monitoring. On the one hand, knowing that their interference is not only needed ("if there wasn't any human interaction it could get too much" (P13: 5)) but that it can enhance nature and its works as well, propels action:

> "The very fact that a farmer would put a fence up or the FHD put a path down, that's showing human presence but it's not spoiling it in many ways, in fact it's making it better." (P4: 4)

On the other, the desire to let nature run free and wild advises caution and stepping back from intervention:

> "erm, the grass doesn't have to be necessarily cut down short; I like to see nature in its wild state, I do like meadows where there's wild flowers allowed to grow, you know, without being cultivated (...)." (P4:2)

Blending in seeks to eliminate all the features that clash or stick out from nature 'as it should be'. This is a wide category, referring either to the obvious rubbish and pollution (including the formerly mentioned sewage) or to less evident elements such as non-traditional materials and non-standard types of behaviour. Fitting in is the standard, standing out the triggering detection device.

Lay actors are adamant about what does not belong. Some ways of thinking and expressing it follow:

> "(...) something that looks as though it doesn't fit in, I mean, that's why litter stands out (...)" (P7: 7)

> "I don't like to see litter and rubbish lying around, or damage to the countryside, I mean you do see some trees that are deliberately damaged; you see the odd car that has just been left abandoned! There was some trouble in Holywell Dene with a car that had been dumped and motorcycles (…) and I don't like to see that, I like to see nature in its clean state" (P4: 1)

> "You might see an old supermarket trolley in there, you know, and this annoys us, I know that won't necessarily do any harm to the wildlife but it shouldn't be there should it?" (P6: 4)

As the same interviewee adds, it is important that order and tidiness prevail over chaos and confusion in an assertion that is both valid for nature and humans as to keep things "in the state it should be". Order and discipline should, therefore, be extended to the way humans behave in nature:

> "(...) people who make graffiti and throw litter around are not just defacing something that does not belong to anybody, they're defacing something that belongs to us all (...). I enjoy seeing other people enjoying the Dene, that's lovely. (...) I don't mind if the children are on bicycles or on tricycles as long as, you know, as long as they're not being rowdy. I like to see the children on their horses in the Dene; this is reasonable use of it. What I hate to see is when somebody, you know, there are little footbridges here and there, and I hate when they've been painted on, you know, with graffiti or they've been vandalised." (P6: 5)

And for those whose behaviour is perceived as a threat to safeguarding regularity, no place is kept in the Dene. The 'PURE Hike' fieldwork notes illustrate this point, through an incident that the FHD's leader brings about as to exemplify the non-fitting users of the Dene and the wrongness of what they have done. The incident was prompted by the risk of disintegration that some of the boardwalks installed by the FHD were facing at some point. These are wooden walkways aimed at stopping erosion or lifting walkers above wet areas. As the mud was rising over the walkways and to protect "a tremendous asset to users of the Dene", fences and stiles were put in to stop motorbikes and horses accelerating the collapse of the boardwalks. However, those barriers were rapidly overcome: "would you believe that youngsters on horses were actually jumping this?!". The FHD's disciplining action persisted though and obstacles were strengthened. And again defeated: "a few weeks ago I got a letter, I got a phone call saying that the motorcyclists had cut this out completely and that they were going off down there, so this time we've double it up and put wire round and so on. And this is what you're up against all the time." (fieldwork notes, the PURE Hike, 5th March 2005).

A different matter arises when specific materials clash with the 'natural elements' of nature. The paradigmatic example, with wider implications, is about a bridge installed not in Holywell Dene but in one of the other PSV sites: Wideopen (see Figure 4.6, below). Again, my fieldwork notes prove to be useful. They read: "To facilitate general access to the area this local group is recovering, PURE/PSV is going to donate a bridge – a footbridge. Both J., the group leader and B., PSV coordinator are pleased; B. even said that "the idea is to have a circular walk"; I guess this is because the pond is the key element in the area and the public would enjoy it more." (fieldwork notes, the PURE Hike, 5th March 2005). A few months after, the perception of that very same bridge – and of an adjacent path – had drastically changed:

> "(...) the site where they've put the new bridge in, it's not natural anymore, it looks like it has been modernised to fit in. I mean, if they had put a wooden bridge in as opposed to a metal one it would have looked better." (P13: 5)

Metal looks new and sticks out whereas wood looks rustic, matching the idea of the wild, unregulated environment. PSV coordinators seem to have failed to understand all the subtleties that their fellow neighbouring group members employ when relating and acting upon nature. The general rationale was identified (granting access, creating a pleasant circular walk) but one of the pieces of the 'model' was overlooked: the defining standard of being

inconspicuously natural was not met by those who commissioned the bridge (PSV, which equals FHD, see 'At-a-glance II', page 62), even if their general outlook is similar. It was perhaps functionality that presided over the design of the metal bridge but, as with other 'wrongs', this too needs repair and fixing. And while the bridge as a 'given' cannot just be scrapped, the path is condemned to restoration in order to re-instate some of its lost 'natural' purity. In the words of the same interviewee:

> "(…) It's not wild, it's not natural, we don't want that. So we are going to take that path out and try to get it back to, basically to what it should really be [just grassland]." (P13: 5)

Naturalness is about ensuring that animals and plants develop in an ecologically appropriate way. It concerns, for example, the natural balance between species and having species occur within their characteristic habitats. The idea of the 'warden's' role, depicted above, is of particular relevance in this context: it is the local groups' job to guarantee a safe environment for local 'natural life'.

The quest for the right habitat implies, however, a broader perspective about environmental issues such as biodiversity and biological soundness. Local lay actors are not unfamiliar with this as the next quote exemplifies:

> "(...) you need a varied environment, a lot of the problems nowadays are the fact you get one set environment, you know, we've got a very large, in Northumberland, we've got a very large conifer forest called Kilder Forest which in terms of environment is very bad because of its intensive use of growing trees for industry in effect. The sun doesn't get to the bottom and there's wildlife in it but it's very limited and very sparse. But if you take a more, (...) combination of trees and water it's the diversity of it that creates a good effect I think. There were already trees there but there wasn't a pond there [justifying the decision of creating a pond in one of the local sites]." (P12:7)

A healthy habitat is a varied habitat; in that particular location (Wideopen) diversity was added in the shape of a pond. Expertise is required but the effort might be rewarding:

> "Very close to it [the new pond] we have some otters and what's happening is these otters are actually, they're quite rare in England now; these animals are based in the Big Waters, which is about 2 Km, and I think (...) they are

extending their range and I've seen them within about 100m of that pond and it, well, it might be a little bit small but it's possible they'd move in there. It's really extending the habitat by sort of a little bit of extra work by the community group. It's got to be a suitable place to start with; you can't just dig a hole in a field." (P12: 5)

As one would expect, a 'natural' habitat is a heavily managed one: as one respondent says in relation to overseeing the wood, "the purpose of managing the wood is to allow everything natural to flourish consistent with access safely." (P11: 7). But while one might reasonably expect a difficult relation between naturalness and wildness, that does not seem to constitute a problem for lay actors at all. Unnatural is what looks noticeably man-made even if, in a more refined sense of man-made, the concept refers in this case to foreign species, invaders:

"(...) the conifers as a quick cash crop, you know, to me that is unnatural and that is an unnatural environment. (...) the worst instance I've seen recently, there's a bypass in the middle of nowhere, in the Scottish Highlands; there was ragwort growing and you just don't expect that at all, you know, it's an invader, (...) you just don't expect to see it, right up in the Scottish Highlands (...) that's an alien that has got in (...)" (P9: 8)

That these 'aliens' have reached the 'untouched' Highlands makes the threat all the more real and feared as it is the perceived identity of an area that is being challenged as much as the – admittedly – weaker local species.

Authenticity offers the answer to (some) of these threats by seeking to have all the species (animal, plant) existing in Holywell Dene correspond with the flora and fauna native to the area. It is a monitoring principle that sees the certification of the origin as the standard for establishing environmental quality in the Dene.

The already mentioned example of the trees is conceivably the most significant due to the role that the notion of the 'ancient woodland' plays in the mobilisation of the group in the first place. Assuring that the planted trees are sourced within strict geographical limits grants FHD members the certainty that genuineness is being preserved:

"(...) all the trees that we planted in the Dene up to now are being grown either from seed local to the area or they've been seed that we've collected not more than within 5 miles of the Dene. (...) But all trees that have been

planted are endemic to the area. We're not planting, shall we say sweet chestnut which you wouldn't see up in that area, probably." (P5: 4)

A similar attitude is found in relation to animal life, whether it is mammals, fish, birds or newts. When asked if the creation of the pond included the objective of introducing the species that would have lived in the area before, the answer of this group member could not have been more explicit:

"Yes, because there would have been amphibians there, newts, great-crested newts. It's normal that there are great-crested newts in Wideopen, in Seaton Burn. There has been in the past, there is still evidence, so we're hoping that they will come back." (P3: 6)

The evidence that sustains these beliefs and the practices that they shape up is, too, the evidence that supports the second dimension of their monitoring rationale pointed to above: local groups are better positioned to act upon and enhance their local environment because their experiential knowledge tells them so.

The status of evidence claims made by FHD

Collaboration with official bodies and local authorities exists and is looked for but local lay actors seem to have found an internal way of gauging when to resort to it:

"We do try and tell the local authorities what we're doing, erm, but without being rude to them, they have got so much else that if you say to them that you're going to put a pipe under a path to take the water, so the path doesn't get washed away, they are not suddenly going to send a person down and say 'well, you know…', they'll say 'oh, really?'. So, after a time you get a second feeling, a second thought that they need to know about that but really it's a waste of time telling them about; just get on and do it." (P2: 6)

So, for instance, they have indeed sought technical help for starting monitoring the water of the Dene, but after the necessary initial training in sampling collection and analysing provided by the University, they were actually going into the laboratories and doing the analysis themselves. Experts were also called on for the water quality monitoring courses that the FHD organised for members of the local community and the Friends. In relation to these, it is interesting to notice that while the Friends that took the course make a positive

evaluation of its contribution to their knowledge about water quality, they mostly appear to rely on what they already knew and skills they already had:

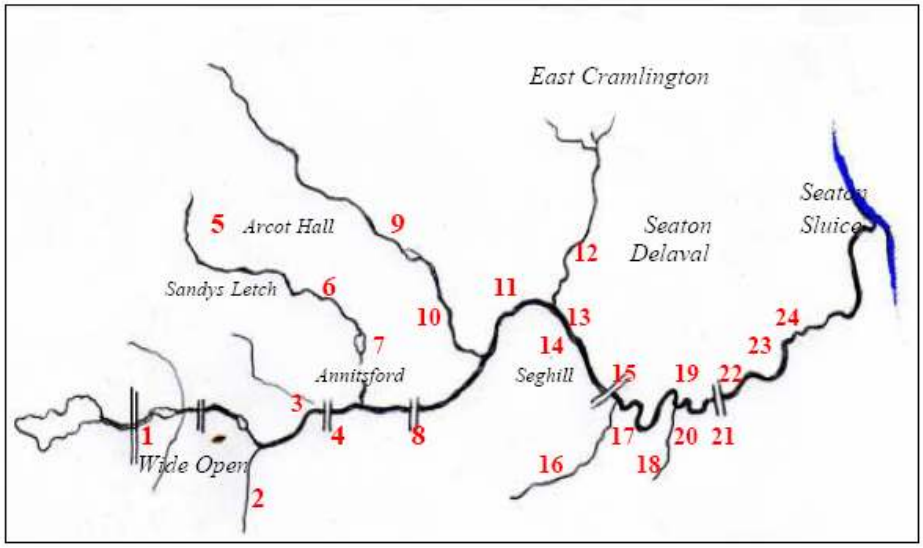
> "I've been on courses - I don't know lots about it but I know when there's something wrong with it, because a couple of years ago it was polluted from Brunswick – there's a very small industrial estate at Brunswick, which is one of the villages right next to Wideopen. It was polluted from there and I knew instantly, I could see instantly that there was something wrong." (P3: 8)

On the other hand, some of the technical aspects that constitute skilled water monitoring are lessened in their magnitude:

> "Erm, yes, I mean, I'm not an expert by any means but certainly a lot of it is common sense – take the pH values. The pH value is the most important aspect which indicates that life is going to have problems existing in that kind of acidity." (P10: 5)

What this interviewee seems to be saying is that what experts name pH, lay actors perceive as a 'problem' in the water, translated by visual signs. Furthermore, as more elements belonging to the sphere of the technical/ expert knowledge become widespread and accessible to lay knowledge and easy to manipulate through the deployment of user-friendly tools (such as the 'kits' with which FHD check out water quality), the less need there is for experts' work. This would be restricted to very specific situations, as in the thorough investigation undertaken of the waters of the Seaton Burn, which involved less familiar parameters. It is, as I have said, the extent and detail of the sampling points that make FHD's monitoring distinctive. The following map, from the report identified above, details their location:

Figure 4.6
Map of Seaton Burn and tributaries with FHD's sampling locations



(FHD & Palmer, 2005, *Report on Water Quality in the Seaton Valley Catchment*, PSV)

It is 24 collection points against the 8 or 9 that the EA's manager recognized to be the norm in the Seaton Burn ("there will be about 8 or 9 different routine sites which we sample every month for a variety of parameters." (P15: 9)). So after evaluating EA's procedures, they thought they could do better:

> "Well, what we used as a guideline is: the EA has these spots which they do on a regular basis but we didn't think that was enough, quite frankly, because they just did the main river, and of course we wanted to do the little tributaries that fed into the river." (P1: 3)

Endorsement – and validation – for their method comes from the University, the domain of the 'other' experts, those that create expertise rather then applying it:

> "We explained to the University on our maps where we were actually taking the samples, and they thought our sampling pattern was probably better than the EA's, because we were doing more and we were also doing them with shorter intervals, so we were doing more samples in the year and taking more samples on the ground. They were quite happy that we were doing it in such a manner." (P1: 4)

Thus, it is really the time-space relation of monitoring that seems to play in favour of lay actors. Whilst for formal monitoring the time-space relation implies a multitude of places and a limited amount of time spent in each of those locations,

in lay monitoring the time-space of monitoring practices and the time-space of daily life run together allowing for a detailed, systematic observation:

> "Now, I walk through there and you just, you look and if you go through, if you do anything regularly you see subtle changes, you see a tree that was leaning like that [showing] and you think you don't know why but it looks a bit different and you suddenly realise that it's leaning a bit more, erm, so you might then do something about that, like ring up, getting a tree surgeon to come down and have a look at it." (P2: 12)

And if this sort of embedding allows subtle transformations to be perceived and monitoring to be responsive, it also makes it possible for lay actors to anticipate outcomes that are unseen by local authorities – and to prove who is right. The next story takes us back to the 'initial' period of the Dene, when the FHD were building barriers and pushing the cows out of it. The local authorities supported them and not just financially:

> "The water level in the Seaton burn goes from perhaps none in a dry summer, to really, really high (...) and they said they'd (...) put a gate under the bridge to stop the cattle going upstream under the bridge and it was a metal bar with legs on and so on [see picture below] (...); this was between Blyth Valley and the Forestry Commission. Now, the first winter it was damaged. And the reason it was damaged is because the horizontal bar wasn't high enough! They thought the water would never come as high as that; (...) the water came to that, the logs came straight down, hit the bar and the bar bent and the whole thing shattered. So they repaired it and we said "look, there's no point in repairing it", but you know, they said "well, the water level to come up to that high you probably won't get it more than once in 20 years" – now, where they got these statistics from, goodness only knows! And I said "well, I guarantee you that it won't last another year!" And it was exactly that! Now, they've raised the bar completely and we've had this massive flood in April when the water was higher than anybody could ever remember and the gate worked perfectly! That's a classical example! We knew exactly where the height of that water came." (P2: 11)

Picture 4.4
The water gate

(21/12/2005, photograph taken by the author)

'Knowing exactly' is not necessarily what local authorities conceded after the gate was given a stable height in the conclusion of this episode. Yet, it demonstrates that more than the 'objective evidence' of statistics, it is the lengthily developed, grounded local knowledge that may be accurate once the limits of formal knowledge are messed up by contextual irregularities.

4.3.1.4 - Tools

Monitoring requires tools, instruments, ways of gathering data and rendering the observations useful and purposeful. This principle, which lies at the core of monitoring policy, is of no less value for lay monitoring than it is for official monitoring. The lay actors of Holywell Dene are clear about their objectives and the means to achieve them as this passage illustrates in relation to water quality:

> "We found out that East Cramlington has a very heavy source of pollution and that's one of the things we're working on with the university now. To come up with a plan to rectify that." (P1: 5)

Moreover, tools are an auxiliary way of identifying the monitoring attitude that was described in 3.1.2 of this chapter and was very nicely expressed when one interviewee talks of "people who clearly are monitoring" with their "binoculars", their pauses en route and the exchange of information (P7: 10). In their function as identifiers, particular tools relate with specific types of monitoring activities, ranging from the mundane litter picking for which Friends resort to prosaic carrier bags ("a plastic bag to collect rubbish" (P11: 8)), to the more skilled water-quality assessment where equipment can be just as sophisticated as in technical monitoring either in sample collection or in laboratory tests ("we

didn't really know what it was until B. came out with his certain test kits and he tested it to see if there's oil in the water" (P13: 10)).

This correspondence is not the full story however; the instruments for lay monitoring are manifold and flexible so as to accommodate the notion of environment local actors hold and the all-encompassing activities they engage in. In the interviews there are also references to water bottles for collection of samples ("I'll probably have a water bottle with me if I needed a sample of water or anything like that" (P4: 5)); binoculars ("usually just the binoculars" (P9: 6)); books ("small books on flowers and birds when I've been identifying" (P3: 8)); pen/ pencil and a notebook ("sheets for butterflies, for insects, for all sorts of things and if I saw one I would fill it in" (P8: 5)); digital camera ("have a camera around all the time and if anything was wrong I would maybe photograph it" (P10: 9)); and the human senses as such ("just your senses, I think" (P12: 12)). Very frequently, different tools overlap in a practical demonstration of the comprehensiveness of their monitoring practices:

> "(...) the binoculars (...) I would probably take my flower book (...). Erm, I've got a digital camera now and it's fantastic to take photographs of plants and I would take a note of what I'd seen." (P9: 6)

In addition, as the previous quote shows, the FHD appear to resort in equal measure to traditional and contemporary technological resources: the binoculars and the books very much associated with the classic image of naturalist enthusiasts, and the digital camera revealing a modern take on nature protection. Their adherence to new technologies is completed by the usage of internet, mobile phones and water-monitoring equipment. In this respect, it is relevant to consider the role of technological artefacts in granting local actors an increased degree of autonomy and self-assurance about the correctness of their practices and the basis on which their judgement is supported. These objects allow for information (or data) to be immediately accessible; they accelerate the process of passing that information on and strengthen the character of the evidence collected. An illustration of how the process is more efficient is provided in the next extract:

> "So, if I was walking through the Dene, taking some photographs (…), and I see something untoward there I would photograph it right away and being as it is digital I could then go back home, get up my computer, download the photograph, email it to B. or R. and say 'this was what I saw in the Dene today. What do you think of it? Does it need to go further?'" (P5: 7)

Examples of pictures as evidence abound but the same interviewee supplies one:

> "(...) not so long ago there was a bit of redness in the water and I tried to get a photograph of that." (P5: 3)

The case of water quality is very fertile from an analytical point of view. Whilst a paradigm of the group's capacity to act and decide autonomously, it simultaneously illustrates the existence of a residual level of dependence in relation to experts and their knowledge. Thus, on one side, there is the water-test kit as the mechanism to have granted access to the identification and resolution of a problem within the group:

> "(...) you could see everything was dying. And we didn't know what it was. Well, apparently it was a canister of oil that had fell over on the far side, but we didn't really know what it was until B. came out with his certain test kits and he tested it to see if there's oil in the water. (...) So, we got it out and there are certain things that you can put into the water that can dissolve them, kind of things without harming the environment around it. (...) it wasn't a council issue, we did it amongst ourselves, our group." (P13: 10)

On the other side, there is the 'V-notch weir'[25] seen in Picture 4.1 (page 68). This equipment installed in one of the tributaries of the Seaton Burn illustrates the more rudimentary side of monitoring techniques but, ironically, was fitted on the direct advice of university scientists, in order to measure flow-rates.

4.3.1.5 - Validation of observations

As in formal settings, the monitoring observations performed in Holywell Dene are to be legitimated before being accepted as valid. The validation itself implies that in the same process those observations are translated into meaningful information. There are, overall, two levels at which the validation-translation of observations takes place: within the group and externally (though varying degrees of formalisation are required for each case).

When the FHD work independently, validation occurs through the course of several layers of lay expertise: observations are passed through a chain of informants, each one with a position understood according to an unofficial classification of levels of expertise, trust and ability to exercise judgement. At the top of the chain are those who merit trust from their peers to decide on the

[25] According to a previously mentioned report, V-notch weirs "allow quick, simple, yet accurate measurement of flow once in place." (Palmer & Jarvis, 2005: 4).

nature, extent and solution of the problem(s) detected, and whose range of external contacts facilitates access to official agencies in case their intervention is needed.

The first layer of the chain is built on the casual "word of mouth" (P7: 8), until one detail triggers the monitoring gaze and the need to pass the information on to the next layer. That is what one of the Friends recounts in relation to one episode involving squirrels:

> "I thought 'oh, good we now have squirrels in the Dene' so I thought this was a good thing and mentioned it as I say to someone (...) and she said 'let R. know' so, that's what I did." (P7: 9)

Other interviewees see in these layers a sense of duty and the recognition of authority:

> "If I found something amiss I'd tell R. or B. and then they would pass it on to the powers that be, they'd contact the environmental agencies because they have the contact points. (...) there's a chain of command, because R. being the chair and B. being the secretary it's ideal that they actually know what's going on." (P5: 7)

This authority rests, however, not so much on the function itself but rather on the capacity to know, the skill to locate, place and relate one isolated event or piece of information within a wider chronological and contextual set of events. The same participant explains:

> "R. (...) may have gone out and investigated and clarified and done a few notes which is building on the actual information I've supplied him, he will give you a better picture possibly than I could have done or what some lay person could have done." (P5: 8)

That is, the Friends operate with an internal classification of being 'lay', allocating the members to a position based on the specialised character of the information provided. Naturally, those able to 'build on the information' are inherently capable of translating it since the two moments coincide. And if, on occasions, technical tools convert sensorial observations into interpreted data almost immediately, as in the oil and water-test kit example provided above, more frequently validation requires the capacity to explore and relate just mentioned. This is when one learns that a squirrel is not simply a squirrel:

> "I did see a squirrel one time when I was walking in the Dene; now, I hadn't realised that this wasn't a good thing and I was very excited, because I'd

thought it was unusual that in such a wooded area I had never seen a squirrel; (...) so I phoned R. and I said 'I've seen a squirrel' but of course he asked 'what colour' and when I told him it was a grey of course he was very sad and I think he then contacted somebody to let them know." (P7: 9)

There are a few aspects worth notice in the 'squirrel affair'. Firstly, the 'lay-expert' asks the 'right' questions, in this case, the colour of the specimen observed will determine whether the observer has reasons to be excited or not. Then, the nature of the squirrel changes during the course of that phone call: from being an undifferentiated specimen, a 'good' thing, that is, 'in place', it soon became a grey squirrel, so 'out of place' that the authorities had to be informed. Finally, what that Friend is now classifying as obvious ("of course") is the result of subsequently acquired information that reorders the place of grey and red squirrels in the Dene.

The second level of validation-translation takes place through the cooperation with external entities, with the experts and technicians of official bodies (the EA, the Forestry Commission, etc) and local authorities (local councils, water bodies, etc), whenever the group feel unable to determine the nature or extent of a problem or whenever proposed actions lie beyond the legal authority of the group (because of planning laws or water regulations, for example).

The first illustration shows that, in some circumstances, it is precisely from the help provided by the experts from the 'outside' that autonomy may be achieved in the future. It also demonstrates that while an identified occurrence, the 'chemical' smell detected the Dene, albeit unnatural, will not get further action since it is not 'out of place' either:

"I know why it happens and I know that it's likely to happen after there's been a lot of rain, after there's been rain after a long dry period and when the water level rises for a day or so you will get this chemical smell and the EA have explained to me exactly what it is, and it's Northumbria Water upgrading their system (...). So, again, you see, we build up this knowledge but you can't impart all that knowledge to every single person who walks through the Dene." (P2: 15)

Only a few will have the ability to be on the forefront of the relationship with experts. The skill to communicate runs parallel to that of negotiation, that is, the external validation of lay observations is as political as much as it is knowledge-

based. When face-to-face, lay actors and experts are negotiating parties and, as one EA official points out, trust plays a considerable part:

> "I think you would feel that when they [the FHD] report something it's more likely to be significant – because of that sort of local knowledge and they know what's normal for that catchment, they know what isn't normal, then if somebody like B., for example, reports a problem I can be fairly assured that there is a real issue there and that it's something significant that we need to look further into." (P15: 8)

Obviously, the water-quality monitoring programme of the Seaton Burn is the best example of validation through collaboration. It is also admittedly the most technologically intense area of activity in which the FHD have engaged – a clear advantage when it comes to translating information to a technical audience. Yet, problems of acceptability of the evidence arise when procedures escape formal definitions. If a Friend (outside the implemented water-quality programme) considers that rinsing a water bottle "several times so there's no contamination" (P4: 7) is a lawful procedure that legitimates the collection of a sample when an incident is spotted, the EA has a divergent perspective:

> "(...) in terms of actually what evidence you can present in court, for example, if somebody saw a pollution incident, quite often you get people saying 'and I've taken a sample in a jam jar' or something like that; we couldn't actually use that in court (...) to present that in court we have to demonstrate that we've followed the correct sampling procedures and that we've taken the evidence as it should be in accordance with the rules that govern evidence collection, that we've transported it safely and securely and then it hasn't been tampered with, and it then goes to a laboratory which has full accreditation, standard methods of analysis so that the results sort of bear scrutiny in every step; from collecting the sample to the results being produced in the lab, there's some sort of quality assurance around the methods so that third parties can have a look and be assured that those results are reliable." (P15: 6)

The chances of an equal participation from lay actors at this level are fairly limited. From local actors' point of view, a court is an 'aseptic' setting, cleared of the contextual details that make their observations reliable otherwise. Back at Holywell Dene, advice and autonomy of action is "carefully controlled" as this interviewee puts it:

> "I can think of a couple of occasions where other Friends have said they wanted to do certain things and I said no. (...) to give you an example (...); there was a path that went along and then it went literally straight down into a very deep gully and up the other side; well, of course in winter that was virtually impassable. So we wanted to build a bridge, a bridge across this gully, erm, well, obviously the local authority has got to be involved and they came, they advised, they provided the materials and they came and checked if it was all right when we'd finished it." (P2: 6)

As in other moments of their monitoring practices, it is on a set of unwritten principles that the FHD support their decision of calling the experts into the Dene. These, the experts, as the same interviewee says "may well see things but they're not going to see the gentle changes." These are a prerogative of theirs, the "amateurs" (P2: 14).

4.3.1.6 - Monitoring markers

Markers are signifiers of the quality of the environment. As such, they entail a sense of the state of the environment in a particular moment or through time, according to previously defined standards. Clearly, the notion of a changing environmental condition exists among community groups – there have been diverse examples displayed so far; the issue will be thus about the indicators they use and their nature.

More than going through a list of parameters, lay monitoring actors collectively define and construct what valid indicators are in accordance with the 'implicit model' displayed early on (wildness, blending in, naturalness and authenticity as its main dimensions). In this sense, markers are context-based. In fact, lay observation appears to be conducted against a background of a community-held theory of nature in the Dene. One could say that, in doing observation and monitoring, community members perform their interpretation of the Dene's nature.

A close eye is kept on water, for instance, even by those that did not take part in its organised monitoring, checking chemical parameters such as pH or dissolved oxygen. The next quote details various water-quality indicators, all of a very different nature:

> "Well, there are certain sights that we sort of expect to see along the Dene as we walk through it. Certain times of the year and depending on tidal conditions we can see tiny little frogs in the water near the river banks and

> just look into the water it's quite clear, you can see them quite easily (...). Another regular sign of life (...) is a feeding heron and further up in the upper reaches, and of course this is all sort of dependent on the time of seasons, you will get wildfowl on the Dene and if you get the right time of year they've got their little chicks with them. If I went to the Dene and didn't see any of that I'd start to get worried (...). Another thing is that there are areas that are very dense with bulrushes and if they were gone (...) I'd wonder why they aren't there any more. So, it's not a direct interaction with the water, it's more the sights and sounds of the creatures we expect to see on and in the water." (P6: 3)

'Sights and sounds', 'on and in the water'; the grace that entails this way of describing good water-quality indicators may be mistaken for ambiguity or imprecision. Yet, the reference to the tides, the seasons – and the moments within seasons – and the details of what is perceived to be 'in place' in each of those circumstances, discloses the confidence of those who know the local 'rhythms' and the pace in which species live (in) their habitat.

Additionally, engaging in a mediated practice of water monitoring has the added value of surpassing some of the limits of perception of which lay actors are aware as well:

> "What people perceive as clean water isn't necessarily clean water and, when you're looking at water quality, one of the fine things is what you see and now we see more fish in the Dene, if we see more kingfishers along the stream, if we see wild life associated with good water then that's the sort of thing that a lot of the lay people actually see (...), well we know that to support that type of life the water oxygen level must be at the correct level without it being too overgrown by weeds or anything like that." (P5: 6)

Hence, whilst secondary indicators are a proxy for those factors that sensorial monitoring cannot reach or be reliable for, justifying experts' intervention, they nevertheless entitle the FHD to legitimately claim to have altered the Dene in its defining quality: from a open sewer with banks "black with coal dust" (P2: 9) to a stream comparable in its purity to the purest of waters of which "dippers (...) because you only think of dippers in mountain streams which are clear" (P2: 10), are the ultimate proof.

Other indicators point to grander transformations, even if at their origin is the same close-knit, regular relation among mundane practices and monitoring,

which makes of mundane monitoring a legitimate category. The sighting of a butterfly has, therefore, several layers of meaning:

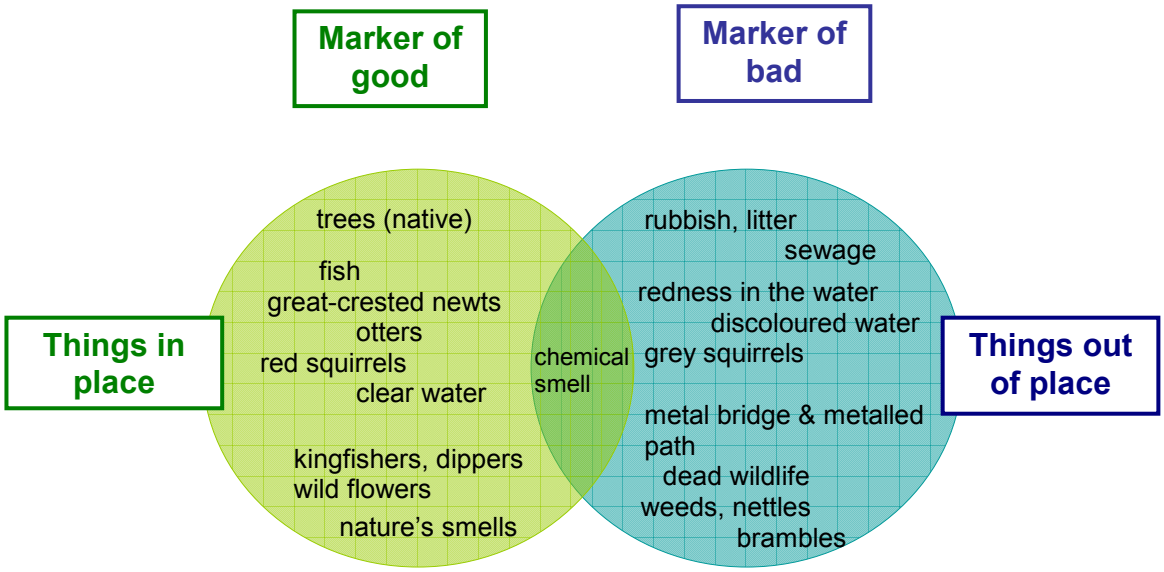
> "(...) recently I photographed this butterfly [a swallowtail] and R. when he got the photographs immediately informed the local butterfly people because it is one that is slowly spreading north because of the change of climate." (P5: 10)

Pervasive risks of this kind threaten to tamper with their notion of nature and the efforts to implement it. It is perhaps the consciousness of the ineffectiveness of the 'barriers' of the Dene (in a conception that is wider than the physical fences and stiles installed), that makes an unexpected encounter all the more significant:

> "I was quite pleasantly surprised to see red squirrels, well in the Seaton Delaval area it wasn't actually in the Dene. I saw a red squirrel the other day in Seaton Delaval which was pleasantly surprising because it's very rare. I know that in Northumberland we've got probably the best head of squirrels but in Seaton Delaval, to actually see one (...) that was surprising." (P4: 5)

The FHD's markers are meaningful in the sense that they implicitly represent a wider cultural classification. My proposal is to access it through the idea of "matter out of place" (Douglas, 2005) as I have pointed out before. As shown in the following diagram, each of the selected indicators, signifies good or bad quality but they also constitute a classification, organisation or sorting of the space in terms of what is 'in place' and 'out of place' according to the perceived 'model' of nature.

Figure 4.7
Diagram of cultural classifications of markers



Indeed, this seems to be Friends' primary reference framework: observations mostly fall into things that are 'in place' and things that are 'out of place'. Yet, rigid categories do not comply fully with the complexity that contextual and cultural systems entail. Squirrels as such may be a marker of good, whereas a grey squirrel in the context of the Dene is definitely a marker of bad. Swallowtails or ragwort (even if in Scotland) may sooner than expected acquire a mark of authenticity and be classified as 'in place'. Or 'good' and 'bad' may confusingly juxtapose as the chemical smell example demonstrates. In these cases, when the boundaries meet and messiness occurs, it is classifications' own cultural nature that comes to the fore. That is what deciding on "how much dead wood" entails:

> "There's a balance I think between the aesthetic and leaving it wild, and dead wood of course is immensely important in terms of insect life and in regenerating the soil and all the rest as time goes on, erm, we do have to ensure the trees are not dangerous and sometimes we have to bring in experts to actually take branches down, we do have to ensure that the stream flows freely and sometimes trees fall across it, sometimes in those instances they do actually block the stream and cause erosion on the bank

and in that case we would want to get rid of the log, on other occasions it can be actually quite rustic and good to keep it." (P11: 7)

Conclusion: re-enacting nature through lay monitoring

In concluding this first case-study based empirical chapter, my aim is to summarise the chapter and draw out some key points. More detailed analytical considerations will be reserved for Chapter Six where I use findings from this case and that are described in the next chapter to propose the idea of different 'modes' of lay monitoring. For now, however, the focus is on what can be learned from this case.

First, it is clear that monitoring is pivotal to this group's environmental practices. Group members spontaneously talk a good deal about observing, recording, passing on information and so on. To some extent this monitoring is an explicit activity: they deliberately take samples of water quality or look out for invasive species or check that nuisances such as cows and vandals are not impacting the area. But it is clear that there is a great deal of monitoring that goes on in a different sense; just by walking in the Seaton Burn or by taking nature photographs or by enjoying the presence of wild birds the FHD are also monitoring on an almost continuous basis. The monitoring is domesticated within their daily lives and their casual engagement with their surroundings; it is ordinary.

In their view, this form of monitoring provides several benefits for the members of the FHD. It allows them to monitor in a different time-space configuration from that used by official bodies. They are not monitoring in set places within the Seaton Burn at specified times. Rather they are monitoring throughout daylight hours and across a very broad range of spaces within the Dene. They thus tend to spot many environmental changes where they occur, where a fence has been damaged or where a water discolouration has started to take place. And because they are monitoring continuously – by walking their dogs every day for example – they may glimpse changes even if they are not looking for those specific changes. They just notice that a tree has leaned some more or if the birds are unusually quiet. They are not responding to set variables but are monitoring in an open-ended way. They have evolved methods for handling this open-ended information – taking digital pictures that can be passed around for example – and have devised ways of checking that what they notice actually

counts for something; they use informal hierarchies of knowledgeability to check the value of what has been monitored.

Accordingly, and this is my second concluding point, it seems appropriate to claim that the FHD have developed a culture of monitoring, a way of interacting with their cherished environment, which is relatively stable though not unchanging (since they are keen to continue to improve their environment and to adopt new tools to help with observing and recording). But this monitoring culture is distinct from that adopted by the Environment Agency and other official bodies. I have suggested that the FHD culture depends on or sits beside a theory of nature as applied to the Seaton Burn, a theory that emphasises wildness, fitting in, naturalness and authenticity. Although this is a 'theory' in the sense that the members of FHD frequently articulate claims about, say, the importance of authentic and appropriate tree species, it is not primarily a cognitive commitment. The theory suffuses their culture of environmental activities and is 'lived out' through their everyday practices of observing, noting and intervening.

It is interesting to note how this theory of nature in FHD fits with the PURE notion of 'spatial quality'. As noted earlier in the chapter the international PURE project placed considerable emphasis on spatial quality, even though there was no precise or easy definition of what spatial quality entails. The PURE report authors provided qualitative indicators such as attractiveness and spatial diversity. Though FHD have not adopted or replicated these indicators, they have evolved indicators on their own and these fit fairly readily with the PURE ideas of attractiveness, sustainability and so on. The approach adopted by the FHD thus fits relatively easily within the PURE umbrella even while not directly addressing or contributing to the analysis of the supposedly central notion of spatial quality in urban-rural environments.

Finally, my third conclusion is that there is a useful sense in which FHD can be said to be 'performing' the environment in the Seaton Burn. I am aware that the terms performing and performativity have been widely used by such celebrated authors as Butler (1990), Lyotard (1984) and MacKenzie (2006), though I do not want to adopt precisely the meaning of the terms as used by any of these figures. My objective in using this term is to point to the sense in which the theory of nature and culture of monitoring that characterise the FHD lead them to act on the Dene so as to produce a form of the Dene that conforms to their theory of nature. Their monitoring is not just observing and reporting, but results in actions and interventions that tend to produce 'positive feedbacks'. The members of FHD watch out, for example, for things that do not fit in and then try

to remove those things, replacing them with things that do fit. The monitoring leads to the Dene becoming more like their theorisation of it. Of course, this may be a dynamic process. I do not mean to imply that they are homing in on a single vision of what the Dene should become; their standards evolve and change over time. The point rather is that they perform nature so that the Dene tends towards conformity with their theory of how it should be.

And this has ironic implications for their relationship with the Environment Agency and other official bodies. These agencies tend to support the FHD and related groups for practical and ideological reasons (to do with the promotion of public participation in environmental policy for example). But the cultures of monitoring and the theory of nature that FHD has evolved may not correspond with the favoured views of the Environment Agency. The 'clash' over the metal bridge and associated path is a clear example of this. The FHD have developed their own notions of naturalness and fitting in and these sometimes lead them into conflict with the chosen management options of official bodies. FHD are not merely 'sub-contractors' working on the environment on behalf of official agencies; they are theorising nature in their own way and monitoring nature into conformity with that theorisation.

It is now time to turn to the next case study, one in which the citizen participants get to take on a strikingly different role but where, nonetheless, the value of ordinary citizens as pervasive observers of the environment comes to the fore.

Chapter Five

Senses@Watch: sensorial monitoring in practice and the practice of monitoring the senses

The previous chapter dealt with monitoring practices that are implicit, context-based and a pervasive aspect of public life in the Seaton Valley area. In the case that is now introduced, researchers hoped that, ultimately, the mass forces of the Portuguese population (or any of other context) would contribute to the upgrading of environmental monitoring in Portugal in a network of highly specialised 'human sensors'. There are two layers of analysis and interpretation displayed throughout this chapter. These, although separated for reasons of presentational clarity, are nevertheless mutually dependent: one layer presents the case in its various but more straightforward and objective components (from the aims to the results); the other deals with the less clear-cut aspect of the internal dynamics of the researchers and the diverse scientific models that guide their scientific practice and research options. Concurrently, these dimensions work together to produce a wholly distinct conception of lay environmental monitoring.

Introduction

Those who open any of the volumes of the final reports from the Senses@Watch project (S@W) will be greeted by an almost unvarying 'executive summary' (the only variation occurs at the end of the first paragraph when it comes to summarising the main characteristics of each of the case-studies); the summary reads:

> "The **Senses@Watch**[26] project aims at defining and evaluating methodologies that encourage the use of information about the state of the environment that result from citizens' voluntary efforts, namely information that is part of reporting environmental incidents or information that is obtained through the human senses like, for example, smell as it relates to air pollution[27]."
>
> (Senses@Watch Project, *Final Report*, Area of Knowledge: Air: 9)

[26] Bold as in the original.
[27] As discussed in the methods chapter all the quotes and transcriptions of this chapter were translated from the Portuguese.

This chapter aims to provide an analytical account of the S@W project in its two central dimensions: developing methodologies for lay participation in environmental monitoring and assessing the extent to which humans can themselves be turned into environmental sensors.

The many questions and complexities that the clear and straightforward style of the executive summary renders imperceptible, surface the moment one starts thinking of the meanings – and their practical implications for research purposes – that are put in place when defining notions of participation or citizens' sensorial information, for example. The senses are at stake in the S@W project in multiple ways. They are 'at watch' since they are conceived as the mechanism for providing information, implying the need to be vigilant or observant (in a multisensorial way); they are also watched, given that the voluntary engagement of active citizens is not a valid enough indicator when it comes to judging the reliability of the data they provide in face of the parameters demanded by official systems. The question of the senses' reliability and warrantability is therefore essential and brings the need for a thorough process of examination of the senses' adequacy in relation to the rigorous limits imposed by technoscientific structures.

This tension between *valuing the senses* and *evaluating the senses* is paramount in the project in that it dictates not only the way the research unfolds – determining the options and the practices – but the adopted epistemological and scientific principles as well. Moreover, as will be seen when it comes to identifying the methodologies for dealing with the second half of the tension, the tension itself becomes a divide amongst the research team. Distinct preferred models of scientific practice and evidence for achieving a measure of sensorial trust quickly opened the way for opposing paradigms to clash, manifestly displaying divergent views about the value and place of sensorial monitoring in contemporary environmental monitoring as a whole.

The S@W project had, undoubtedly, an ambitious agenda. Still, as I hope to demonstrate in the course of this chapter, its ambition was matched by a creative and innovative drive as well. Every time the research team found themselves researching in areas that were, to some degree, unfamiliar to most of them, the driving force was the strong belief in the underlying principle that lay publics do have a role to play in monitoring the environment. This is so, even if – as was clear from the start – it is the former that has to accommodate to the needs and demands of the latter. The desired policy outcomes and implications of the project (ultimately, an internet system capable of channelling the public's

contributions is to be put in place) were key to the research design and environmental regulations were decisive in the important task of filtering the 'bad' information from the 'good' in an effort to select it out according to some objective criteria. New information and communication technologies had a major role to play in the network the team wanted to establish, acting simultaneously as: the main structure around which the network would be effectively assembled; the means of mediation among all the constituent elements; and the principal tool for translating otherwise meaningless observations into data, as well as yet another means of sorting those data out. In other words, new technologies are to embody the notion of the network itself. In this process humans, too, are reconfigured: in order to place them as one of the central 'mobile nodes'[28] of the network, their physiological and biological abilities are to be refined, extended and transmuted to the point of classifying humans as sensors. To what extent this can be done is not just an intellectual question, it is also the basic precondition for the network to be materialized.

All these entangled dimensions will be under scrutiny and for that it is necessary to disassemble the stabilized version one is presented with in the 'executive summaries' of the project. From the contextual and background level of the project I will be looking into the multiple, the diverse and the contradictory dynamics within it. My analytical interest rests chiefly on those moments prior to the "putting in place", before the 'messiness' is untangled and ascribed with meaning. This methodological strategy will be the means for revealing a particular conception of lay environmental monitoring.

So, the intention of this chapter is to unpack two distinguishable – although intertwined – stories about lay monitoring: one that derives from the project's objectives in finding a way in which sensorial monitoring could, reliably, be put into practice and the other that, rather more opaquely, results from the distinct and basically contradictory scientific models adopted by the research team and through which the former is nonetheless supposed to be achieved. Uniting the two stories is the foundational belief that the advantages in capturing citizens' participation in environmental monitoring largely outweigh the epistemological and practical difficulties, particularly from the point of view of policy actors:

[28] This is the researchers' conceptualization of citizens within their theoretical and empirical framework. For a recent account of their perspective published in the aftermath of the project, see Gouveia, C., Fonseca, A., Condessa, B. & Câmara, A. (2006) "Citizens as Mobile Nodes of Environmental Collaborative Monitoring Networks" *in* Drummond, J., Billeu, R., Forrest, D. & João, E. (eds) *Dynamic and Mobile GIS: Investigating Change in Space and Time*. London: CRC Press.

citizens are numerous, spread throughout space – unlike official monitoring resources – and (can) have valuable information.

5.1 - Setting the sensorial scene

5.1.1 - The conceptual and methodological scene

The S@W[29] is an academic research project designed and implemented in Portugal but with a (generally speaking) universal ethos. By 'universal' I mean that there is little in the project that can be said to be specific or unique to Portugal as a social entity. The fundamental quest is not in any way related to a specific Portuguese idiosyncrasy in regard to sensorial skills, nor are the major outcomes expected to impact exclusively on Portuguese society[30]. The fact is that the nature and range of the questions asked allow it to be considered a decontextualized project in such a way that the context itself became a contested and controversial variable throughout the project's course. I will come back to this issue later in the chapter.

In line with the general epistemic aspiration underlying the project's rationale, the main research question can be summarised as "to what extent can human senses be reliable monitors of the environment?" To determine this soon became the pre-condition for the development of methodologies that would encourage the use of sensorial information for environmental monitoring purposes. Thus, from the straightforwardness of the general purpose presented in the first lines of every document of the project, we are subsequently conducted to more exacting and precise questions arising immediately out of the direct empirical consequences of the research. Such is the case with the previously cited Air report:

> "In the component of **AIR**[31] the objective is to test individuals' smell sensitivity in the context of the presence of odours in their environment, that

[29] Its complete title is "Senses@Watch - Collaborative Monitoring in Environmental Systems: Tools and Modelling for Obtaining and Analysing Environmental Information" as it is identified in the official documentation of the Fundação para a Ciência e Tecnologia of the Portuguese Ministério da Ciência e do Ensino Superior (Foundation for Science and Technology, Ministry of Science and Higher Education), the funding body.

[30] Evidently, one can not be oblivious to the fact that there are aspects of the research that can only be meaningful in the context of and to the Portuguese society. We can point, among others: the specificity of environmental regulations despite of the European Union's regulatory impact; cultures of participation within environmentalism will necessarily vary between countries; the case-studies were chosen under particular constraints; the very research culture influences decisions about research design, resources, scientific approaches, etc.

[31] As in the original.

> is, to test whether people are good monitors of the surrounding odours. (...) we want to discover exactly at which level people sense unpleasant odours and whether those odours that are sensed coincide with higher concentrations of total reduced sulphur."
>
> (Senses@Watch Project, *Final Report*, Area of Knowledge: Air: 13)

Or, in relation to the question of Taste:

> "In what concerns the case study of Taste, the objective is to evaluate whether people, using their taste, are good indicators of mains water quality in relation to chlorine and if they can monitor the quantity of chlorine present."
>
> (Senses@Watch Project, Research assistant's report. Case study of Taste. December 2002: 4)

Experimental and precise objectives of this kind – determining the level of confidence that can be placed in lay people's detection abilities – require equally specific elements of study. Pragmatically, then, the project is structured around four specific case-studies, each corresponding to one human sense and each investigating the potentialities and the limits of a clearly identified human sensorial capability in relation to a specific environmental parameter. I suggest that an overview of the organisation of the project can be gained from the following table (Table 5.1):

Table 5.1
S@W case-studies & main characteristics

Human sense under examination	Chosen case study	Question	Environmental parameter
Smell	Sulphur emissions from a cellulose plant in Setúbal	Are the people living in the area surrounding the industry able accurately to identify smells and their intensity?	Total reduced sulphur emissions
Taste	Chlorine levels in mains water in Setúbal	By tasting the water they drink, can the public monitor the quantity of chlorine in it?	Chlorine concentrations in mains water
Hearing	Traffic noise in Lisbon	Can people quantify the intensity of traffic noise in public spaces?	Noise as measured in decibels
Sight	"Blue flag" beaches along the Porto coast	Having as their reference data the 'blue flag' criteria, can people evaluate environmental quality on bathing beaches?	"Blue Flag" criteria for environmental quality

(based on my own summary of project documents and other materials)

The 'Sight' case study immediately stands out from the others. For one thing, the broader nature of the parameter assessed – "environmental quality" – seems to indicate that some particularities will emerge during the research process for which a specific methodological strategy will most likely have to be put in place. This apparent deviation is only being highlighted at this stage because uniformity was at the basis of the methodology designed for the project:

> "The objective is to use similar methodologies for the collection and treatment of sensorial data in each case study. For that purpose in the experimental design two components were defined: a laboratory one in which experiments are set up in a controlled environment in order to determine the detection thresholds of the variable under examination, and a field one undertaken in normal contextual conditions in a way that closely resembles the contexts in which voluntary citizen participation takes place." (S@W Project, *1st Annual Progress Report*: 8)

Thus, the adoption of this twofold strategy meant, for instance in the 'Hearing' case study, that the answer to the question "can people quantify the intensity of traffic noise in public spaces?" had to be objectively measured and

validated in order to be effectively investigated. As one researcher puts it when asked about validation and its meaning for engineering as a discipline:

> "(...) we wanted to establish a correlation between what people say and what is being measured; to know if there is or there isn't such a correlation. (...) that is, we have data from people's measurements, we have data from equipment and sensors; if a correlation could be established, we could say 'we believe in a positivistic way in what people say'". (S7: 3)

In the context of the 'Hearing' case study, this would have been achieved by implementing the following procedures (as described in several documents[32]):

- collection of official data (the 'noise map' of Lisbon);
- collection of individuals' qualitative evaluations and parallel measurements with technical equipment (noise-meters) in situ (two of the main green spaces in central Lisbon were chosen);
- two laboratory experiments – one undertaken in a natural environment chamber and the other in an anechoic chamber[33] – set up to identify, on the one hand, individuals' ability to detect different levels of noise intensity and, on the other, their ability to evaluate "an absolute level of noise" (S@W Project, *3rd Progress Annual Report*: 11).

The integration of the separate sense-based studies in a structure capable of receiving lay people's inputs was, as we know, the leading aim of the team from the very outset. Hence, considerable attention was given to the technical facilities needed for achieving such integration. And these, as far as the team was concerned, were best provided through the deployment of new information and communication technologies. Consequently, an internet site was conceived as the centre-piece of the desired, collaborative, environmental monitoring network. In principle, the site itself should embody the ideas of collaboration and participation in such a way that individuals' subscription to it would immediately be framed as part of a wider collective effort. This sense of collectivity would be achieved and reproduced by displaying a wide range of information resources, shared tools for those who channel the data in and those that access it. Acquiring, storing and editing information would be facilitated by a set of tools intended to meet all users' needs:

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[32] Mainly: the project's website that broadly describes it (http://sig.igeo.pt/senses/ce_audicao.html, accessed on 14/01/2003; can now be reached at http://panda.igeo.pt/senses/sp/ce_audicao.asp) and the annual reports delivered to FCT.

[33] Anechoic chambers are intended to provide an ideal-as-possible environment for the measurement of spherically radiated sound waves emanating from a sound source.

a) uploading and depositing of information, in special multimedia information formats, such as pictures, videos and sounds;

b) geo-referencing, with the use of ArcIMS software (an Internet Map Server) in the web mapping component;

c) visualisation;

d) communication among the various actors in the network.

(adapted from various S@W documents)

The team's strong conviction of the significant part that new technologies can play in lay environmental networks should not come as a surprise, not after some familiarity has been acquired with the documents from the project, nor in light of the extent of collaborative knowledge-based systems in existence today (Cullen and Cohn, 2006). As is claimed in almost every piece of written S@W work, the principal assumption about the design of the monitoring system was that:

> "recent developments in the area of information and communication technologies, namely the development of collaborative systems that deploy the facilities of the WWW and sensors, can be conducive to a widespread usage of this kind of information [environmental information provided by citizens], facilitating access to the data, its visualization and to communication between the several agents involved."
>
> (S@W website, http://panda.igeo.pt/senses/sp/index.asp)

New technologies would help in organising, accessing, translating and transferring the information throughout the network because this is what S@W, in the end, is about: building 'collaborative environmental monitoring networks' as the team puts it.

5.1.2 The organisational scene

New technologies were, in addition, central to the support for and functioning of the organisational structure of the project and in publicising it in the public domain. In relation to the latter, the upshot has been the previously mentioned website (see http://panda.igeo.pt/senses/sp/index.asp or Figure 5.1, page 119, for a screen shot of the webpage) a place where research progress could be followed, with regular up-dates and a general explanation of the objectives, case-studies and anticipated outcomes[34]. The website also includes a

[34] Although these were the intentions, the website was never exactly "finished" in the sense that quite a few of its sections were either stagnant or even empty.

database of links and bibliography in the main areas of the project. To help with the management of the project, the researchers also developed an internal website aiming at speeding up the exchange of information and communication between team members. This would be the preferred forum for the presentation of discussion papers and for general research coordination.

For running the study, the team had been granted a period of 36 months. The project started in 2000, more precisely and officially on 1st November[35]. However, several drawbacks of various sorts (financial, organizational and scientific) implied an extension of the deadline for its completion by over a year, bringing it well into 2005. This meant, for instance, that from the initial research team only the central nucleus, comprised essentially of the main researchers, still had some sort of relationship with the project during its final stages. The high turnover of research assistants within the group, who primarily held one-year research grants or were training with a view to completing their undergraduate courses, may be seen partly as a consequence of the extended duration of the project but also as one of its causes. Unsurprisingly, a relative detachment is felt in relation to the project among these young researchers and "collaborators" – the preferred official designation for those yet to finish their degrees[36].

Initially, then, the team had 14 members including both main researchers and research assistants (although in a later website up-date, one could count 21), whose academic backgrounds fell into two main scientific areas: environmental engineering and social psychology[37] with some researchers highlighting as well their expertise in specific sub-areas such as systems engineering (geographical, informational) and new information and communication technologies in general. Such expertise would be key in the design and conceptualisation of the collaborative website.

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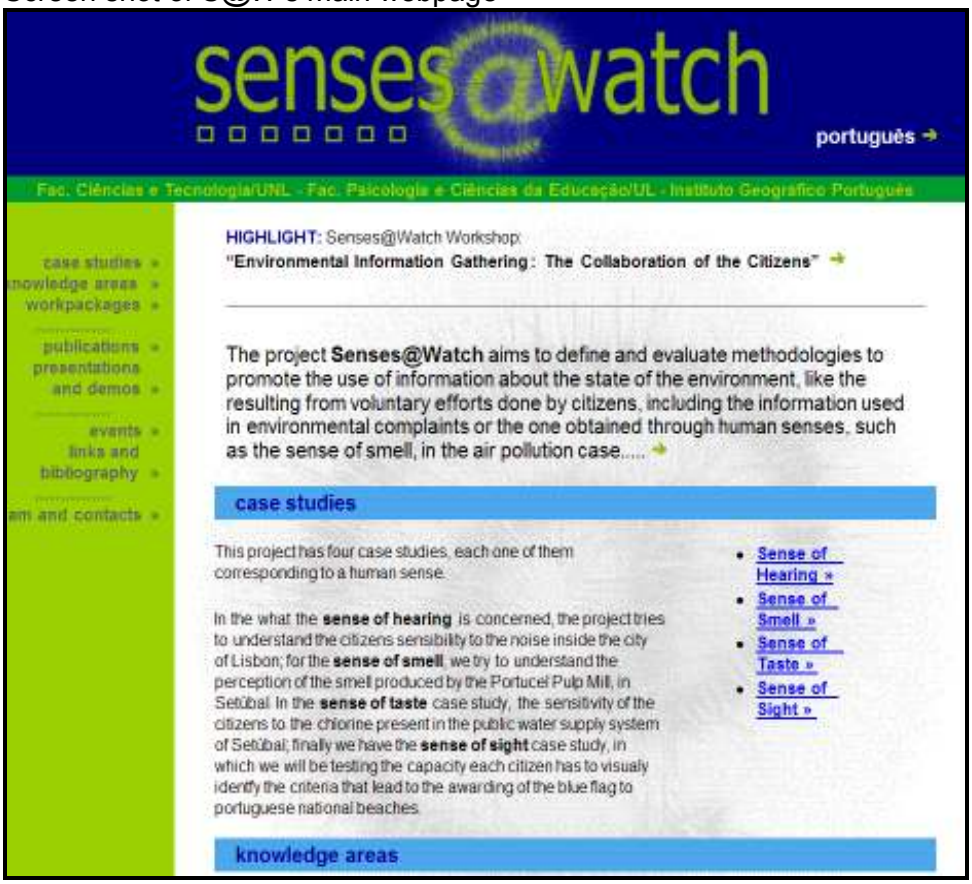
[35] As is made clear in any of the official documents of the project, for instance, in the yearly progress reports.

[36] That is the case of interviewee S5c, clearly stating a very instrumental objective: accomplishing the degree. For that, "was involved in the design of the chlorine experiment and running the first tests (...). Then I left." There are other situations, however: S5a was initially part of the team, but in 2002 decided to pursue their career with a Masters degree for which they travelled abroad. Or S5b, who only joined the project in 2001, took part in two laboratory tests and left "not even a year after."

[37] Their institutional affiliation follows, very straightforwardly, the general pattern of their scientific background: Faculty of Sciences and Technology of the New University of Lisbon, the Faculty of Psychology and Educational Sciences of the University of Lisbon and the Portuguese Geographical Institute (the geographical information systems component was essential in developing the internet system).

Figure 5.1
Screen shot of S@W's main webpage



5.2 - From the object to the study and back

5.2.1 - The object

It is worth looking in more detail into S@W's background, framework and, indeed, conceptual heritage. This retrospective will allow us to go deeper in understanding the conceptions about lay environmental monitoring that the S@W team brought to the fore. In reaching towards the broader underlying rationale that shaped the project, one will be entering not just the inner world of the researchers' views. More important, one will gain a sense of the hopes they entertained about what the project could achieve and, correspondingly, an insight into the likelihood of their building a collaborative environmental monitoring system together with the other team members.

Evidence about the researchers' perspectives is available from a variety of sources. It can be obtained directly from the interviews as well as from notes and memos, but it can also be inferred from the research agenda they developed and from academic and other publications they produced. From such material it

becomes clear that contextual elements of a conceptual, theoretical and even personal nature are undoubtedly present in the way the project unfolded.

Questions about the general background of the project are a first step into those perspectives since they sometimes disclose personal research agendas that may or may not coincide with the overall objectives of the project.

Recent trends relating to the growing role of participation in environmental policy and management were thought likely to be central to future developments, and therefore worth exploring:

> "(...) there was this idea that (...) technological innovation would allow people to be better equipped to intervene. Intervention not just in the terms used by environmental movements but in the sense of having more technological abilities. (...) the conjunction of technology and public participation would be a major trend in the field." (S6:1)

On the technological side, there was a whole research and development background (summarised in Tables 5.2 and 5.3 below) that made the team well aware of the potentialities that new information and communication technologies represented. It was with this potential in mind that one of the leading members identified the S@W project as being part of a wider research strategy:

> "[there were] three thematic areas worth exploring. (...) the third, which is where S@W comes in, is about two fundamental phenomena: the internet and people being internet users and the fact that people themselves can become sensors." (S1:1)

Leaving aside for the moment the implications of the notion of 'turning humans into sensors', one cannot avoid noticing the highly confident tone of the comment: rising numbers of internet users make for a corresponding growth in a web-based environmental monitoring system that regards humans like any other component or artefact. However optimistic and ambitious this prospect may seem, the fundamental principle that sustains it is rather simple. According to the same researcher,

> "[the S@W idea] is closely connected to the open source movement. The open source is basically a collaborative process of developing software in which people add elements. So the idea is to produce open source monitoring in which monitoring the environment is not restricted to traditional entities – they don't own the system. It is open." (S1:2)

Opening official monitoring systems to wider participation has obvious implications for how those systems are conceived and, ultimately, for their nature. In such a case, producers and users of information would become indistinguishable for example. The 'openness' of the source means, literally, the collapse of orthodox monitoring systems from their conception to their outcomes. The rigidity and formality that characterise traditional systems will give way to a flexible, collaborative process of co-constructing authoritative environmental data.

Other respondents drew attention to the likely benefits from a policy-making point of view. At this level there are essentially two major aspects that can guide the system's implementation: a clear cost-benefit advantage and the scale of the network. Thus, setting up participatory systems, "allows the information to be gathered more cheaply than investing in highly sophisticated technologies." (S4:2) Moreover, this researcher adds, S@W pledges "to use environmental information that, however quantitatively inexact, is none the less qualitatively pertinent and can contribute significantly to monitoring."

This positive outcome should undeniably appeal to official authorities once some of the barriers to the use of information provided by citizens have been overcome. Ultimately, lay information would be instrumental in making environmental regulations effective and in rendering those who breach them accountable for their actions. This factor would be all the more important once coupled to the realisation that, potentially, the network could be the size of an entire population; this would definitely put the seal on the attractiveness of S@W's policy implications:

> "We can, then, have a vast community of people that monitors the environment all the time and therefore build a grid that complements the official grids of data collection, corroborates or contradicts them." (S1:2)

In such a context, it is worth noting that the notion of community emerges with a 'new' meaning: it is a community that, as a community, is essentially detached from the local. And this is true even if it is individual citizens' connection with local phenomena – as represented by their ability to monitor – that, as individuals, qualifies them for a place in that virtual community. Training, sensors and new technologies in general would hold this community together and ensure the integration of the two grids mentioned above.

It is none the less apparent that, from the very outset, the team displayed strong differences of opinion about the best method for equipping the members of the community with the right tools in order to take part in the grid. This divide,

which I shall explore in more detail subsequently, plays a central role in the way the investigation unfolds and, consequently, in its results. In some researchers' comments, it is apparent that it is the sensors and new technologies that are the most important means for putting the collaborative system into practice:

> "The idea of collaborative monitoring should be supported by low-cost sensors that people have at home."[38] (S1:3)

Others put more emphasis on the importance of training individuals to turn them into effective monitors:

> "(...) S@W's basic question is: up to what point can people be trained in order to make of them good monitors from an environmental point of view?" (S8:2)

Training individuals in order to suit them for socially significant purposes is, of course, one of the classical problems that societies face; it is frequently designated by the preferred terms of 'education' or 'enskilling'. What this researcher is proposing though is to transform lay sensorial monitoring into a highly refined capability: a precise expertise that results from a training programme rather than a 'given' talent. This would be the way to make sensorial abilities reliable and trustworthy.

5. 2.2 - Locating the study among other studies

One could say that the S@W project aims to encapsulate the history of lay environmental monitoring and to draw on as well as go beyond it. In the course of this attempt a comprehensive collection and examination of earlier projects and initiatives was undertaken, and it is this prior legacy that constitutes much of the project's conceptual heritage.

Making use of the data gathered by the team, an abridged version can be presented of the tradition within which they locate their work and on which they see themselves as building. In the following table (adapted from Gouveia et al 2004: 138), the projects are placed in groups based on the role that the volunteer monitors get to play:

[38] The cost-benefit logic underlies the rationale for the system again. The same interviewee had just pointed out the rapid decrease in the prices of sensors: "(...) sensors that were extremely expensive are now cheaper and cheaper; for example, the price of a normal GPS sensor used to be around €1000. Nowadays they are sold in China for €7" (S1:2).

Table 5.2
Monitoring initiatives & volunteers' roles

Initiative/ project	Environmental field	Volunteers' role
*The stream quality monitoring project, Ohio Division of Natural Areas and Preserves' Scenic Rivers (http://www.dnr.state.oh.us/dnpa/monitor/sqm.html) *Maine phytoplankton monitoring program (Young-Morse, 2000) *National Audubon Society Christmas Bird Count (http://www.audubon.org/bird/cbc/index.html)	*Streams & lakes *Marine & coastal zones *biodiversity	Identify & record the occurrence & distribution of species
*Investigation of odor problems associated with wastewater treatment facilities in North Carolina (http://www2.ncsu.edu/ncsu/wrri/reports/srs6.html) *Coastwatch (http://www.geocities.com/RainForest/Canopy/1595/index.htm) *Storm drain monitoring team (http://wwwfortworthgov/DEM/news061402a.htm)	*Air pollution *Marine & coastal zones *Biodiversity	Identify and record the presence of pollution
*Spanish dolphins, Earth Watch (http://www.earthwatch.org/expeditions/canadas.html) *Mapping the Monarch migration in real-time (http://kancrn.org/monarch/wave/)	*Marine & coastal zones *Biodiversity	Observe & record the behaviour of species
*The Chesapeake Bay citizen monitoring program (http://www.acb-online.org/citmon.cfm) *The Globe project (http://www.globe.gov) *US National Weather Service Cooperative Observer Program (http://www.nws.noaa.gov/om/coop/index.htm)	*Stream & lakes *Soils *Weather	Sampling & measurement of physical & chemical parameters (e.g.: pH, temperature, dissolved oxygen)
*USGS Earth Science Corps (http://interactive.usgs.gov.Volunteer/EarthScience Corps/index.asp) *The Shoreline alteration citizen monitoring protocol – The Beach Watchers Project (Scinto, 2000)	*Land cover & earth features *Marine & coastal zone protection	Surveying & mapping

(adapted from Gouveia, C. et al, 2004)

Despite the apparent breadth of the initiatives listed, it is undoubtedly traditional activities that predominate when one analyses the roles citizens are mostly engaged in. Identifying, recording, observing and even mapping all fall in the category that has been most commonly associated with amateur monitoring practices: environmental conservationism. Accordingly, when looking into the environmental fields covered it is difficult not to notice the dominance of three

fields: marine and coastal protection; biodiversity, and stream and lakes. All of these are areas where a straightforward association with the naturalist tradition is easy to establish and where, therefore, the work of amateur naturalists can readily be transformed into monitoring practices.

The merits of such a compilation are self-evident: Table 5.2 (and to an even greater degree the much more detailed original one) maps a great deal of the typical work done by volunteers and in so doing, the S@W team is calling for a recognition of the track record of volunteer monitoring and, thus, its existing contribution to official systems. But – by contrast – they are also making a case for the enlarged and technologically enabled notion of volunteer monitoring they want to test.

It is, then, by means of another Table (Fonseca and Gouveia, 2005:8) that aspects of the researchers' own statements about lay monitoring can be further appreciated. Significantly, this time the projects or initiatives gathered combine multimedia tools and general environmental management tasks and may or may not involve the general public:

Table 5.3
Spatial multimedia tools for environmental management

	Spatial Multimedia Tools		
Environmental management tasks	**Access to multimedia data & navigation tools**	**Spatial analysis with visualisation & other multimedia tools**	**Collaborative & communication tools**
Environmental data collection and production	The use of video to measure geo-phenomena such as air pollution (Ferreira, 1999)	GIS based multimedia database in Pielsen project (Al-Kodmany, 2001)	Map based annotation tool developed in Virtual Slaithwaite (Kingston et al, 2000)
Organise and explore the information about environmental problems	Fly over realistic representations of the terrain in Portugal Digital (Neves et al, 1998) project and Virtual Tejo (Câmara et al, 1998)	Interactive maps in Descartes (Andrienko and Andrienko, 1999)	Data input in Internet-based database in Naturdetektive, (http://www.naturdetektive.de/2002/dyn/1407.htm). School children can input their nature observations (including photos) and the data are represented over satellite images
Analyse environmental problems and phenomena	The Visualizer Tool (Fonseca, 1998) within the EXPO'98 Environment Exploratory System	Access to animated maps, which are .gif images, showing atmospheric ozone levels for US and Canada. Ozone in the Mapping Project by the USEPA (http://www.epa.gov/airnow/)	Emails are sent automatically to registered users any time ozone reaches unhealthy levels in Sacramento county (http://www.sparetheair.com/)
Share and discuss problems, solutions and ideas and generate alternatives	Playing the sound of aircraft taking off as heard from different locations in CPS (Shiffer, 1995)	Animation techniques associated to models; Superimposition of video sketching onto a video; Access to graphics with sounds, in the CPS (Shiffer, 1995)	The use of argumentation maps as a way to summarize and discuss the different alternatives (Rinner, 2001). Argumentation maps use text, maps and images
Evaluate, negotiate and vote on alternatives/ scenarios	CPS (Shiffer, 1995) allows access to a wide range of multimedia data by selecting resources from a geo-referenced image map base	Multi-criteria evaluation techniques in the Open Spatial Decision-Making on the Internet system (Carver et al, 1997)	Multimedia online survey for measuring visual preferences, in Pilsen Project (Al-Kodmany, 2001)

(in Fonseca, A. and Gouveia, C., 2005)

For each selected management phase (or task in the authors' terminology) there is more than one multimedia tool available. More importantly, tasks combined with multimedia tools are already being put into practice in creative ways. The overall message is rather simple. Environmental monitoring has been essentially under-explored due to the combination of two factors: the limiting of volunteers' work to traditional activities and failing to appreciate the flexibility that new technologies can grant to volunteers (and others). The S@W team accordingly positions itself at the point where these two limitations can be simultaneously overcome. How exactly they put this into practice is what follows.

5.3 - S@W case-studies at large

"**S8:** We are here talking, how many decibels do you think there are?
[And as my face gives away my hesitation]: Go on, give it a try.
ER: Erm, I don't know... 10?
S8: No, no. It must be around 48/50. 55 is usually considered the limit; and a computer sitting by your side can get to 40 or more."
(Interview S8, 20/06/2005)

The 'here' refers to a restaurant at a busy lunch time in Lisbon and as the background noise in my tape attests, 10 is obviously a ridiculous number. I did not know that at the time; what I clearly knew was that the chaotic mixture of voices, dishes and cutlery, glasses and bottles, cooking implements and food processing in a close-by, semi-open kitchen, all produced a loud, disturbing noise not conducive to interviewing at all. It was certainly something I could qualify as "too much noise", uncomfortable and distressing. But my attempt at quantifying it, using an unfamiliar decibels scale, proved to be neither a very successful guessing exercise nor indeed an effective way of expressing my discomfort.

5.3.1 A programme for lay sensorial monitoring

Although the aforesaid episode recounts my personal take on noise and noise-measurement scales, there are wider connections to be made. Not only does the commitment to quantification – the "how many" – reflect S@W's adopted epistemic principle of objectivity in its most crude sense, my own failure to translate what I was experiencing into numbers illustrates in some degree the sort of obstacles the researchers met in the course of their experiments. Moreover, the prompt offer by my interviewee of an example or standard that is certainly familiar from my daily life – the drone of a computer – exemplifies the

idea of learning and training and the adoption of scientific standards in the use of the human senses.

One can think of S@W as a programme that sets out to achieve a clearly identified objective. As such a programme, it encompasses a series of phases, each one encapsulating the requirements needed to move to the next; each one being a step further in the direction of a better usage or exploitation of the human senses. Analysing this process, I was able to identify three main, concurrent phases that I have called *refinement* (the quest for objectivity through testing and training), *extension* (expanding sensorial abilities by means of new technologies and sensors) and *collaboration* (setting up joint systems for experts and lay actors). The path from the first to the last is the path to integrated lay sensorial monitoring.

5.3.1.1 - Refinement

Refinement is about making the senses objectively reliable. The researchers themselves provide a clear diagnosis of the main problems concerning the use of sensorial information that they wish to overcome:

> "(...) the impact of volunteer collected data is limited since many of these initiatives do not follow conforming sampling procedures [sic] and represent isolated initiatives. Data credibility is one of the major obstacles to maximize [sic] the use of volunteer collected data. Additionally, access to volunteer collected data is usually difficult, as they are dispersed and non-structured[39]."
>
> (Gouveia, C. et al, 2004)

Such obstacles demand, from the researchers' perspective, an evaluation of the senses' suitability to provide 'better' data. When it comes to applying the project's methodology, this amounts to testing and training. As one of the main researchers puts it:

> "(...) is the information provided by the public valid and therefore able to be used by the regulator in order to alter an industry's course of action, or to force a water board to increase or decrease the level of chlorine (...), or is this information too diffuse and lacking in rigour to be used?" (S4:2)

One of the tested parameters was (as described in Table 5.1, 'S@W case-studies & main characteristics', page 109), chlorine concentration in mains water.

[39] From the original article published in English.

The common assumption that individuals can detect chlorine in the water they routinely drink was considered to be a good indicator of the potential usefulness of sensorial observations. But people's detection ability was, of course, deemed unscientific and, consequently, likely to be of limited value when faced with the – assumed – robustness of the regulatory, evidence-based policy knowledge.

From project materials[40] one gets to know that chlorine has been used as a disinfectant in mains water since 1825, having been retained until now as the main method due to its cost-benefit advantages: it is inexpensive, highly powerful and effective at low concentrations. Despite the recognition that exposure to chlorine carries health risks, it is also acknowledged that the normal dosages employed in mains water are safe for human consumption. The main consequences are, mostly, an unpleasant flavour and odour. Yet, only taste is under scrutiny in S@W.

Describing the experiments and tests in all their detail and complexity would be too long and tedious a process; it would not necessarily contribute a great deal to a better understanding of the idea of refinement. In opting to leave some aspects out, I am not questioning their value from the researchers' own perspective, but highlighting the most relevant elements instead.

For the chlorine, two main aspects were at stake:

> "In the first place, the minimum detection threshold, that is, beyond what level of chlorine are people able to say *'yes, there's chlorine in the water'* and, secondly, the detection of variation intervals, that is, we increase the portions and people say *'hmm, it seems that there's more chlorine now'*; in principle there should be a logarithmic relation [between the concentration of chlorine and the perceptual response]. So, we had series of gradually higher concentrations of chlorine in which we registered, 1st from what point people could detect the chlorine; 2nd from what point they detected successive variations." (S5c:12)

In relation to the first – determining the minimum threshold – three laboratory experiments were conducted each comprising various sub-tests; each experiment built on and aimed at verifying the results of the preceding one. By and large, the experiments were of a very similar structure: the preliminary results would point towards the aspects that ought to be altered in pursuing statistically significant results (say, the size of the sample or the types of information supplied

[40] There is, obviously, a commitment to use documents from the project. In this case: *Case study of Taste*, Research Assistant Report, 2002.

to the participants). It should also be noted that, according to the opinion of the research assistants involved in implementing the tests, the experiments were experienced as quite demanding by the participants in relation to the number of tests and, above all, in the concentrations of chlorine used (as it clear from interviews S5a, S5b and S5c).

The participants were a "convenience sample", recruited from amongst the students and members of staff of one of the project partners. The basic procedure consisted of asking for volunteers at lunch time in the café-bar. For those who decided to enrol, a brief explanation of the events to follow was provided (in this case in relation to the first of the three experiments):

> "We are going to carry out a series of tests. In each of the tests you will be given two glasses of water. I'd like you to tell me if you can identify any difference between the water in the two glasses and in that case if you can identify which has chlorine. In each episode you should take a mouthful of water and swill it around your mouth. You can taste the water at most twice before you reply. Between each test there will be a half-minute pause."
>
> (Case study of Taste, Research Assistant's Report, 2002: 16)

The first glass of chlorinated water to be sampled was prepared on the basis of 0.1mg of chlorine per litre of water. Subsequently, the sample concentrations were gradually increased in 0.1mg/l steps up to the limit of 0.5 mg/l. The participants were asked to:

> "a) (...) distinguish between a sample of water without chlorine and a sample of water with chlorine, with the initial concentration of 0.1mg/l;
>
> b) (...) distinguish between two samples of water both without any chlorine;
>
> c) (...) distinguish between a sample of water without chlorine and a sample with chlorine (with a chlorine ratio equal to the one in the first test)."
>
> (Case study of Taste, Research Assistant's Report, 2002: 16)

Those who failed to differentiate between the two glasses of water in a) were asked to repeat the test, with a higher level of chlorine in the water (starting with 0.2mg/l), successively until whichever was first achieved: the level of 0.5mg/l or the identification of the chlorinated water. Also, those that in stage b) identified some (non-existent) chlorinated water were asked to start again at step a) and given samples with higher amounts of chlorine in them.

Thus, the minimum detection threshold was defined as:

> "The minimum detection threshold of each individual corresponds to the proportion of chlorine that that individual was able to correctly identify in the first and third test of the same series, having simultaneously correctly answered in the second test of the series."
> (Case study of Taste, Research Assistant's Report, 2002: 16)

What sort of conclusions did the experiments generate? Considering just the one I have been referring to, it indicates that, for instance, 61.7% of the participants in the tests were able to spot the chlorine in the water at concentrations up to 0.5 mg/l. It shows that a third of those who successfully distinguished the chlorine are able to do so at levels of chlorine between 0.35 and 0.45 mg/l and indeed that 0.33mg/l is the average level of chlorine that could be detected by the subjects in this first experiment. Naturally, having arrived at this point, what really matters is, on the one side, the extent to which these results are themselves valid and, on the other, their meaningfulness to the general aims of the project.

In regard to the first issue, despite introducing mechanisms in order to secure statistically significant results (for instance, increasing the size of the sample as was pointed out above), the results proved to be repeatedly disappointing, albeit to different degrees. Thus, at the end of the first of the experiments the researcher has no reservations about declaring the results simply unsatisfactory (ibid: 27) while, at the termination of the third, there is the recognition that a significant difference has been found between those individuals who can detect chlorine and those who cannot. It is, however, when striving for more detail – by testing people's ability to discriminate at different concentrations – that the tests prove to be unsatisfactory: ironically, at the highest levels of dissolved chlorine, the ability of people to detect the chlorine does not differ statistically from the result that would be expected by chance alone. Given the way that the statistical support seems to fade as the chlorine concentration increases, it is of little surprise to find a rather modest overall conclusion:

> "Establishing the minimum detection threshold is not a simple process, sometimes (...) it is not confirmed by the control test. (...) it is an extremely difficult process whose results are predominantly unsatisfactory."
> (Case study of Taste, Research Assistant's Report, 2002: 42)

This perspective is confirmed by some of my interviewees in the research team when invited to evaluate the case study:

> "The 'chlorine', erm, raised problems. This was the case study with the highest allocation of person-months, where we had an enormous but meaningless amount of data." (S6:10)

Or:

> "The literature and our own investigation tell us that the variability in water parameters – pH, temperature, dissolved calcium carbonate, etc. – can be so wide that it is impossible for someone to provide an accurate number." (S4:6)

Some of the obstacles had been foreseen and, whenever possible, taken into account or at least identified as factors that could interfere with the results. That is the case of the 'saturation effect', documented in the psychophysics literature, and to which an indirect allusion was made some paragraphs ago: after various 'tastings' of different chlorine concentrations, an individual's detection ability notoriously diminishes (numerous 'dumb tongues' were reported after the tests). A fruitful illustration emerges from the type of water used in the tests: because the water in the experiments was tap water, the level of chlorine already contained in it had inevitably to be measured. It was the accuracy of those measurements and that of the experiments in general that, in itself, raised concern among the researchers as some revealed during the interviews. The reservations were, for the most part, focused on the level of expertise required to conduct the experiments. The key issue here is that the personnel involved lacked such expertise:

> "Well, none of us was truly equipped to do all that lab work. (...) We don't have a background in that area. And then the results were ill informed by that problem; we weren't using a standardized lab so, therefore we had the influence of, let's say, the temperature. And the temperature ruined the results: most likely we had those results because we didn't control the temperature! So, let's repeat the experiment: we'd fix the temperature, but we'd never have the necessary support for a competitive job in that area." (S6:11)

If a conclusion is possible from the experiments, it is that the results are for the most part meaningless. It will be fair to say that the only relation with proven statistical evidence is that individuals are able to detect chlorine in water. This, considering S@W's broader objectives, is certainly disappointing. Testing the senses, in this case the sense of taste, was thwarted in its quest to objectify –

and translate – sensorial information; to be precise, to investigate the possibility of transforming “it tastes a bit of chlorine” into, for example, “the chlorine concentration is 0.17mg/l”. Indeed, this study indicated the unfeasibility of such an ambition. It is unclear whether this was due to the lack of preparedness of the team, as the aforementioned researcher suggests, or rather to the variability and range of the parameters interfering either in a controlled environment (such as the laboratory) or in a real context, as one colleague appears to indicate (S4 in the quote above); resolving this issue seems to be of little importance other than for placing the ‘lack of skill’ more on the side of the team or on the side of human sensorial aptitudes.

Still, the implications are wider: one might ask how would the minimum detection threshold – supposing there were one – offer any practical help in the context of day-to-day monitoring? Since the idea was to strip the water of the elements that are indisputably a part of mains water (such as variable amounts of dissolved carbonates and variations in temperature, even if such standardisation was only partially achieved) it is hard to see the contribution of such information to the wider system and its goal of spontaneous citizen monitoring.

Nonetheless, irrespective of the analytical reservations one can raise, the scientific value of knowing the boundaries of human sensorial detection abilities seems obvious. Laboratory studies aimed at defining sensorial limits are a well-developed area in psychophysics and that tradition had an undeniable weight in the whole of the S@W project. As one of the leading members of the team, and psychologist, puts it:

> “Psychophysics studies the relation between stimulation and perception which it has been doing for more than 100 years and that relation is usually logarithmic. (...) so there are psychophysical dimensions when we talk about detection; about detection levels; about differences between people at lower levels [of detection]; about what level variations they can identify; or if they can distinguish between several stimuli, if they can spot stimuli contamination. These are problems of the perception organ.” (S8:3)

Once socio-cultural factors are stripped out, sensorial aptitudes lay bare the sense organs and their perceptual capacities. It is this understanding that psychologists in the team tended to bring to the fore – not without opposition from fellow team members – and that so strongly influenced the methodologies in the chlorine study as detailed in the pages above. Not all researchers found a similar level of support for such methodologies though:

> "We didn't have previous studies in the case study of noise. Our noise was traffic noise, which is not studied. There are studies about *white noise*[41], essentially laboratory studies (...)" (S5b:12)

The focal distinction between one and the other (chlorine/taste and noise/hearing case-studies) results precisely from the very basis on which the data were compiled. If for tasting the chlorine, the team attempted to isolate that variable from all the others (either laboratorial or context-related), the noise experiments took place in a real-life context[42] (two green spaces in central Lisbon) where 'traffic noise' is necessarily 'contaminated' by other noises and sensorial stimuli, turning it into a rather messy category on its own and difficult to 'pick out' from other contextual elements. Thus while the randomly chosen passers-by-turned-into-volunteers had to decide if the category 'traffic noise' was "very high", "high", "average" or "low"[43], the noise meter was simultaneously reading simply 'noise'. It is this gap between, on the one hand, the absolute readings of the meter and the qualitative ones of the subjects of the experiments and, on the other hand, among the chlorine thresholds and their effectiveness in a daily environment that the researchers believe can be filled by training.

As I have pointed out before, where *refinement* is concerned, testing is coupled with training. One can legitimately anticipate, therefore, that the latter would be the mechanism through which the effort of disciplining the senses would be channelled, once the results of numerous tests had been gathered and interpreted. But regardless of how disappointing those results appeared to be, training seems to figure in S@W as no more than a rhetorical device.

Indeed, as more resources were diverted into testing – due to the ever more demanding requirements for introducing precision and validity in the experiments

[41] According to the literature, this is noise that has a flat power spectral density (PSD). Basically, this means that the noise is at the same level at all frequencies. Such white noise is commonly used to cover up other random noises such as those found in an open office.

[42] In a first instance. As I have written based on S@W documents this case study involved two sorts of experiments: contextual and laboratorial. Analysing data from the interviews, one learns that the laboratorial stage did not produce interesting results not least because "they [the psychologists of the team] were mostly attempting at assessing a scale." (S6:15).

[43] This is, naturally, a simplified description of the methodology in this stage of the experiments. A more accurate account is produced in interview: "Initially people had a certain amount of time to gain consciousness of the surrounding noise and sounds. We then asked them to classify the noise according to a qualitative scale. Then we asked them about the sources of noise or sound in the area (buses, cars, planes, birds, all of it) – people were given some examples, but had the chance to think and suggest other sources of sounds. After this, and I may be forgetting some details, we went back to the first question only adding a quantitative scale." (S2: 5).

– fewer were available for putting training in practice. One finds it in the discourses of the researchers, various documents and it certainly has a place allocated in the initial design of the experiments. However, there was never the capacity to accomplish it.

> "(...) the initial idea of training people wasn't followed through; that methodology wasn't adopted. (...) we had to come up with a compromise solution. But it would have been useful to have had trained participants... even for the noise case study." (S3:11)

Or, as expressed more definitively by another researcher:

> "We've adopted the psychologists' strategy of measuring in the laboratory first and going to more participatory contexts afterwards [allusion to the taste case study]. But what happened is that we got stuck in the laboratory because the difficulties of doing the lab work were so big that it prevented the participatory part from taking place, and then the project had ended, we didn't have more resources, the research assistants had left... (...) priorities were inverted, you know what I mean?" (S6:12)

What notion of training is then available for us discursively? There is, firstly, the distinction between areas suitable for training and areas where such a technique will not be appropriate:

> "(...) the conclusion [is] that people are not always good assessors. For two main reasons (...), there are intrinsic difficulties in estimating – where I believe training is possible; (...) because it is possible to adjust your psychological scale. (...) we all have psychological scales. And there are things where we can do that [adjust the scale] and things where we can't. Chlorine in the water, that's complicated; noise, that's easier. And that's it. (...) The extrinsic problems – it's that not every environmental indicator is [sensorially] detectable. Particulates that you can recognise are one thing; NO_x[44] which you can't see, which doesn't have a smell, is quite a different thing." (S8: 2-3)

From obstacles in adjusting our personal scales to the very sensorial limits of some critical environmental parameters, the making of trustworthy monitoring-citizens-producers of environmental data is not fully achieved through the

[44] Oxides of nitrogen are a common air pollutant and NO_x is the generic name for a group of reactive gases all of which contain nitrogen and oxygen though in varying amounts. Many of these gases are colourless and odourless.

contribution of training. Another constitutive element is, secondly, the general objective of training which, not surprisingly, is a matter that elicits divergent opinions:

> "When we speak about training, (...) the objective is not that people become environmental engineers. We have environmental engineers. The point is that people are able to evaluate [environmental situations] according to a set of parameters, they don't necessarily need to know the chemical elements of the pollution in the river." (S5b:7)

Retrospectively, one of the leading researchers regards training as "not interesting":

> "(...) it became clear that training isn't easy, that is, training implies such a big effort that we may end up with 3 or 4 or 5 persons achieving it! So what makes sense for us is to inform non-trained people. (S4:6)

On the contrary, the top psychologist of the team based on his own experience locates training's disadvantages in its costs:

> "(...) I can look at a chimney and tell if it's producing more than 40 milligrams of particulates per m^3. Because I have training. It's the same thing. If you train someone you'll attain it; because it relates with the general appearance of the thing. (...) That is, you can have training, but the costs it implies are out of proportion to the gains. Also, very detailed parameters do not work." (S8:5)

Training had always been thought of as a complement. It would add the skill to the biological functions of the organ in order to attain refined sensorial abilities. What one comes to find at this point is, though, a set of insurmountable obstacles made up of elements of a very similar nature to those psychologists withdrew from the 'perception organ': neither perception nor its training make sense without the social-contextual aspects that social actors inherently carry either as isolated participants in an experiment or as nodes in a monitoring network.

Refinement irrevocably withdrew the context from the participants; with it went the prospect of them contributing to policy making and the enforcement of regulations – nominated early on as one of the issues under investigation. Its applicability in the wider collaborative system is, as a result, certainly limited.

5.3.1.2 - Extension

> "(...) people can collaborate but not through their senses, they have to extend those senses with sensors." (S1:4)

This extract from one interview captures the central notion of extension, the second moment in the programme of lay sensorial monitoring that I have outlined above. At the same time it clearly sets apart the two models of sensorial monitoring that are concurrent but opposing within S@W.

Extension picks up on the human senses once they have been "purified" (Latour, 1993) and through the use of sensors and ICTs expands their abilities to perceive, select, collect, interpret and even send the relevant environmental data to others. In the extension phase human sensorial skills would be enhanced not surpassed by technologies: the generic principle is that of senses naturally benefiting from the potentially enhanced capacities allowed by new technologies.

With much of the background rationale for the deployment of ICTs and sensors already depicted in the first sections of this chapter, it will be through comprehending the only case study in which those technologies had a definite place that further conceptual grounds will be accessible. The sight case study presents itself, in fact, as the single empirical illustration of the conceptualisation of a technologically enhanced notion of sensorial capabilities. Without the sensors; these constantly come up in the narratives coupled with "new technologies" or even as an individualised item as the quote from the interview above exemplifies, but to the participants in the tests the opportunity to confirm whether their senses would be improved by their usage was not provided. It is precisely this lack of innovation and creativity – factors that were strongly expressed in the initial project and theoretical framework – that a researcher points out:

> "(...) one of the initial ideas was to use innovative sensors. For instance, electronic noses or others (...) we could have tried to explore (...) see how they might work but we never got beyond the level of theory. We didn't use them in fact. (...) The approach ended up being more traditional if I can put it that way. In the study of noise, for example, there was a technology in use, right? But it wasn't an information technology – it was a noise meter (...). Erm, which is already a very much tested and used technology. (...) It would have probably made more sense to have chosen a different case study where we could evaluate, say, the electronic nose." (S6:6)

Despite this absence or because of it, the sight case study stands out from all the others for three main reasons. It tries out some “new” technologies (such as the mobile phone), it states the multisensorial nature of humans’ perceived notion of environmental parameters and, arising out of the combination of the first and the second, the third distinctive element is that it creates the basic set up for collaboration through the construction of a ‘Senses@clipart’ (Figure 5.2, below).

Basically, the exploratory phase was divided up into two different moments (2001 and 2002) and two beaches in the Porto area were chosen for investigating publics’ ability to evaluate environmental quality on bathing beaches. The ‘blue flag’ criteria were selected by the team as the reference point. At the beaches, the participants (students at a teacher-training college) were asked:

> a) in moment one, to explore the beach sensorially in such a way as to determine whether it should be distinguished with the blue flag. The participants should support their arguments using images from disposable cameras, accompanied by written comments; check-lists with the blue-flag criteria were distributed to help them with their monitoring and participants were interviewed at the close of this phase.
>
> b) in moment two, participants were encouraged to imagine that they were sending multimedia and text messages (MMS was not widely available at the time of the experiments) to the environmental authorities with reference to sounds and smells and to submit annotated photos, for example with observed problems highlighted in marker pen. Researchers were at this stage interested in checking which sensorial elements would be selected by participants when overtly prompted to provide multisensorial information.
>
> (adapted from working document “Blue Flag – Visual Sense”)

From a) to b) the fundamental direction and hence the conceptualisation of the case study has changed: if when developing (a) the researchers were very much dealing with the narrow one-sense perspective by focusing on sight, what one sees and how it is seen, it was definitely a multi-sense orientation that dominated the experiments in (b). Several concurrent factors were decisive to that turn. Analysing the same working document in relation to the results of the tests in moment (a), the researcher indicates the fact that the respondents mentioned no problems involving sounds or smells even when these existed, were rather intrusive and indirectly visible in the pictures. As I was told by the researcher responsible for this case study, at the time of the test, there was a moving and noisy excavator on the beach; this was not highlighted by the respondents. On top of this, it was found that photos do not easily indicate

positive environmental features that are absent from the beach: for example, a shortage of waste disposal facilities at the seaside. It is hard to show in a photo something that is missing. These limitations were accompanied by the underlying perception of the singularities of the sense of sight:

> "(...) we knew that separating the senses, analysing them individually, only made sense because of the correlation we wanted to establish with exact measurements. When thinking of the instruments for validating the observations in the beach, we chose a video camera (...) which, after all, does more than collecting images, right? It picks up sounds, among other things, and those sounds may lead to other sensorial information that we possess, for example, when it's windy, we can clearly see it in the video camera... (...); because it's much more than just sight. (...) What's more, variables such as the olfactory and the auditory could contribute to validating the sight." (S7:5)

This assertion about the intersection of the senses in deciding on the existence of a problem or identifying its likely origin (that is, validating sensorial data or not) was firmly supported by the testimony of the expert from a local monitoring station. The same interviewee continues:

> "(...) the questions an expert would ask in order to confirm the correspondence between what people say and an environmental problem, bring the other senses in. (...) He [the expert] showed us exactly when sight isn't the best sense to detect a problem on the beach[45]. Progressively, then, by overlapping his expertise and the difficulties experienced by the participants, the synergy and interaction among the several senses prevailed. (...) Finally we got to that very similar MMS format of mobile phones; it's an image, right? It can have sound, it can have a small text and with it all one can provide a whole of sensory experiences which can have high environmental value." (S7:6)

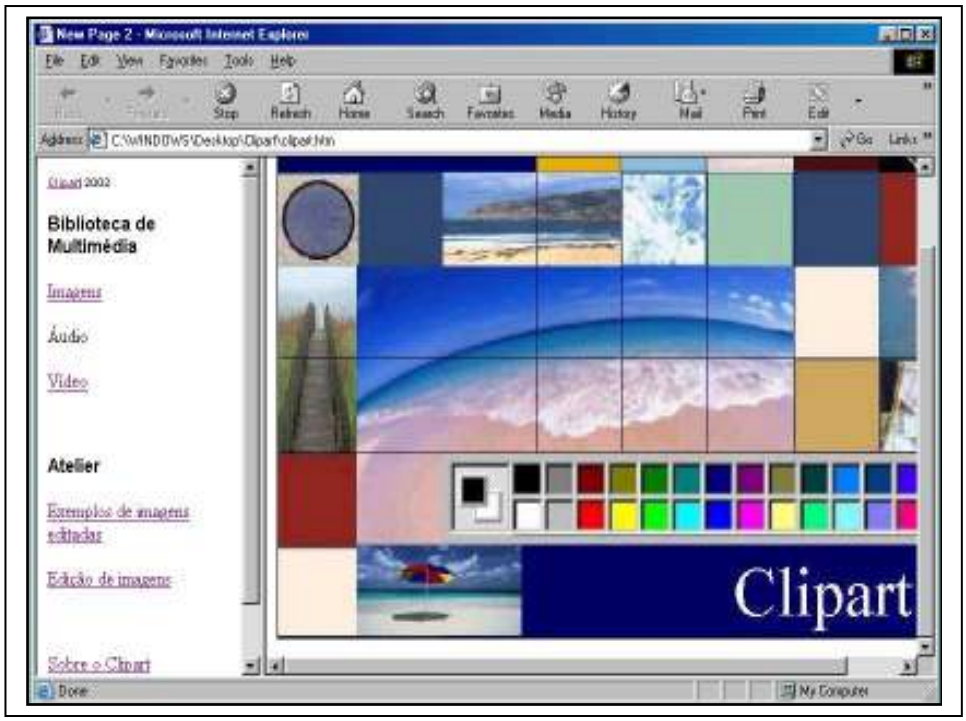
Image, sound, text and determining the position from which data is sent – all possible within the MMS structure – are cleverly combined; the plasticity that

[45] A well known example is provided later on in the interview, which I have placed in the footnotes for reasons of length: "The participants would look into the water and say: 'the water is roily (...) it's not transparent, it doesn't seem to be a good quality indicator.' And M. [the expert] would say: 'it's roily... it's always roily in here!'. He explained to me later that turbulence is due to the water dynamics, there're many waves ... that stir up the sediments. (...) For example, the smell in conjunction with sight would give us a better idea if there's a problem in the water." (S7:7) Water can look 'dirty' when it is merely muddy for perfectly natural reasons.

new technologies allow appears to be the way out of the narrowness of the one-sense sourced data. It is this rationale that is to be deployed in the development of the central phase of this, now transfigured, multisensorial case study.

To the challenges that arose in the exploratory tests, the researchers responded with the development of a clipart prototype to help publics in composing messages. In this system, publics access a library of images, sounds and colours which can be mixed, changed, and edited to compose each person's message and data. Such a reconfigured personal message would allow people other than the individual that submitted it to be able to read and interpret it. The following figure depicts the main 'Senses@Clipart' page:

Figure 5.2
Senses@clipart screen shot



(from working document "Blue Flag – Visual Sense")

The background rationale for having chosen the clipart structure is explained in a published article:

> "Senses@Clipart uses the well-known *clipart* metaphor to suggest an easy-to-use interface. It was designed to integrate different media in meaningful multi-sensory messages that, in a public participation context, could be sent as sensory *postcards*. The structure of those multi-sensory messages was thought to be compatible with the MMS of mobile phones. This way, the

interface integrates familiar but appealing ingredients of everyday communication." (Gouveia et al, 2004:2)

It is almost disarmingly simple: the easiness, familiarity and attractiveness granted to the interface originate in exploiting the very 'situational' circumstances of the publics, dramatically enhanced by a reconfiguration of the uses of widespread technologies. These, combined and directed both to the nature of environmental data and the needs of the publics, can bring their contribution to monitoring systems. Such is the case of sensors:

"(...) sensors are thought to be the next wave of innovation by Saffo (1997). There is indeed a growing market for inexpensive and wire-less sensors for home use. The Nighthawk Carbon Monoxide Detector sold through utility companies in the United States is a prime example. (...) By using transducers with digital communication and graphics capabilities, ground sensor data may be easily integrated in real time in environmental multimedia information systems." (Câmara, 2002:53)

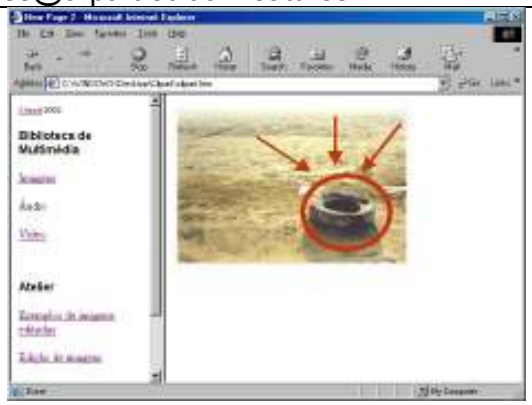
Figure 5.3 represents another feature of the Senses@Clipart, with the comments of the researcher highlighting some of the editing tools that are part of this 'interface'. The 'pick and mix' nature of the editing component acquires a prominent role since it will be through this feature that users will compose their sensorial message in such a way as to match the 'real' experience. The role and interference of mediation instruments that in mediating intervene or 'act' in the construction of the message do not enter into researchers' concerns. The aim is to expand human aptitudes. That in that process the experienced phenomenon and the constructed one may be dissimilar in nature is a normal, expected outcome that, additionally, indicates the success of the interface. Transforming 'raw' sensorial data into meaningful, multisensorial and edited data is certainly central in achieving that. The following passage of the previously cited article confirms this idea:

"(...) Senses@Clipart intends not only to inform users about the importance of sensory data within environmental quality but also to translate sensory data into environmental quality information." (Gouveia et al, 2004:3)

It encapsulates the fundamental problem of S@W only pointing towards an almost inverted notion and operationalisation of sensorial monitoring to the one I have described in the case study of taste. More precisely: researchers from the sight case study are as involved in exploring the integration of sensorial, lay

observations into official monitoring systems as their colleagues from the taste case study. The inversion takes place in the preferred method adopted to achieve it. In the taste case study the option depends on perfecting the very source of sensorial perceptions – the senses – placing the translation effort on the side of the publics; in the sight study the decision to build an interface, which has the ability to receive and improve multisensorial messages, is certainly closer to a shared notion of translation.

Figure 5.3
Senses@clipart edition features



Clipart – Image Edition Component

Image editing can be fundamental in constructing significant multisensorial messages. For that reason it will be developed and tested with users. Several editing tools will be available, namely, highlighting, the usage of words, sounds and icons which can grant a contextual basis for information such as odours.

(from working document "Blue Flag – Visual Sense")

The choice of the term interface is neither accidental nor it is just an illustration of computing science jargon. I have already demonstrated that the whole of S@W's architecture depends on the notion and working of the internet (from the internal structure of the project to the outcomes, see pp...), but being and acting as the interface has further, meaningful implications. The interface is the link, the connection point amongst multiple and distinct elements; in this case it links the raw material and the useful information, the lay and the expert, the user and the provider (of the interface, the information...)... But there is more: being and acting as 'the interface' means, as I have said, that in the process of transforming what is perceived (observed or sensed) into meaningful information, the nature of the observed changes; however, it means also that in benefiting from a mediation structure the actors involved will see both their own nature and the nature of their interaction reshaped.

Thus, from the moment a 'user' uploads his/her picture adding sounds and text and locates whatever was observed through the usage of web mapping tools, what a user is certainly asks for examination, as Oudshoorn and Pinch

(2003) have demonstrated. The whole system calls for such an investigation since all the stabilised, presumed notions could be questioned.

5.3.1.3 - Collaboration

Having arrived at this point, what remains to be done under the label of collaboration? The third and final stage of the programme for lay sensorial monitoring presents us with 'voluntary citizens' reconfigured into 'mobile monitoring stations', geographically spread, always 'on'. Their abilities were tested, trained, extended. Presumably they are now the "nodes of environmental collaborative monitoring networks" (Gouveia et al, 2006), working alongside experts and policy officials. Obstacles such as reliability, validation and data credibility have been overcome or – at least – reframed in order to accommodate some of the specificities associated with lay sensorial monitoring. The following quote from one of my interviewees addresses this adjustment particularly well in that it signals the difficult balance between the potential fruitfulness and value of sensorial information and the need for it to adapt to the requirements and protocols of formal knowledge systems in order to be valuable and usable in policy terms:

> "The real richness of sensorial monitoring is this: that we do it in situ, where we know more sensorially than anyone else. But then for this richness to be turned into power in terms of policy interventions there needs to be a form of translation, you see." (S7:11)

It is not as much that sensorial information lacks authority as it is that the nature of that authority (admittedly contextual) does not comply with the format of techno-scientific authority. What S@W's collaborative system is proposing is an interface that understands the differences without superimposing one over the other. Collaboration makes communication possible without undermining actors' assets. Translating is not any longer about learning how to transform a perceived experience into formalised data, in the way that refinement seemed to be; it is about designing tools that regardless of the highly specialised infrastructure required for their support (as in the case of technologies like the internet) promote the usage of lay sensorial information. That is, boundaries get to be permeable without being undermined.

The collaborative website (Figure 5.4) corresponds to the area where interaction takes place. In principle, it perfects the notions described above, and exists as the setting for their performance as well. How is this achieved? A great

deal of the background rationale and assumptions were already described or referred to in the course of this chapter (mainly in 5.1 – Setting the sensorial scene and in the analysis of extension/sight case study/clipart). Even so, there is a little more to uncover about collaboration and the collaborative website, chiefly concerning what the implications for the notions of lay sensorial monitoring and monitoring itself may be.

The picture of the website prototype[46] exemplifies the basic idea of a straightforward, "friendly" interface that in a way attempts to seduce potential users with its sensorial appeal (strong colours, simple images of "the environment" that can accommodate users' own interpretations, visually striking) and its focus on their role (it invites "your" knowledge, and allows you to "report", "take part", ...).

[46]For the sake the of the clarification of the argument, the segments of text are translated (identified by the colour):
Title: "Keeping your eyes on the environment … using your senses in the environment";
Red: about the site;
Blue: contribute using your own knowledge;
Yellow: report a problem;
Green: take part in a monitoring network: what are monitoring networks?; existing monitoring networks; how to build a monitoring network; official monitoring networks;
Grey: sort out your environmental doubts.

Figure 5.4
Collaborative website screen shot

Thus any citizen, from any given location and at any given time, would be able to feed the system with information that originates from his or her own efforts; that they have collected sensorially, with the aid of sensors or similar technological gadgets; that they have gathered systematically through time or that results from a one-off event; that they have rebuilt and improved using maps, images, graphics or text among other available tools; that they have followed through, comparing, analysing, networking within the network itself or broadening it up to different settings, contexts, locations. Translation would not even need to be thought of as it would start the moment the 'information' began its course as a 'message' up till it became 'data'.

Still, this is a prototype. It was never tested in a 'real environment' situation. Some time after having concluded my fieldwork, a restricted number of researchers were conducting laboratory tests while simultaneously trying to find a host institution for lodging the website, its associated costs and maintenance. The news was not exactly promising if for no other reason than that the collaborative website requires a rather demanding infrastructure for it to function as a platform for collaboration and to produce results. An illustration of this difficulty is found in the categorisation of the types of monitoring in which citizens engage. Roughly, there is the understanding among researchers that lay

monitoring falls into one of these types: routine or exceptional. What distinguishes the one from the other is not just the period of time over which monitoring is performed, it is for this matter the nature of the observed, its likely cause and the eventual need for action as well. And even if the ability to detect the 'exceptional' is clearly correlated with the practice of everyday monitoring, as the researchers point out, it is the classifying of an occurrence as a possible "problem" that calls for the prompt and permanent involvement of a whole structure of experts, policy bodies or law enforcement actors. In the words of my interviewees:

> "[There's] the level of reporting, but verifying technically at the scene, measuring and validating, it's always required. To report is to alert and the more specific that alert is the more it can contribute to finding a solution." (S2:9)

Or said more explicitly:

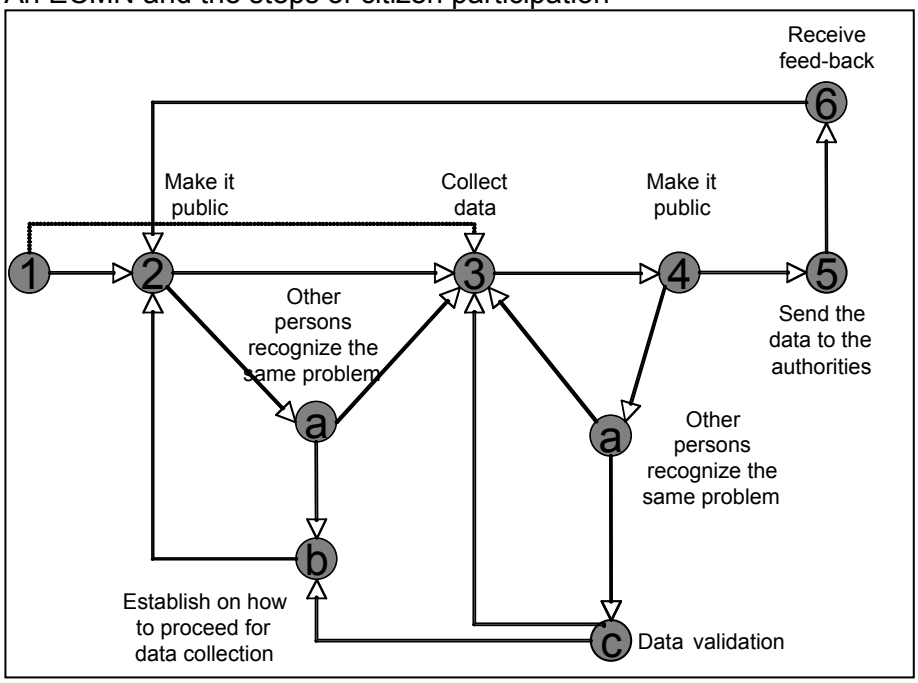
> "One thing is the daily, routine monitoring. A different thing is for me to find an environmental problem, an unusual smell or an unusual water colouration... if there's a report there's intervention that is costly (...)" (S7:13)

Thus even if having citizens do the monitoring can be cost-effective at its source (considering the resources needed and their continuous presence throughout space), there may be an unpredicted increase in the need for resources – and costs – at its end due to the amplification of vigilance. And it is not that the connection with authorities is a minor element of the network. The policy implications of such a network are a recurrent element that traverses the whole project. Apart from the cited interviews, one finds this link in the official reports too:

> "The objective of an air quality monitoring network is to make data available and to execute the analysis of legal conformity on a continuous basis." (Senses@Watch Project, *Final Report*, Area of Knowledge: Air: 10)

A similar objective drives environmental collaborative monitoring networks or ECMN, except that whilst in traditional monitoring networks "the nodes are sensors or measuring devices connected to data loggers" (Gouveia et al, 2006:5) in ECMN a 'node' is a citizen (or a group of citizens) whose enhanced sensorial skills supply the system:

Figure 5.5
An ECMN and the steps of citizen participation



(in Gouveia et al, 2006)

Participation starts in 1 with a citizen/group of citizens recognizing a problem and wanting to contribute to its solution using a variety of links (data transfer, networking, one-way or two-way communication, etc.) and an equally diverse number of steps which, in the end, will determine the data that authorities will be sent and their response to the problem[47].

There are in this conception of an ECMN a certain number of assumptions that remained unexamined throughout the project: citizens' willingness to participate and their likelihood to use new technologies in the way researchers expect in order to boost participation levels in environmental monitoring are two possible examples. Yet despite their role in the smooth functioning of the system, I will briefly focus in the final part of the current section on the encounters of the various actors involved and their consequences for environmental monitoring.

Will the actors meet in a system designed to be open? Although rhetorical, this is not an empty question: the open source software movement punctuates researchers' discourses as an exemplification of one of S@W's core ideas; as in the open source, an ECMN is built up of single or collective contributions that together shape the system, produce its objects (environmental data in a ECMN) and make sure that they remain open, that is, freely accessible and used. More specifically, the format and contents of the network is ultimately decided through

[47] A detailed account of this scheme is provided in the article cited.

the collaborative process. There is in this sense, one can assume, an encounter between actors' expectations, 'knowledges', and so on. As in other areas of social life the outcome will depend on the negotiation established, the resources deployed, ... meaning that although open, although co-constructed the system will necessarily incorporate some of the unevenness that characterises its actors externally.

In what concerns S@W's collaborative system if, on one side, as I have said, its heterodox character opens up environmental monitoring systems to examination and interrogation by simply 'reformatting' categories such as users / producers of the system (who uploads data and feeds the system, for example?), on the other side much of that transformation is induced by those that belong to the orthodoxy, not the lay-voluntary citizens (in the sense, for instance, that those that design the initial system will have a clear advantage over all the others).

The co-construction may in this sense be little more than an adaptation process, where the changes induced by lay actors will not have the power to radically alter the initial system. Surely, formal monitoring systems are compromised since previously stabilised categories do not match their contents any longer (such as users and producers as in the example provided above). Yet, it is not possible to foresee which categories will emerge.

Conclusion: what humans for lay monitoring?

All the interviewees were asked the same question: "How do you evaluate the project? What do you think of its results?" Of all the answers this one is particularly meaningful for all it says in so very few words:

> "I think the project has two phases. One is to check if people are good sensors or not and the other is, basically, to conceptualize a collaborative system in the internet. The second phase adopts the results of the first and these are a problem (...)" (S1:2)

It is a crude assessment of S@W: a project with two moments in which the limitations of the first were an obstacle for the second. In a strict sense there may be some truth in this, and the analysis and discussion provided throughout this chapter admittedly tend to support this point of view. Nonetheless, in this concluding section I will aim to bring to the fore a dimension that cuts across the whole project and that accounts in the same degree for much of the intensity of the debates – conceptual, methodological – held within the team and the problems alluded to in the quote above. Moreover, through these different angles

the notion of S@W as a *mode* of lay monitoring will emerge and this will form the basis for my discussion in the next chapter.

The scientific perspectives and corresponding practices of S@W researchers are key to the project in that they dictated the clear conceptual divide upon which the investigation unfolded: from early on, psychologists and environmental engineers confronted one another with opposing understandings of human sensorial abilities and sensorial monitoring that influenced every aspect of the research, leading ultimately to an organisational split of the team into two, each side representing one of the competing "paradigms".

The two phases emphasized in the previous quote can perhaps guide my intent. I will firstly analyse the objective of thinking about humans as sensors, turning subsequently to the purpose of constructing methodologies for collaborative monitoring.

Turning humans into sensors has an undeniable intellectual and social appeal. It relates to pervasive notions of post-human abilities, surmounting physical limits, or of an imagined future of improved human beings. The theoretical possibility of conceiving and exploring similar ideas in environmental monitoring makes thus its normal route in the field, particularly in a context where new technological devices appear to be enveloped in a discourse of unlimited potential and achievements.

This is the approach that environmental engineers clearly favour; it was the conception which prompted S@W. As one of the environmental scientists puts it:

> "(...) If we look at the person as a sensor, basically we have sensors which malfunction." (S1:4)

That is, human senses are a useful but rudimentary tool, they are somewhat prone to error by scientific standards and therefore have to be extended or supported by electronic sensors and new technologies in general. Yet, for environmental engineers this intrinsic inadequacy does not diminish the attractiveness of thinking of human actors as environmental monitoring actors. There are several advantages that may outnumber difficulties, even for policy objectives: people are numerous, widespread and mobile, which grants the theoretical possibility of conceiving a larger and more comprehensive network than official ones.

Psychologists are sensitive to these arguments but from the moment they were called into the team[48], an alternative interpretation of 'human as sensors' is introduced:

> "People make good exposure instruments, so the best way of getting full data is to ask people to be carrying gadgets. But this is the systematic use of sensors by citizens. A different thing is for us to utilise citizens' psychological evaluation to do such analysis. In the first case he uses an instrument, in the second he is the instrument." (S8:4)

Using or being a monitoring instrument, thinking of humans as sensors or humans as sensor-users, that is the essential S@W tension. So, psychologists rather than thinking of compensating for human sensorial shortcomings with the competence of technological artefacts, want to explore those faults in order to beat them. They put forward an approach based on the principle of a rigorous, highly formalised evaluation of human sensorial capacities. If people are fallible when assessing environmental quality, if their senses become contaminated by non-factual elements, any thorough examination will have to remove those away from them. This is psychologists thinking about a different form of inappropriateness from that pointed in the previous chapter (matter out of place); they are putting forward a notion of *perception* out of place. Only when the fallacies of perception are surpassed will it then be possible to know the senses' 'real' abilities:

> "Do you know how the Douro [the river Douro traverses the north of Portugal originating in Spain and terminating in Porto] used to be? Muddy, muddy, muddy. The only blue river in Portugal is the Sado. There's even a local song which asks: 'where's such a blue river like mine?' – do you see? (...) The way we apprehend nature, water or whatever, is determined and influenced by the mental models we possess. And those mental models of how the water should be, how the landscape should be, how the industry should be, and so on, will condition our perceptions and evaluations." (S8:7)

[48] As one of the engineers recalls it was the recognition that the dimension of the "social" was progressively shaping up as unavoidable that was decisive in (mistakenly, one can argue) bringing psychology to S@W:
"(...) we began to see that if the component of public participation was to be so fundamental, it might be interesting to have someone from psychology so that when people are asked to give information one can have the questionnaires properly done and also have a better understanding of their perceptions." (S6:2)

From this point onwards the 'story' is familiar: psychologists develop an extremely demanding method of testing, firstly, and training, secondly, human senses with the objective of defining precise confidence levels in their abilities to monitor specific environmental parameters. In this process, credibility was always on the line: finding a way of validating lay sensorial information was as much a scientific challenge as a policy requirement. The fact that, as I have demonstrated in the analysis of one of the case studies (chlorine levels in mains water), contextual elements pervaded the experiments in a quite visible – and disastrous – way was decisive in the process of re-evaluating the meaning of validation, particularly when ideas such as an extended and public monitoring frame the investigation. Validation and warrantability would have to be sought within the scope of contextual sensorial knowledge as the sight case study indicates. That is, it is a mistake to try to over-discipline the senses, to try to make people into 'scientific sensors' since in that process people risk losing sight of the true value of the senses: the richness of knowing more sensorially than anyone else, as one interviewee put it.

There are constraints though. Using people's contextual knowledge in order to build a 'distributed monitoring' cannot readily override experts' classification simply because it is through their judgement that data will be sorted and channelled to policy and enforcement bodies. Context remains, in the end, mostly a controversial category that a technological interface aims at controlling. The collaborative website, the prevailing S@W's methodology for sensorial environmental monitoring, places new technologies at the centre of lay monitoring. But it still faces a dilemma: does it aim to discipline lay actors so much that they become mere feeds for technical data, or does it try to introduce a radically open system? Many supporters of S@W seem to favour the latter option, but the question of how open it can truly be then remains unanswered.

This will be, in part, discussed further in the next chapter which will be devoted to the display and analysis of the proposed modes of lay environmental monitoring. To better support my proposal a third case study is presented, strengthening my claim about the diversity of modes that constitute this area.

Chapter Six

Modes of lay environmental monitoring: analytical interpretation by means of introducing a third case study

The preceding empirical chapters, dealt both with the detailed presentation and analysis of the main case studies of this research. Despite their comprehensiveness so far each of the cases, PURE and Senses@Watch, remain as two isolated entities, two blocks of sociological interpretation informed by the research questions laid out in Chapter Three but monolithically separated. The strong connection between the two will be established by the notion of modes of lay environmental monitoring. In order to achieve this, a third case is introduced. The Volunteer Water Monitoring Programme (VWMP) of the US Environmental Protection Agency (EPA) was studied through secondary data mostly available online. The three cases will allow for some level of generalisation and interpretation when it comes to determining which forms, or modes, of lay monitoring can arise or can be adopted in relation to various environmental issues.

6.1 - Contrasting the cases

The first observation one can draw from the analysis of PURE Seaton Valley (PSV) and Senses@Watch (S@W) case studies is that lay monitoring emerges from a rather different set of conditions in each of the cases. Their nature, their features, the objectives, the notion and practices of monitoring they uphold are all indicative of the sheer diversity a – so far – hidden field of study can hold.

Indeed, differentiation between the cases was, as explained before (Chapter Three, page 34), one of the concerns when selecting the case studies. As I put it then: *"the cases need to represent diverse modes of capturing lay monitoring, exercised and displayed in areas that would necessarily enlarge traditional environmental collaborative systems and, most likely, alter the dominant meanings attributed to monitoring*." Demarcation, however, while solid ought not to compromise the dialogical relationship between the two – this is not only essential for the current exercise; it is central to accomplishing the declared objective of establishing modes of lay monitoring as well.

In PURE, the monitoring practices I have analysed emerge out of a frame where planning and management are the main features. This is the case when

considering the large European consortium's objectives but it is the case also when, as I did, one approaches the Seaton Valley dimension of the project. It is management issues combined with a sense of protection of a local woodland area that one sees displayed in the Friends of Holywell Dene (FHD) Constitution, for instance (Chapter Four, page 66); it is a deep concern with the managing conditions of that area that drives the FHD to enthusiastically support the negotiation of the 99-year lease with the owner of Holywell Dene and, by the same token, to force the cows out of the woodland and the stream beds (Chapter Four, page 75). The resemblance between the initial set of motivations of the local group and what I have, later in that chapter, classified as a culture of monitoring thus turns out to be rather limited. Monitoring is, in this sense, the unforeseen upshot of a wider set of concerns and notions about managing the environment and nature.

S@W's departure point is, conversely, monitoring. The researchers declare it unequivocally as part of the main objective of the project ("(...) the use of information about the state of the environment that result from citizens' voluntary efforts (...)", Chapter Five, page 110); and it is monitoring coupled with new technologies that make for the greater part of the background rationale of the project, conceptually and empirically (as demonstrated in section 5.2.2., Chapter Five). But it is above all the purpose of developing and evaluating methodologies for lay (or 'volunteer' in S@W's preferred term) monitoring that better pinpoints S@W's nature. The clear drive to create innovative tools that promote lay monitoring and at the same time render it visible to official systems is what motivated the team in the first place. The fact should be acknowledged that, somewhere along the process the team apparently slightly lost sight of the initial motivation, channelling energy and resources to testing sensorial abilities. Still, the underlying purpose was always monitoring. In S@W monitoring is the means to attempt to implement a wider system of public participation in what relates to gathering information about the state of the environment.

To further draw the line between the two cases, the set of variables that have surfaced as being central to each of the cases will be called on. Context and new technologies are, from the outset, the established key 'identifiers' of PSV and S@W respectively. I shall consider each of these while simultaneously introducing other relevant attributes of the cases.

Monitoring practices are in fact context-laden in PSV: examples abound throughout Chapter Four in what comes to demonstrating how context influences, 'formats' and determines the practices and organisation of lay monitoring whilst

being influenced by these practices in turn. Contextual elements of a socio-cultural, historical and environmental nature (from the celebrated industrial past to the socio-economic depression that followed mine closures and the inherited pollution in water and soil) provide the foundations for the embedding of local actors in their local circumstances, and in doing so endows them with the necessary tools to act, for sure, but to develop the common understanding about what issues are at stake and what path of action to pursue (for instance), that precede action. It is the condition of the 'localness', as I refer to it, that works as the main instrument in organising Friends of Holywell Dene's (FHD) monitoring practices. Thus, what they see or observe is distinct from that available to the occasional visitor to Holywell Dene due not to an exceptional gift or innate skill but rather because of the 'situated' elements that frame their observations – and interpretations – in a particular rationale.

This rationale is the defining structure of monitoring, in that it sorts and classifies what local actors see within the 'perceived model' of nature and the environment (or gestalt as I said then) which is upheld against their observations. In this way, what 'does not fit' for example is condemned to be banned or driven out, be it invasive species, rubbish, cows or youngsters' inappropriate behaviour.

The connection with the context arises at another level as well: monitoring practices are mundane, daily practices, enmeshed with routine activities such as dog walking. Clearly, some exterior traits (binoculars, note book, etc.) may help to make up (and identify) the monitor 'in action' as one interviewee points out in Chapter Four (page 85) or it may happen that local actors engage in specific monitoring activities (water quality as the FHD did) requiring equally specific tools, procedures and attitudes. However, by and large the time and space of monitoring coincides and co-occurs with that of the routines of daily life.

The significance of this variable can be better appreciated when considering and explaining how the FHD's monitoring at times disputes and competes with that of official environmental agencies. As I have pointed in Chapter Four, this 'mundane monitoring' operates at several levels: it allows them to perceive the small changes that are key to detecting problems from the outset; it takes monitors 'out and about' in Holywell Dene on a regular basis constructing a permanent network of 'eyes and ears'; finally but not of less value, that overlap between monitoring practices and everyday life makes monitoring into an enjoyable experience.

Turning to S@W, one can say that there is little pleasure to monitoring as it was conceived in this project. As I claim above, new technologies stand as the

key identifiable dimension of S@W. Yet, it is not this option that accounts for the lack of joy that seems to envelope the monitoring experience. Nor, one can admit, is it the shrinking of the contextual variable to an extent that renders it barely visible. Rather, the cause is directly found in the 'deviation' into testing that I have analysed in Chapter Five.

Thinking succinctly of the context for now, it is only at residual level that it is considered in the project. S@W researchers were aiming at building a vast "grid" (in the words of an interviewee, Chapter Five, page 121) of monitoring citizens, a network of nodes of information spread through a territory and connected by new technologies (which would feed the information into the system as well) in a practical application of 'the network society' (Castells, 1996, 2004) or informational governance processes (Mol, 2006). As a consequence S@W necessarily overlooks individuals' insertion in a local area: equipped with sensors, internet and other information technologies (such as mobile phones), individuals are set to 'detach' themselves from local conditions and become mobile informational nodes. The community of monitors is, as opposed to that of PSV, virtual and independent of any condition of 'localness'.

Theoretically, S@W researchers are not short of evidence to support their claims and even at an empirical level, the examples are many and varied, as was shown in the preceding chapter (mainly in section 5.2.2). But, while in PSV local community groups established an instrumental relation with information technologies (or simply with technologies), which is very much determined by their concrete needs (for example, using email to send the group leader a digital photograph to authenticate an observation), in S@W new technologies are central to the system as a whole. They unify the system providing coherence, structure and method.

The chief implication of this observation is one that I have already pointed out: the deviation away from developing and evaluating methodologies (as stated in official S@W reports) to gauging sensorial capabilities. Parallel to this, testing (or refinement) surfaces as a dimension that nearly chokes off the development of new technologies. The point is that establishing new approaches for harnessing lay environmental information is strongly tied with wider conceptual and scientific grounds. From here the story is known: the team clashed as to what would be the thing to test in the first instance (new methodologies or individuals' sensorial skills), turning this into a methodological issue related with the overall consistency and rationale of the project. The result was a quasi-obsession with testing (after which training should follow), that failed to produce

any significant outcome other than a number of “dumb tongues” in the words of a junior researcher (page 131), when referring to the experiments from the chlorine case.

In S@W’s favour one can argue that it tries to deal with some problems raised in PSV, as is the case of the reliability of the data fed into the system, particularly in light of public policy and governance processes (a problem brought into discussion in Chapter Four when the EA representative dismisses the usage of the monitoring data collected by the FHD). However, exhausting participants in the experiments by investigating detection thresholds did not prove to be the most suitable strategy to obtain meaningful data nor to enlist keen future contributors to the system.

The idea of enhancing human sensorial abilities rests almost untouched by S@W not because the project has failed to obtain confidence levels (which, in the end, some researchers were happy to admit are not that important) but rather for the reason that S@W stripped participants of their contextual elements in order to be able to test the senses in their purest form (the exception being the sight case study).

Having highlighted some of the key differences between PSV and S@W, the question to address is now one of the ability to make general prepositions about lay monitoring out of each of these cases. I propose to do this through the notion of modes of lay environmental monitoring, which are – briefly – ways of organising lay monitoring, but that can be understood in a more comprehensive manner as each *representing a distinct multiplicity of interactions, motivations and perceptions about monitoring, its methods and objectives; about the environment, nature and the quality of both, displayed by the actors involved in that process, who are themselves diverse.* A mode of lay monitoring is, in this sense, much more than a set of monitoring practices and the principles that organise them since it places those practices in a wider frame of social relations that are central to its understanding.

I will for now just argue that in order to sustain those propositions or generalisations I want to make, a third case will be introduced. It is the Volunteer Water Monitoring Programme (VWMP) of the US Environmental Protection Agency (EPA) as was said above; through the triangulation of the essential variables of the three cases, I hope to put generalisation onto firm and substantive footings.

6.2 - The Volunteer Water Monitoring Programme

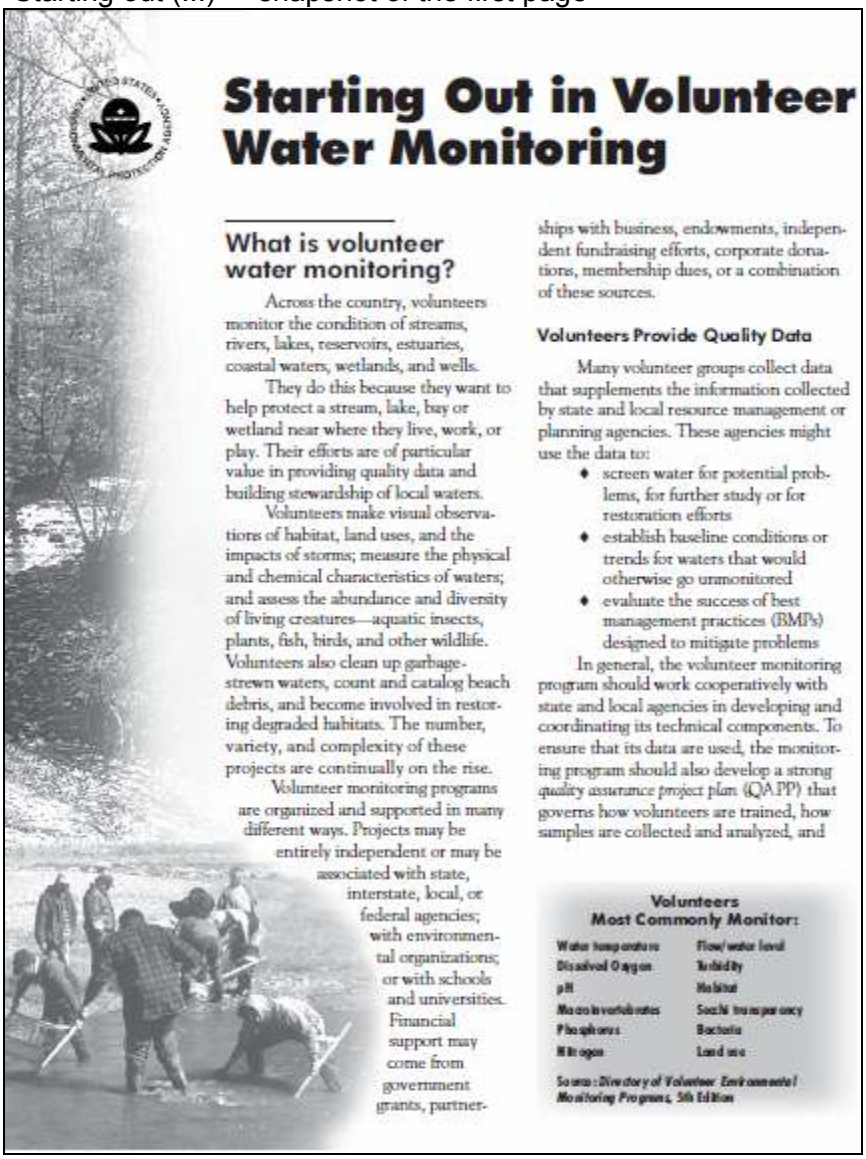
The Volunteer Water Monitoring Programme (VWMP), supported by the EPA is within easy reach by anyone with access to an internet connection. It can be found at http://www.epa.gov/owow/monitoring/. This programme is essentially run online and its main visible feature is a website that works simultaneously as a training school, a reference guide, a library and a news-and-meeting room, among other facets (these dimensions will be illustrated below). Apart from providing the online means of the programme the EPA also supports physical initiatives such as the National Monitoring Conference(s) – the most recent held in May 2008 – and the National Volunteer Monitoring Conference(s) – of which the most up-to-date available information reports to a conference held back in 2000.

All the documents, reports, guide books, manuals, the newsletter numbers and conference proceedings are accessible online for download which constitutes an extensive collection of materials ready for questioning and analysis. This was precisely the strategy I have adopted for investigating lay monitoring in what comes into view as a totally different setting – and concept – of environmental monitoring from the previous two. Apart from these, it should be noted that, a recently published piece (Pfeffer and Wagenet, 2008) is based precisely on the case of volunteer water monitoring within EPA's programme.

6.2.1 – "Starting out in Volunteer Water Monitoring"

The sub-title of this section is actually the name of one of the first documents to greet anyone who visits the EPA website. As the name shows, the document aims at introducing potential volunteers to the world of water monitoring. A brief glimpse of how the issue is presented to users of the website is given below through a snapshot of the first page. In making this choice of sub-title I intend to introduce the programme in its main characteristics, structure and objectives.

Figure 6.1
"Starting out (...)" – snapshot of the first page



Starting Out in Volunteer Water Monitoring

What is volunteer water monitoring?

Across the country, volunteers monitor the condition of streams, rivers, lakes, reservoirs, estuaries, coastal waters, wetlands, and wells.

They do this because they want to help protect a stream, lake, bay or wetland near where they live, work, or play. Their efforts are of particular value in providing quality data and building stewardship of local waters.

Volunteers make visual observations of habitat, land uses, and the impacts of storms; measure the physical and chemical characteristics of waters; and assess the abundance and diversity of living creatures—aquatic insects, plants, fish, birds, and other wildlife. Volunteers also clean up garbage-strewn waters, count and catalog beach debris, and become involved in restoring degraded habitats. The number, variety, and complexity of these projects are continually on the rise.

Volunteer monitoring programs are organized and supported in many different ways. Projects may be entirely independent or may be associated with state, interstate, local, or federal agencies; with environmental organizations; or with schools and universities. Financial support may come from government grants, partnerships with business, endowments, independent fundraising efforts, corporate donations, membership dues, or a combination of these sources.

Volunteers Provide Quality Data

Many volunteer groups collect data that supplements the information collected by state and local resource management or planning agencies. These agencies might use the data to:

- screen water for potential problems, for further study or for restoration efforts
- establish baseline conditions or trends for waters that would otherwise go unmonitored
- evaluate the success of best management practices (BMPs) designed to mitigate problems

In general, the volunteer monitoring program should work cooperatively with state and local agencies in developing and coordinating its technical components. To ensure that its data are used, the monitoring program should also develop a strong *quality assurance project plan* (QAPP) that governs how volunteers are trained, how samples are collected and analyzed, and

Volunteers Most Commonly Monitor:

Water temperature	Flow/water level
Dissolved Oxygen	Turbidity
pH	Habitat
Macroinvertebrates	Secchi transparency
Phosphorus	Bacteria
Nitrogen	Land use

Source: *Directory of Volunteer Environmental Monitoring Programs*, 5th Edition

(http://www.epa.gov/OWOW/monitoring/volunteer/#factsheets)

The start-date of the programme as such in its current format is not easy to establish. In an article published in a 'special topic' issue of the programme's newsletter – The Volunteer Monitor (vol. 6, n.1, 1994) – a 'brief history' of volunteer monitoring is set out, though the closest it gets to pointing to a starting date or moment is the following:

> "Water quality monitoring by volunteers is a more recent undertaking [than weather or bird populations], essentially starting in the late 1960s and the 1970s as grassroots efforts by lake associations and stream conservation groups. The 1972 passage of the Clean Water Act, which required states to

assess the quality of their surface water, provided the impetus for several of the early state-supported volunteer monitoring programs."

(Virginia Lee, "Volunteer Monitoring: A Brief History", *The Volunteer Monitor*, vol. 6, n.1, 1994)

The year of 1972 comes as the breakthrough moment when a legal disposition embraces and gives momentum to an already existing activity. Policy needs and the recognition of the limits of official monitoring stations provide the strong arguments for the acknowledgement of volunteers' work. From the Clean Water Act onwards, volunteers' activities slowly make the route of credibility, diversity of issues monitored and quality assurance which is, roughly, the present situation – allowing for volunteer data to be part of the official system.

Another important step was made around the same period albeit at a different level: a researcher from the University of Minnesota gave the answer to an instrumentation problem key to facilitating the access of volunteers to rigorous water monitoring. Though the source is not revealed, the next passage is attributed to Joseph Shapiro, the researcher concerned with the quality of lakes:

"But how does one monitor 12,000 or even 2500 lakes? Is there a parameter that is diagnostic and at the same time easily enough measured so that it can be measured by those persons already at the lakes – the residents of the area? Fortunately, such a parameter does exist – Secchi disk testing."

(Virginia Lee, "Volunteer Monitoring: A Brief History", The Volunteer Monitor, vol. 6, n.1, 1994)

The resonance with S@W's intention to constitute a network of monitors spread throughout a territory is unavoidable and exhibits all the reasoning that is commonly brought to the fore when arguing for increased levels of lay participation and governance. In this particular case as (more acutely) with S@W, instruments and methodologies are a central element in balancing accuracy with the ease and simplicity of procedures. Nowadays, the Secchi disk[49] is a main

[49] The detailed and accessible explanation about what a Secchi disk is comes from another document from the VWMP: "Father Pietro Angelo Secchi, scientific advisor to the Pope, was asked by Commander Cialdi, head of the Papal Navy, to develop and test a new water transparency instrument in the Mediterranean Sea. This instrument, now named the "Secchi" disk, was first lowered from the papal steam yacht *l'Immacolata Concezione* (*The Immaculate Conception*) in the Mediterranean Sea on April 20, 1865. The typical Secchi disk used in lakes is an 8-inch disk with alternating black and white quadrants (like a checkerboard). It's lowered into the water until the observer can no longer see it. The depth of disappearance, called the Secchi depth, is a measure of the transparency of the water. Transparency decreases as the amount of particulate materials—such as algae and suspended sediment—increases. The amount of algae that

intervener in water monitoring, irrespective of whether it is routine monitoring or special events such as the Great North American Secchi Dip-in. This is a celebratory event, involving thousands of participants from across the US and Canada in the first two weeks of July. It is, according to the leaflet of the event (http://www.epa.gov/OWOW/monitoring/volunteer/#factsheets), not just 'great', it is 'fun' also for the involvement or the sense of accomplishment it provides, among other reasons. The Secchi disk measures water transparency, though the 'Dip-in' event admits other instruments in the activities thus enlarging the range of the parameters monitored (temperature and pH). The discourse is highly motivational and enthusiastic about volunteer participation: it is the volunteers' contribution that have – since 1994 (the first year of the event) – made it possible to have 27,000 data entries about water transparency cross-country. This data series allows for several types of analyses, from the linear temporal one to more relational analyses combining, for instance, transparency with water type, geological characteristics or land-use variables.

Obviously, apart from obtaining the data, the event has strong educational and awareness-raising objectives, in that it attempts at bringing more people into volunteer monitoring while at the same time giving evidence of the connection between human activities and water quality. For that matter the meaning of water transparency as a parameter is one of the central features of the event leaflet:

Figure 6.2
The meaning of water transparency

(from "Dip into Volunteer Monitoring with the Great North American Secchi Dip-in", http://www.epa.gov/OWOW/monitoring/volunteer/#factsheets)

grows is affected by the amount of nutrients coming from sewage treatment plants, septic tanks, and lawn and agricultural fertilizer, as well as suspended sediments washed from construction sites, agricultural fields, urban storm runoff, or churned upward from bottom deposits." ("Dip into Volunteer Monitoring with the Great North American Secchi Dip-in", http://www.epa.gov/OWOW/monitoring/volunteer/#factsheets)

In spite of being focused around a particular monitoring instrument, the example of the Great Dip-in is nevertheless a good illustration of the present state of the VWMP in general and its side activities, their objectives and impact[50]. Still, the programme has other facets: I have indicated above that one can view the website as a vast learning, training and research campus with all the resources and 'facilities' required for those purposes (reference guides, a library, training opportunities, etc). In fact, in the initial page of the VWMP one is given a general overview of the offered resources. Beneath I reproduce the categories as provided in the website adding a short description of the contents:

- *Fact sheets*: short documents about the programme or related subjects and events that introduce the theme in an accessible and simple way (example: "Starting Out in Volunteer Monitoring");
- *Methods*: includes guides and manuals for issues such as project organisation, quality assurance, methods and procedures for monitoring diverse water environments;
- *Newsletter*: this is the volunteers' 'newspaper' (The Volunteer Monitor), directed and maintained by monitoring groups and individuals with the financial support of the EPA;
- *Listserver*: an online forum (Volmonitor) provides a sense of identity and belonging for the members of the 'monitoring community' as it is called, offering them the chance of exchanging experiences, discussing difficulties and successes;
- *Directory*: databases with results of volunteer monitoring activities and current national monitoring programmes;
- *Conferences/Events*: call for papers, proceedings and related information on the various conferences and events held in relation with the programme;
- *Related Links*: links to websites that are either connected with volunteer initiatives or that provide further advice and knowledge about water monitoring (such is the case of this scientific article: "Volunteer Biological Monitoring: Can It Accurately Assess the Ecological Condition of Streams?", Sarah R. Engel and J. Reese Voshell, Jr. (2002), *American Entomologist*, 48 (3): 164-177).

[50] The celebration of the Monitoring Month, from September to October, and of the World Water Monitoring Day on September the 18th would be an equally interesting example: they deserve constant attention from the EPA website, they mobilise a wide array of resources, actors and activities and are another opportunity for environmental and monitoring education. More details available in http://www.epa.gov/owow/monitoring/volunteer/monitoringmonth.html.

This list offers some evidence on how much the EPA values volunteer monitoring within its programme of action. Extended validation can be drawn from EPA's own discourse extracted from various documents. The underlying principle for supporting and encouraging volunteer initiatives is that, through these, many advantages can arise and not least in the area of problem-solving. The following extract provides a good illustration:

> "The U.S. Environmental Protection Agency's (EPA) Office of Water encourages all citizens to learn about their water resources and supports volunteer monitoring because of its many benefits. Volunteer monitors build awareness of pollution problems, become trained in pollution prevention, help clean up problem sites, provide data for waters that may otherwise be unassessed, and increase the amount of water quality information available to decision makers at all levels of government."
> (http://www.epa.gov/owow/monitoring/volunteer/epasvmp.html)

Furthermore, when given appropriate training, volunteers' data have a wide spectrum of uses for state or federal agencies. Assuming that the range of parameters monitored is equally wide, some of the possible uses indicated by the EPA are to:

> "(...) screen water for potential problems, for further study or for restoration efforts; establish baseline conditions or trends for waters that would otherwise go unmonitored; evaluate the success of best management practices (BMPs) designed to mitigate problems."
> ("Starting out in Volunteer Water Monitoring")

The same document ("Starting Out...") specifies the most commonly monitored parameters. These cover chemical, physical and biological factors including: water temperature, flow and water level, dissolved oxygen, turbidity, pH, habitat, macroinvertebrates, Secchi transparency, phosphorus, bacteria, nitrogen, land use. Naturally, the more 'specialised' volunteers become through training and practice, the more complex the parameters are that they are able to monitor.

It is possible to measure the success of the overall programme through numerous variables[51]. On the side of the volunteers, the appraisal of the

[51] For instance, the last time I checked the national directory of volunteer monitoring programmes, randomly choosing three states – Alabama, California and Iowa – I have counted over 190 programmes spread through all the water contexts (rivers, lakes,

numerous initiatives held throughout the country was the subject of a special issue of the Volunteer Monitor ("Success Stories", vol. 14, n. 2, 2002). Through some of the accounts one can also appreciate how volunteer monitoring acts in problem-solving, which was, in fact, one of the trends anticipated in the article of 1994 referred to previously ("Volunteer Monitoring: a Brief History"). In order to illustrate this point I have chosen "The case of the 'Inky Stinky'" by Margo Andrews. Like the author I will start with the outcome of this case: a court ruling against a pulp and paper mill (in York, Pennsylvania) that:

> "for decades, (...) had been discharging dark brown industrial wastewater into Codorus Creek. Often the discolored, malodorous discharge made up half the total volume of the small creek, earning it the local nick-name of 'the Inky Stinky'."
>
> (Margo Andrews, "The case of the 'Inky Stinky'", Volunteer Monitor, vol. 14, n.2, 2002)

After an enduring programme of water assessment (volunteers started their collections in 1990 and the ruling was pronounced in February 2001) and a similarly long legal battle (which among other aspects came to reveal that the Pennsylvania Department of Environmental Protection had allowed those violations to occur against the federal Clean Water Act and the local Pennsylvania Clean Streams Law), the ruling settled on $30 million in upgrades the company had to implement by April 2004, together with establishing a $2 million "Codorus Creek Watershed Endowment to support environmental research, restoration, protection, and education" (Margo Andrews, "The case of the 'Inky Stinky'", Volunteer Monitor, vol. 14, n.2, 2002).

This case exemplifies more than a 'hands on' approach which was indeed the sense attributed to the identified trend in 1994 (the author spoke of "integrat[ing] monitoring with action", meaning "moving from data collection and interpretation to community action and restoration of their rivers"). To be sure, the groups involved in the 'Inky Stinky' were a network of national, state and local environmental organisations and activists that at some point benefited from the intervention of the National Environmental Law Center[52]. Yet, such a level of

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estuaries, beaches, wetlands, ground water, as well as surrounding lands). Obviously, stating this 'naked' number is a rather meaningless observation, though it can be a valuable indicator of the dynamism of the field when properly contextualised.

[52] The National Environmental Law Center (NELC) is a non-profit environmental litigation centre founded by the State Public Interest Research Groups (PIRGs) to take enforcement action against the US worst polluters. On behalf of citizen-plaintiff

organisation and action planning outside the traditional boundaries of volunteer monitoring is an added element to stand for the commitment these actors put into their activities.

6.2.2 – Training as a universalistic principle

It has been said more than once that training assumes a central role in the EPA programme. Throughout the pages and links of the website, users – potential volunteers – are constantly reminded of the importance training has in the setting up of local monitoring programmes. From the very first moment prospective volunteers start wondering about what it takes to do water monitoring, they get instructed about the intricacies, difficulties and seriousness of the job.

It is again the document "Starting Out in Volunteer Water Monitoring" that displays relevant examples in this respect. For instance, under the heading "How do you get started as a volunteer monitor?" one is invited to reflect upon the personal motives and goals in the first instance:

> "Ask yourself why you want to become a volunteer monitor. Do you want to provide high-quality data to be shared with state and local government agencies, or are you more interested in helping local students learn about the environment? Do you want to monitor a specific stream in your neighborhood or are you willing to be assigned a site by your county resource management agency?"
> ("Starting Out in Volunteer Water Monitoring")

To each of the questions asked a different answer will imply distinct levels of commitment, requirements or, simply, dedication. The document continues to set out those alternatives:

> "Participating in a volunteer program that provides data to be used by government agencies will usually require that you take part in formal training sessions and commit to a regular schedule of sampling (usually weekly, monthly, or seasonally, depending on the project). If you are more interested in learning about your local waterway and educating others, your time commitment may be less and any training will probably be less formal."
> ("Starting Out in Volunteer Water Monitoring")

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organizations, NELC obtains court orders to stop illegal discharges of pollutants and secures major penalties against violators of environmental laws.

Any enthusiastic citizen should, therefore, be aware of the constraints and demands of volunteer monitoring done 'appropriately', that is, according to the set procedures, rules and needs. The fact that one wishes to take part or has a vague interest in the quality of the local water environment is far from being the necessary requirement to actually do the job of monitoring. In order to be connected with government agencies, that citizen will have to comply with formal rules defined in the name of bureaucratic, administrative or scientific principles.

And for those who are willing to face these obstacles and conform to the stated principles, another kind of barrier may rise:

> "You will need money for equipment and possibly for staff; appropriate meeting, training, and lab facilities; a network of knowledgeable people (such as educators, extension agents, local government representatives, etc.) who are (...) willing to advise and help out; connection to (or sponsorship by) potential data users who can help you plan your project so that it meets *their* needs as well as your own; and organizational skills to manage and maintain the project. Most of all, you will need time to make contacts in the community, design your monitoring plan, develop training sessions, recruit volunteers, revise the program as it matures, raise funds, analyze the data, and report back to the volunteers and the community."
> ("Starting Out in Volunteer Water Monitoring")

Not an easy task for sure as the document claims, mainly for those wishing to set up a programme from scratch (to whom the latter advice is directed). Such a collection of requirements and the level of demand places these desired volunteers more on the side of skilled and resourceful professionals than on the side of the 'keen citizen' paradigm (an aspect that is analysed in Pfeffer and Wagenet, 2008). Clearly, this appears to be a successful example of state regulation – at a low cost – over a well-identified area of public participation that had already been exercised over the years in a less co-ordinated way.

Once this phase of the preparation is well internalised and inscribed in one's set of attitudes, it is time for the practice, that is to say, for the training to take place. For this purpose the EPA offers volunteers-to-be a varied compilation of guides and manuals. It is worth describing what is in the main catalogue: The Volunteer Monitor's Guide to Quality Assurance Project Plans; Volunteer Estuary Monitoring: A Methods Manual; Volunteer Lake Monitoring: A Methods Manual; Volunteer Stream Monitoring: A Methods Manual; Volunteer Wetland Monitoring: An Introduction and Resource Guide. Each of these documents is large, detailed

and thoroughly illustrated with figures and pictures depicting the situations, procedures or instruments described beforehand. I shall provide some examples in other to develop my line of argument and demonstrate some aspects of this mode of monitoring.

The Volunteer Stream Monitoring (227 pages) publication aims at supplying comprehensive methodological guidance for, as the name indicates, the monitoring of streams. Thus, from the introductory "Elements of a Stream Study" which discusses the concept of the stream environment, highlights key aspects of the design of a stream study and (among other things) outlines safety and equipment considerations, the manual progresses to specialised themes such as the techniques for monitoring 10 water parameters (and by techniques the authors mean from the preparation of the sampling containers, to sampling and so on). There is also one chapter on "Managing and Presenting Monitoring Data", which according to the document:

> "[has] an emphasis on proper quality assurance/quality control procedures. Spreadsheets, databases, and mapping software are discussed, as are basic approaches to presenting volunteer data to different audiences. (...). Lastly, the chapter briefly discusses ideas for distributing monitoring results to the public."
>
> (Volunteer Stream Monitoring: A Methods Manual, EPA, 1997)

The fact that management and communication skills are considered a part of the job of monitoring should not be overlooked since it stands out as a distinctive feature of this form of mobilisation for lay monitoring and contrasts significantly with both PSV and S@W.

In the chapter on the subject of macroinvertebrates and habitat, three methods are described, each with various steps and tasks within those steps. I have selected the following from the "streamside biosurvey" just for illustrative purposes:

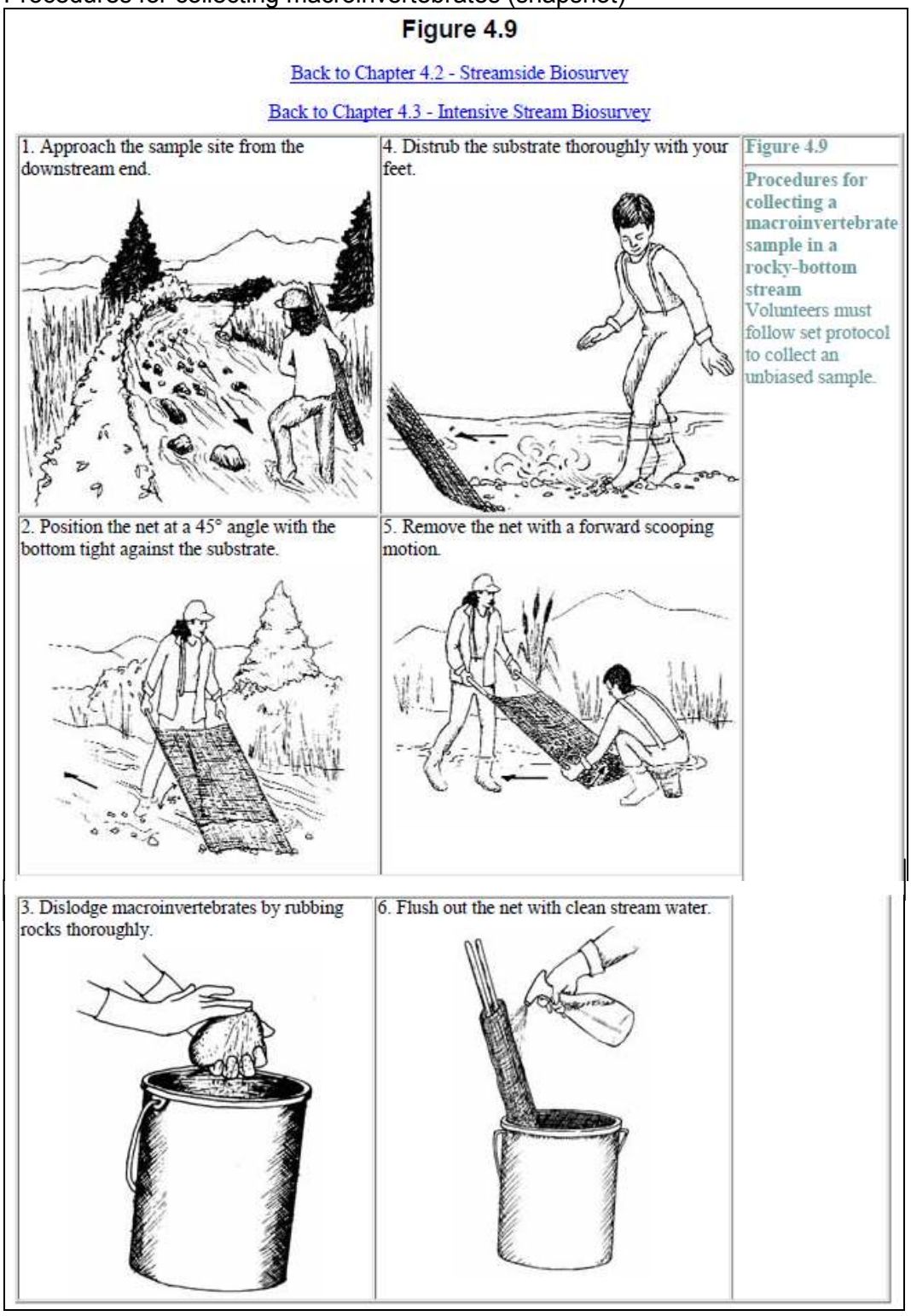
> "***Step 1 Prepare for the Streamside Biosurvey field work***
> TASK 1 Gather tools and equipment for the Streamside Biosurvey
> In addition to the basic equipment listed in Section 2.4, you should collect the following equipment needed for the macroinvertebrate collection of the Streamside Biosurvey:
>
> - Vial with tight cap filled about one-half full with 70 percent ethyl alcohol
> - Buckets (2)
> - Hand lens, magnifying glass, or field microscope
> - Tweezers, eyedropper, or spoon
> - Plastic bag

- (...)
- Taxonomic key to aquatic organisms
- Calculator

For rocky-bottom streams--Kick net, a fine mesh (500 µm) nylon net approximately 3x3 feet with a 3-foot long supporting pole on each side is recommended).
For muddy-bottom streams--D-frame net (a dip net with a frame 12 inches wide with a fine nylon mesh, usually about 500 µm, attached to the frame).
Step 2 Collect and Sort Macroinvertebrates
TASK 1 Identify the sampling location (...)
TASK 2 Get into place (...)
TASK 3 Dislodge the macroinvertebrates (...)
TASK 4 Remove the net (...)
TASK 5 Collect the second and third samples (...)
TASK 6 Sort macroinvertebrates (...)"
(Volunteer Stream Monitoring: A Methods Manual, EPA, 1997)

After the written description, in a separate section devoted to figures, the previous method is represented in its basic steps. Its graphical value justifies its inclusion here:

Figure 6.3
Procedures for collecting macroinvertebrates (snapshot)



(Volunteer Stream Monitoring: A Methods Manual, EPA, 1997)

Of the various levels of reading and interpretation that this representation allows (from the way volunteers are depicted to the decision of which moments to include in it) I will simply highlight the caption located at the top hand-right corner

of the figure. The second half of this caption reads: “volunteers must follow set protocol to collect an unbiased sample”. This is not a proposal or an indication of the ‘best practice’; it is a strict guidance that volunteers must follow in compliance with EPA’s and other agencies’ procedures in order to obtain valid regulatory data (which raises several pertinent issues when thinking of the distinction between regulatory science and research science proposed by Jasanoff (1990). Furthermore it falls into a noticeable contradiction with the claims made in the Introduction to the manual:

> “The purpose of this manual is not to mandate new methods or override methods currently being used by volunteer monitoring groups.”
> (Volunteer Stream Monitoring: A Methods Manual, EPA, 1997)

Clearly, as one can realise in the next paragraph of the Introduction, EPA’s intentions are mostly to develop “partnerships” (volunteers – state and local water quality professionals) in order for volunteer programmes to:

> “(...) gain improved credibility and access to professional expertise and data; agencies gain credible data that can be used in water quality planning.”
> (Volunteer Stream Monitoring: A Methods Manual, EPA, 1997)

It is the volunteer made into a functional professional-expert at the hand and in the service of state planning and regulatory objectives that is in formation in the methods guides and manuals. This is taken even further with the Volunteer Monitor’s Guide to Quality Assurance Project Plans.

This Guide is committed to the objective of removing one of the main problems in volunteer monitoring: lack of credibility. According to the Guide:

> “One of the most difficult issues facing volunteer environmental monitoring programs today is data credibility. Potential data users are often skeptical about volunteer data – they may have doubts about the goals and objectives of the project, about how volunteers were trained, about how samples were collected, handled and stored, or about how data were analyzed and reports written. A key tool in breaking down this barrier of skepticism is the quality assurance project plan.”
> (Volunteer Monitor’s Guide to Quality Assurance Project Plans, 1996)

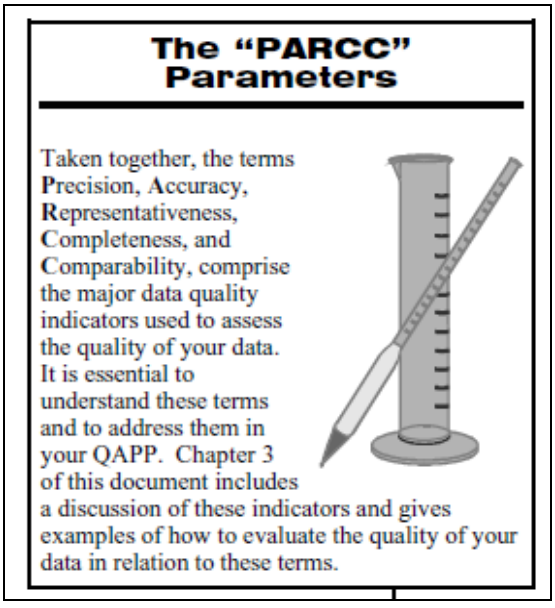
Straightforwardly, a Quality Assurance Project Plan (QAPP) is a written document which outlines the procedures a monitoring project will use to ensure that the data it collects and analyses will meet project requirements. The Guide

(67 pages) teaches people how to accomplish a QAPP with minutiae: with steps, illustrations (for instance, tables with the standard deviation, relative standard deviation and the relative percent difference formulae key in obtaining 'precision'), reasoning for each described moment; appendices with work sheets and forms, and so on.

In the Executive Summary another reason for the need to implement QAPP is put forward: all EPA funded monitoring programmes "must have an EPA-approved QAPP before sample collection begins." In addition, even those programmes that do not benefit from the EPA's money are recommended to develop QAPP so that their data can be used by government agencies.

The example I want to bring into light is what is referred to as the 'PARCC Parameters' as shown below in Figure 6.4. These are pointed to as the basic concepts in quality assurance and quality control processes and are the object of treatment in a specific chapter (the source of the standard deviation formula example given above).

Figure 6.4
PARCC parameters snapshot



(Volunteer Monitor's Guide to Quality Assurance Project Plans, 1996)

There are five PARCC parameters to consider: precision, accuracy, representativeness, completeness and comparability. It is worth briefly looking into what each of these means in the EPA's sense:

"***Precision*** -- the degree of agreement among repeated measurements of the same characteristic. It may be determined by calculating the standard

deviation, or relative percent difference, among samples taken from the same place at the same time.
Accuracy -- measures how close your results are to a *true* or expected value and can be determined by comparing your analysis of a standard or reference sample to its actual value.
Representativeness -- the extent to which measurements actually represent the true environmental condition or population at the time a sample was collected.
Completeness -- the comparison between the amount of valid, or usable, data you originally planned to collect, versus how much you collected.
Comparability -- the extent to which data can be compared between sample locations or periods of time within a project, or between projects."

(Volunteer Monitor's Guide to Quality Assurance Project Plans, 1996)

The conformity with the procedures defined in each of the five PARCC is assumed as a central condition of the quality assurance process that, subsequently, will turn the credibility of the data gathered into a reality. It was not possible to obtain data about how many monitoring programmes are currently funded by the EPA[53]. It would have been interesting to relate those numbers with the level of demand of the QAPP. Nevertheless, the extent, detail and seriousness of the technical requirements a QAPP involves, allows for the assumption that monitoring programmes will meet EPA standards mostly at points when comparable levels of expertise have been achieved. Therefore if the distinction volunteer-expert renders itself obsolete through this process of tough learning and training, one ends up with 'professional' as the category that better distinguishes the two. In fact, if the procedures follow equally formal and universal procedures, if the results are checked and validated against thorough quality assurance processes and, finally, if the data are part of the same system of monitoring, the differences between volunteer and government agencies monitoring has to be searched outside of the lay-expert divide.

The VWMP places the volunteer practices of monitoring at a level of quasi-professional demand as I have suggested in Chapter Three. However, the time, space and, generally speaking, the compensations of volunteer monitoring do not coincide with those of the professional monitor. As pointed out before, volunteer monitoring requires time but this is, in principle, the free time of the volunteer (many testimonies of the newsletter refer to the hours in the evenings reallocated to monitoring related issues); monitoring requires resources, tools and equipment but at the expenses of the groups rather than of state or federal bodies; volunteer

[53] Though Pfeffer and Wagenet (2008: 242) do present a table with the "Number of self-reported citizen monitoring programs by type of quality assurance program and state, 2005".

monitoring is a salary-free activity – it is the basic defining principle of volunteer activities.

Furthermore, the fact that likely monitors are socialised into the beliefs about the 'rigours, credible and validated' monitoring as to have their data accepted by the overall system, diminishes any potential flexibility and openness that an online system could offer or take on. Volunteers are disciplined in their attitudes and practices. They can comply and be accepted or stay out.

6.3 - Modes of lay environmental monitoring

The objective of proposing modes of lay monitoring traverses the research throughout. After the initial scoping phase, the investigation was driven by the idea of analysing and situating those different ways of thinking, organising and practising ideas of monitoring, the environment and its quality put in place by a range of diverse actors. The notion I am looking for is necessarily dynamic, interactional and results from the articulation of multiple dimensions.

I have now a collection of three different cases in order to illustrate my claims. Each of these is to represent a distinct mode since each of these corresponds to particular ways of conceiving and exercising lay monitoring. The 'mode' results from the salient dimension of each case combined with other relevant characteristics such as the relation with expertise and technical-scientific knowledge, which I have selected among others as, for example, the time-space configuration. I introduce the modes below, through the graphical option of a table and will afterwards explain each one and the relation between the three. Needless to say that these modes are not mutually exclusive – just like the various elements that dynamically combined make for one to stand out more prominently in a mode, so the modes are part of a relational process leading to overlaps, concurrences or, of course, differentiation.

Table 6.1
Modes of lay environmental monitoring

	PSV	S@W	VWMP
Key dimension	context	ICTs	training
Features	context provides tools for spotting 'matter out of place' (Douglas); construction of a 'culture of monitoring' based on a 'theory' of nature which is reproduced and reconfirmed as it is performed	individuals as sensorial specialists through refinement and extension, ICTs and sensors; individuals as monitoring stations always "on"; disciplining of the senses to obtain automated observations	internet is the tool for the formalisation of practices based on universalistic rules; compliance with the limits of scientific procedures and proof; disciplining of observations for their authoritativeness
Relation with expertise and technical-scientific knowledge	a resource used selectively when observations or data have to be validated or certified	training and new technologies transform humans into sensors with refined detection abilities; they need no further expertise to act as sensors	regulates monitoring practices and procedures through manuals
Mode	an "excess of context" may lead to problems of generalisation (situated definition of standards, markers, objectives, and so on)	a "deficit of context" (through testing and training) disciplines human senses but limits their possibilities with 'automation' and fragmentation of sensorial information	formal universalism avoids scientific error and manages 'proof' but reproduces traditional 'top-down' forms of participation

Context, ICTs and training are the variables that conspicuously render each mode possible. PSV is supported on the grounds of the context; S@W locates research potential in ICTs and the VWMP sees volunteers as formatting units through training.

In Holywell Dene, monitoring activities are concurrent with daily life. In a sense it is this co-occurrence that causes 'matter out of place' (Douglas, 2005) to be identifiable and work as a categorisation and sorting of the space together with other components of the perceived model – or theory – of nature. Furthermore, this nearly complete overlap appears to be crucial to the production of what I have called a culture of monitoring – the element that sets apart local actors and official agencies in their attitudes and perceptions. It is this culture that triggers lay actors' ability to observe, gather data, analyse them and act accordingly, in respect to 'what nature should look like' in the area. Monitoring

surfaces as the means through which local groups perform and confirm, by practising, that idea or interpretation of nature.

This 'spontaneous' or ordinary monitoring is checked against a set of control procedures – the way local groups found to validate their practices (and data) internally but in face of official agencies as well. Overall the control system (or QAPP, one could say metaphorically) is based on a non-official hierarchy of trust and informal expertise which, from one level to the other, validates or rejects the observed.

Local groups do not monitor in competition with official bodies (their principle is one of selective collaboration). Simply, their constant presence in the area they are monitoring – the situational strength of their practices – has produced, in some areas at least, better, more precise, accurate, representative, complete and comparable data ("PARCC"?) than those of monitoring agencies such as the EA. That was the case with the water monitoring programme whose results the EA fails to acknowledge for lack of compliance with formal procedures. However the pride that accompanies the exhibition of a picture of a half-eaten-trout (allegedly an otter had been the perpetrator) is the proof local actors need about water quality improvements in Holywell Dene.

Senses@Watch sees humans as sensors whose sensorial abilities can be improved and extended through the usage of ICTs. These are a tool at the service of human senses and the essence of the collaborative system conceived by the team of researchers. Human senses are valued from the start but in order to diminish their limitations they have to be simultaneously evaluated. It is in this context that refinement and extension come to the fore. The need for objectivity justifies that refinement is sought through testing and training. ICTs and sensors would extend human sensorial abilities enhancing their environmental performance. Through testing, training and extension, individuals would make a large-scale, widespread and permanent network of monitoring stations.

The clash over the distinct perspectives at stake (humans as sensors or humans as sensor-users in the words of one researcher) make the role of ICTs the more significant since it is the re-addressed multisensorial case (the study of vision) that ends up as the source for the prototype of a collaborative system. In a way S@W tries to compensate for having attempted to remove contextual elements from human senses through their specialisation. The disciplining of the senses results, paradoxically, in limiting their aptitudes, for human monitors do not experience environmental parameters in a decontextualized or fragmented way.

The VWMP has as its distinctive element the disciplining of observations through training and procedural formalisation. Training (in a broad sense) offers quality assurance to observations, the basic condition for acceptance in the EPA programme. Some similarities with S@W can be discerned at the level of narrowing down the limits of volunteer monitoring through discipline and training. However, while S@W aims at disciplining human senses as such, the VWMP objectively formalises observations using universalistic criteria. In what concerns training, in the EPA notion of what role volunteer data should have, training is about teaching procedures and techniques whereas the S@W vision of lay collaboration in official monitoring systems leads the research to focus on the refinement and specialisation of the senses.

The EPA assumes the role of the regulator over a pre-existing monitoring work, encouraging it further. Its mission is, in this sense, to provide the correct tools in a way that volunteers' work conforms to legal and statutory regulations that, in turn, determine scientific proof. Its tools are the manuals, guides and all the documents that carry and transfer the EPA's notions of environment, water monitoring and so on (that is, inscriptions; Akrich, 1992). The overall goal is to ascribe authority (in the Weberian sense) to observations and gathered data using universalistic procedures.

Volunteer water monitoring is, in the context of the VWMP, ultimately inscribed in the category of citizenship activities. Government agencies view these very highly though the demand on the side of volunteers is equally high. Still, the State that requires the observance of formal universalistic rules also recognises the importance of developing the sense of community within the extensive group of volunteer monitors. It therefore supports and promotes opportunities for volunteers to meet and exchange experiences (conferences, the newsletter among others) outside the space of the internet.

The VWMP definitely escapes the 'automated'-monitor type S@W attempted at obtaining at some point. VWMP monitors are very much 'humans', committed and engaged in their community volunteer activities, thus supporting Putnam's (2000, 2004) analysis of the distinctively prominent role of civic engagement in American society. With this notion in hand, the degree to which volunteer monitors corresponds to the EPA's requirements follows a pattern that has undoubtedly changed over time, finding ways of renewing civic involvement and participation. However, the VWMP reproduces above all a traditional, top-down way of participation.

In face of the brief contrast between the three modes, the first implication to draw relates with the idea of 'mode'. Despite the inter-relational character of the general notion I displayed above, there seems to be little dialogue between the context-based mode and the ICT one for instance. That is, these modes appear to be mostly separated by their main 'identifiers': the richness of the context, the specialisation of the senses and the demands for universalistic principles.

Secondly, none of the modes presents itself free of limitations. The first one emerges as having what I have called an "excess of context" in the sense that the situational negotiation of patterns, objectives and general practices of monitoring is an obstacle to its generalisation as a 'mode', particularly since the way that negotiation takes place is precisely context-dependent (in the sense that the culture of monitoring and the theory of nature where the first is supported cannot be transmuted to other contexts). The second, by contrast, displays a "deficit of context" since the capture of the contextual variables has implications for the actual monitoring possibilities of the senses. The definition of a threshold detection of a parameter in laboratory conditions is of very little use in a real-context environment where in fact senses and 'samples' are continuously contaminated. The third limits lay participation to traditional formats, excluding diversity, creativity and flexibility of the set rules and principles. Universalistic principles reduce the error and guarantee standards conformity but, similarly, exclude innovation from participatory processes.

My final comment at this stage is about the lay actors of each of the modes.

In the first one we seem to have a happy community, pleased with the way life is lived locally but certainly aware of the risks that come from afar. These actors are as resourceful as any others and they have started a thorough programme of environmental management mostly of their own initiative. They have time and a sense of belonging to the local community that enhances the feeling of protection of its assets.

The second mode is made up of individuals; they are conceived as nodes of a wider network. They are detached from any sense of communal feeling and have in ICTs all they need to be permanently 'on', connected to the system and uploading data that they have gathered through sensors, a digital camera or even through their senses. They are, ultimately, monitoring stations.

In the third mode, the category to emerge is that of the volunteer. Committed volunteers who see themselves in EPA's rhetoric about the usefulness of their data, of their contribution to a bigger cause and of the difficult demands of doing water monitoring. These volunteers adhere to the message

and embrace their task with dedication not in their name but in their community's name.

Each of these 'categories' of lay monitors has a place in a mode. As with the other elements that are part of the mode, the actors influence the shape of the mode but are, on the other side, influenced by the mode on their perceptions, attitudes or even practices of monitoring. Still, their relevance to the mode is variable: the local community of PSV can be said to have a great deal of significance to the formation of the mode, for example. In any case, it is lay actors who do the monitoring and this is, irrespective of context and other variables, central to each mode.

I will conclude this chapter commenting briefly on monitoring and how one can understand it in face of the overall analysis.

Before that, however, I systematise my central claims on modes of monitoring in the following table:

Table 6.2
Modes of monitoring and related types of monitoring

Case study	Mode	Type of monitoring
PSV (context)	Re-enacting nature *situational embedding of local actors; *co-occurrence of monitoring and routine practices; *development of a theory of nature; *nature is performed through monitoring; *disputes official monitoring decisions.	Mundane (ordinary, routine)
S@W (ICTs)	Humans as sensors *sensor users or being sensors; *evaluating the senses for reliability purposes; *extending human abilities through ICTs; *policy requirements implies warrantability of the system; *collaborative system has to be multisensorial and highly technological.	Specialised (aseptic, multisensorial)
VWMP (training)	Volunteer monitoring as formal universalism *guidance and regulation of activities; *training and specialisation of procedures; *formal principles in order to achieve authoritative data; *volunteers as quasi-professionals; *recognition of the relevance of volunteer data.	Civic (committed, socially responsible)

6.4 - Conclusion

In the table above I display three modes of monitoring with corresponding types of monitoring. The three cases I have investigated have allowed me to build and think of three distinct ways of understanding and doing monitoring.

Firstly, monitoring can be a mundane practice, performed routinely in the neighbourhood. Seen from this perspective, there is nothing remarkable in monitoring. It is the continuation of daily life, the repetition of ordinariness. The notable side of mundane monitoring surfaces when one manages to go deeper in the motivations, the notions and the practices of monitoring deployed within these mundane practices. In this sense monitoring corresponds to a wider frame of notions about and understandings of the world.

Monitoring can be seen as a step into further specialisation and – consequently – enhancement of human abilities, particularly of human senses. Monitoring is understood as having its meaning drawn from the relation with environmental policy. For this reason, the senses which are thought of as the main providers of lay environmental information, have necessarily to be refined, worked on and exercised. Enhancement of human aptitudes results from extending these aptitudes for which task ICTs are key. Specialised monitoring is the monitoring which was removed from possible sources of contamination, it is aseptic.

Civic monitoring is, as is indicated in the table, the monitoring of those socially responsible. It is the monitoring that is, probably, closer to a sustainable development posture. Because of the awareness and the sense of duty towards the others, this monitoring can be said to have no 'face': it is not personal but collective and possible to generalise to numerous contexts. Through monitoring activities citizens become more knowledgeable, more aware, and even more conscious of the usefulness of their involvement for the 'general good'.

Thus, the modes of lay environmental monitoring I have analysed and proposed in this chapter allow for generalisations and not just about the modes and what they constitute; they – as I have done – render visible different types of monitoring in a more abstract way. Modes of lay monitoring constitute the diverse ways of representing, organising and putting into practice a set of notions and perceptions about the environment – or nature – and about monitoring that involves a diverse set of actors in interaction. The type of monitoring is one of the outcomes of the modes of lay monitoring in practice.

In the next chapter, Chapter Seven and the final chapter of the thesis, I will review the central claims I made throughout the thesis from those I have set up theoretically (such as the place and space of a sociology of environmental monitoring) to the empirical ones which refer, mainly, to the research questions.

Chapter Seven
Environmental monitoring in sociological context

7.1 - The space for a sociology of environmental monitoring

As I noted at the outset and in the review elements of Chapter Two, this thesis is intended to be a pioneering study and opening up of monitoring as a topic in environmental sociology and to some extent in sociology more broadly.

This is not to claim that others have not taken an interest in monitoring. Clearly the cases I have studied contain many actors who are very interested in monitoring. These range from the US Environmental Protection Agency (EPA), which seeks to win a larger commitment of volunteers' time and to school them in the art of dependable volunteer monitoring, to Senses@Watch (S@W) where people's everyday sensorial abilities became one main focus of interest, to the everyday community practices of observing and recording that characterised the Friends of Holywell Dene. One might say that it is these people who have 'discovered' environmental monitoring in its variety and multiplicity, not me. And, of course, many other sociologists have taken a strong interest in social phenomena of which monitoring is a key part, such as surveillance and the recording of crime, or Goffman's characteristic interest in the reflexive monitoring of everyday conduct and its role in the presentation of self in everyday interaction. They too 'discovered' monitoring before I did.

What I believe I have done is to build on these other insights and practical interventions, and to have begun the systematisation of our understanding of environmental monitoring. Thus, with regard to sociological and environmental science authors, what I have done is to show that monitoring is central to a variety of important environmental activities, activities which other analysts have been interested in but without explicitly focusing on the part played by monitoring. To paraphrase a popular notion of the ethnomethodologists, monitoring has to date been a "seen but unnoticed" aspect of pivotal environmental activities. I hope to have brought it to notice. And with regard to actors who are engaged in environmental monitoring, what I have been able to do is to step back and investigate different ways – different modes – according to which environmental monitoring can be organised. The actors I have studied have been very engaged in building their own practices and procedures for monitoring, but they have not studied or investigated other ways of doing monitoring.

Already in Chapter Two I addressed one important counter-argument to my claims. Maybe, I suggested, it is because observation is so pervasive and

ubiquitous that no one has focused on it; maybe monitoring is everywhere but also trivial. Maybe, therefore, other environmental sociologists have noticed it but not spent time on it precisely because of its triviality. In Chapter Two I sought to dispense with this counter-argument by showing, through a review of the literature, that there are good reasons to think that monitoring is not trivial; rather, it is often the focus of hard work and struggle. In the case studies in Chapters Four and Five I believe I have now gone much further than this. I have documented in detail the complexities of monitoring, showing for example just how hard it is to set up a system for calibrating people's 'ordinary' sensorial monitoring so that they can be transformed into an army of environmental monitors, always alert and always 'on'.

In Chapters Two and Three I also set out a list of research questions, namely:

7. While it is widely acknowledged that there are sociological influences on the shaping of environmental problem claims, what are the key sociological dimensions of environmental monitoring activities?
8. What are some of the distinctively different ways in which the task of environmental monitoring can be socially organised and does the form of social organisation adopted impact on how that task is performed?
9. If environmental monitoring can be organised in different and contrasting ways, can one identify characteristic modes or 'ideal types' of the social organisation of environmental monitoring?

Through the case studies in Chapters Four and Five and through the comparative discussion in Chapter Six, I have supplied answers to each of these questions.

With regard to the first question, the key dimensions in these cases clearly relate to the conception of the actor and their role(s); the kinds of tools for monitoring and the extent to which actors have flexibility in the selection of those tools; the kinds of network or social world in which the monitoring actors participate; and their relationship to the official environmental protection authorities.

For S@W, actors are representative of 'the human being'. The volunteers or subjects are precisely not chosen for their connection to a place, but represent the everyman or 'everyperson'. The senses they use (and learn to augment) are precisely the ones that the ordinary, regular person has, not benefiting from familiarity with a specific locale and its changing appearance. The actors in the

other two cases are self-selecting and are expected to have a commitment to their area or region. With the Friends of Holywell Dene the key actors choose to walk the Dene very frequently, sometimes daily. Through constant exposure to their surroundings they know it very well and are able to spot things that have changed or are out of place even if they have not been specifically encouraged to watch for those changes. In the case of the EPA volunteers, it is the sense of duty towards the community and the notion of contributing to the 'common good' that propels action and indeed compliance with a set of extremely demanding procedures and protocols.

The cases differ also in the tools that are used. Both the US EPA and S@W depend on formal, technical tools, though only the latter highlights the potential for respondents to constitute an informational network. It is in S@W that novel tools are presented as a means to enhance human sensorial abilities. Moreover, new technologies would allow actors to 'feed' information to the network directly. Volunteers in the EPA water monitoring programme are tied to traditional monitoring instruments and processes but they can obtain on-line very detailed specifications of the kinds of equipment they will need to get hold of, as well as instructions in how to use the equipment they acquire. By contrast, the members of the Friends of Holywell Dene developed their own ideas about the tools available (from very mundane objects such as carrier bags to water monitoring kits) and they produced innovations, such as their re-design of the cow-proof barriers that fit under bridges to stop farm animals invading the Dene when the river is low.

The three examples also offer different visions of the social world of environmental monitoring. The Friends of Holywell Dene commonly do recreation and monitoring at the same time; they recruit additional members themselves and develop their own culture of monitoring activities and commitments. In the other cases, people are recruited and given specific tasks, though in the US case they are encouraged to become quasi-professionals while in the Portuguese example they are expected to remain 'the everyman'. Even after they have been equipped with refined and extended sensorial capabilities (assuming S@W's training protocols work), they are still examples of the ordinary citizen since it is assumed that such refinement and extension would work in a statistically predictable way across the population of ordinary citizens as a whole. And these differences in people's social worlds also impact on their relationship to the environmental protection authorities. As was shown in Chapter Four, the Friends of Holywell Dene were often slightly at odds with the authorities, even though they agreed

over broad aims and were dependent on the authorities for legal protection and some financial support. They sometimes criticised the interventions that the authorities proposed (for example, over the design of a bridge or the construction of a pathway); they also appeared to operate with their own independent criteria in determining which of the actions they planned for the Dene were worth communicating to the planning authorities in advance. In the other cases the actors were expected to be subordinate to the official agencies' agenda. While the Portuguese case opened up the possibility that citizen-sensors could become whistle blowers by observing excess noise or sensing odours that urban authorities were failing to regulate within legal standards, the monitoring volunteers of the EPA programme were conceived more as data gatherers contributing to the general functioning and performance of the system.

These points also relate directly to the second research question since it is clear that different ways of socially organising monitoring do impact on how that task is performed. In the case of the US EPA scheme, the programme is precisely organised to promote standardisation and uniformity of practice whereas in Holywell Dene the Friends developed their own practices of monitoring. These generated internal hierarchies and rules of thumb about how to process information. They also fostered a culture of environmental management that led to the actors adopting strong views about what fitted and what did not, what was natural and what was alien. In turn these notions and practices led to occasional conflict with official conservation bodies. The concept behind S@W's citizen-sensors would lead to myriad autonomous individuals who have their monitoring practices shaped by the technological devices in use. With their abilities shaped by training and extended by the continuous possibilities offered by new technological instruments, these monitors would be flexible, trustworthy and ubiquitous.

Finally, the third research question was directly addressed in Chapter Six where three modes of citizen monitoring were outlined. This issue is taken up again in the final section of this chapter which looks at possible future lines of investigation, and further discussion of this topic will be saved for that stage.

7.2 - Environmental monitoring and the theorisation of environmental intervention

In the Introduction and in Chapter Two, as well as discussing the way that monitoring and observation had been treated in the literature, I drew attention to a

number of other connections with the broader social science literature and it is time to return briefly to these (see pages 8 and 9 of the Introduction).

One key connection to the broader STS literature relates to the rapid growth of participatory initiatives in the governance of science and technology. The case of Friends of Holywell Dene was, in part, an example of this, as the interview with the official environmental agency representative cited in Chapter Four made clear. There was a demand for more participation in the Agency's policies and Holywell Dene was seen as a suitable case. But one clear aspect of this case was that the nature and scope of participation soon became broader than the official body had originally anticipated. As monitoring became seamlessly woven into the lives of the members of the Friends, into their dog walking and photography and bird watching, their 'participation' in governance became suffused into their daily routines and they simultaneously began to develop their own culture of nature protection which did not coincide at all exactly with the ideas of the agency. This indicates that participation does not only encourage ordinary citizens to engage in the official activity to which they have been invited, but tends subtly to transform the way that whole activity is framed. Perhaps only the rigid socialisation that characterised the EPA's programme can avoid this outcome.

Secondly, as described in Chapter Two, there are popular claims in the environmental sociology literature about the alienation of the senses. Environmental threats – so the argument goes – are increasingly 'expertised' and mediated through technical equipment which bypasses our everyday senses. Yet the two cases here, in their different ways, both indicate shortcomings in this view. Some technologists at least are still attracted to the human senses, not necessarily because they are more dependable than machine readings but because they are ubiquitous; our senses are always with us. Rather than surrender to the alienation of the senses, one possibility is to try to cultivate and systematise those senses. Chapter Five indicated that there are many obstacles facing this ambition, but it is unclear that the ambition must be discarded altogether. Given the problems encountered by the S@W scientists, it seems likely that trying to transform everyday actors into 'scientifically valid' measuring devices will remain a too-challenging task. However, S@W's experimental work on the visual senses shows that lay human senses and simple technologies combined can produce interesting results; pooled together with an online interface made up of friendly library tools citizens might well be able to capture sensorial information that would be of value from a policy point of view.

The experience of the Friends of Holywell Dene also contrasted with claims about the redundancy of the senses. The key issue in Holywell Dene was that people's daily exposure to the site gave them an intimate sense of how it looked and sounded and smelled when it was 'right'; their everyday senses were then adequate for spotting when something was out of place. In this case there was no attempt to determine monitoring variables in advance. It was holistic, everyday familiarity that allowed people to spot the exceptional incident. This was perceived by local people as superior to mechanised or automated systems that would only have been able to detect problems only in relation to a specific set of variables. One ironic consequence of this is that even if having citizens do the monitoring can initially appear cost-effective, there may be an unpredicted increase in the need for resources – and costs – in the longer term due to the amplification of vigilance and expanding ideas about what needs to be observed and checked.

Thirdly, there are two issues which I highlighted in the Introduction and in Chapter Two but which have not proven to be as conspicuous as I anticipated. These were the issues of the corrigibility of observations and the potentially problematic connection between monitoring and environmental performance. To start with the latter, as I pointed out early on, it is a well known phenomenon that if some variable is used as an index of something else and if that variable is monitored, then actors will tend to concentrate on improving the performance in the index irrespective of its impact on the broader goal. When, around 2000, the UK Labour administration made patient waiting times a criterion for assessing hospital performance, extraordinary energy was put into reducing apparent waiting times, even if this did not always actually help patients. Equally, as we saw earlier air quality in urban areas in the UK is assessed by measuring a small number of pollutants. Just because levels of these specific chemicals decrease that does not guarantee that 'urban air quality' as a whole improves. In the cases reviewed here, this issue has not particularly come to the fore. It was to a large extent by-passed by the Friends of Holywell Dene since they prided themselves on having developed their own indicators which went beyond those proposed by the Environment Agency and followed the internal logic of the 'model' of nature analysed in Chapter Four. The issue might well have arisen for the S@W case because their experiments focused mostly on getting citizens to assess key, individual indicator variables. For example, initially at least, drinking water quality was going to be evaluated through assessments of the amount of dissolved chlorine. But since this component of the S@W programme was not very

successful, this potential problem with the choice of monitoring variables did not command a great deal of attention. On the other hand, the collaborative website which would have made possible the handling of many indicators – and even allowed some reflection on the choice and combination of variables – did not go beyond the prototype phase. More interesting is the matter of corrigibility.

As I pointed out in Chapter Two, in principle monitoring observations are always interpretable and corrigible. A naively scientistic view might lead one to think that direct monitoring could resolve disputed issues, revealing how things 'really' stand. But in scientific controversies this commonly does not happen. Indeed, the literature from the sociology of science leads one to expect disagreements to arise over environmental observations. The interpretability and corrigibility of observations should allow 'space' for controversies to occur. Rather than environmental disputes being resolved by observations, they can escalate into disputes over the observations used in monitoring. The cases studied differ in their relation to this point.

For example, the EPA water monitoring programme is constructed in such a way as to limit such disputes over corrigibility. Volunteer observations must follow a definite line of procedures in order to reduce both error and the space for interpretative flexibility. Indeed it is only after assuring that the room for contestation is minimal that local monitoring groups are granted access to the EPA system. In this way volunteer monitors are effectively bracketed out of any disputes over the validity of the monitoring protocols that may subsequently arise. Something rather different happens with the two other cases. In PSV, the corrigibility issues mostly arose when community groups found themselves in a position to question and dispute official data. Thus, in spite of having their water monitoring data dismissed by EA officials due to its lack of quality assurance, lay groups insist that they know what they see in their local environments and what they see tells them that EA's information is not only incomplete but also no better than theirs. They sought access to better monitoring equipment and aimed to make partnerships with academic researchers who could lend authority to their observational data. Lastly in S@W most of the trials did not get beyond trying to calibrate human monitors against scientific measuring scales. The possibility that human sensors could challenge scientific assessments has not yet arisen. Again, the collaborative website which might have given rise to conflicts between official measurements and the collective voice of many citizen respondents did not advance beyond the prototype phase.

Finally, it is clear that these cases are in some sense all about surveillance and the surveilling of environments. But it is not, at least at first sight, the social actors themselves who are being surveilled, as is commonly the concern in sociological studies; rather they are the means or the originators of surveillance. Particularly in the case of Holywell Dene, the local actors have evolved their own routines and standards of observation. They look for and record wildlife that is out of place, elements of the natural environment which appear irregular, and polluting behaviour by neighbouring landowners. But they also watch for and record behaviour by motorcyclists or vandals that needs to be controlled. For them surveillance is an indispensable part of maintaining their environment in the 'wild' and 'natural' state that they value. Indeed their surveillance even extends to keeping an eye on the activities of the environmental protection authorities, making sure that new bridges installed by the authorities are suitably rustic and so on.

In the other cases there is less discretion about surveillance. In the US EPA volunteer monitoring programme the citizens are 'disciplined' to try to ensure that they monitor in the legally mandated ways. And in S@W citizens' normal skills are intended to be used objectively to monitor the environments they happen to encounter. Of course, this does not mean that the exercise of monitoring has no impact on these actors, even in the case of Holywell Dene. As was discussed in Chapter Two in connection with the work of Oudshoorn (2008), placing an expectation on users of a technology (for example, users of health monitoring equipment) does not just grant those users new powers and competences; it places expectations and – in a sense – duties on them. Exactly how this dynamic would have worked in the case of S@W – what it would do to everyday actors if one succeeded in turning them into mobile monitoring stations – is a very interesting sociological thought experiment, but as yet it is only that since the system has not been implemented.

Through these reflections on the connection between my studies of environmental monitoring as it is practised and some leading sociological conceptions of monitoring and of environmental harms, we can conclude that empirical studies of environmental monitoring can be very informative for sociological theory. These studies throw novel light on the social meanings and practices of surveillance and provide insights into the way that the human senses relate to environmental harms and threats.

7.3 - The scope for future work in the sociology of monitoring

As set out in my third research question, one aim of this research was to seek to specify different modes of environmental monitoring. In other words, it had seemed likely all along that if I could identify cases where actors were consciously and deliberately engaged in monitoring but where the ways that they had selected to achieve this differed, then there should be a basis for outlining different modes of monitoring. Two possible research directions follow immediately from this.

First, though one cannot of course try to compile a comprehensive inventory of citizen environmental monitoring activities, it will be interesting and practically worthwhile to add further cases to the ones outlined here. For example, it would be very interesting to look at other community-based environmental initiatives to see whether they too have evolved cultures of environmental protection which they perform through their monitoring activities. This would be of practical value too since it might offer some insights into the character of successful and unsuccessful partnerships between official agencies and community groups in environmental management. It would also be academically interesting to collect cases from different geographical areas and different socio-economic backgrounds.

Secondly, it would be useful to be able to see whether additional modes of monitoring exist. One could imagine that there could be 'virtual' modes based around internet-mediated communities. There might also be modes based around different kinds of community organisations – ones based on schools and youth groups or ones tied to community economic development organisations in depressed or impoverished areas.

Establishing the importance of environmental monitoring practices in an empirical manner and indicating that such monitoring may occur in various modes is likely just the beginning of the sociological study of environmental monitoring. There is much still to explore.

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