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Scales of Imagination and Experience

*I have never followed a science, rich or poor, hard or soft, hot or cold,
whose moment of truth was not found on a one- or two- meter-square flat
surface that a researcher with pen in hand could carefully inspect*

Bruno Latour, "Pandora's Hope"

*...scale is not just a neutral frame for viewing the world: scale must be
brought into being: proposed, practiced, and evaded, as well as taken for
granted.*

Anna Tsing, "Inside the Economy of Appearances"

Introduction

On April 9, 2003 the American military fed the world an image that signaled the end of the Iraq war: a photograph showing a crowd of Baghdad residents cheering over the fallen statue of Saddam Hussein (Fig. 1). Soon after, however, another picture was posted indignantly on the websites of independent media organizations. It showed the same scene of Saddam's topple, only from an apparently greater distance; a perspective that revealed that the Iraqi "crowd" surrounding the statue ended abruptly, and that beyond the edges of the original image a large empty plaza was surrounded by American tanks (Fig. 2).

The two images tell drastically different stories about the progression of the war and its reception. They demonstrate that scale matters. A particular scale reveals distinct levels of detail, pattern, and context, suggesting particular explanations for a phenomenon over others, and can result in particular social consequences – in this case, consequences that we are still living through with unknown resolution. The two images also demonstrate the degree to which scale can be manipulated for political reasons. The first, sanctioned image was published to present evidence of America's victory and Iraq's relief. The second was posted to protest the conclusions represented by the first, and to expose and condemn the secrecy and propaganda through which the war, and the image of Saddam's topple, were produced.



Figure 1. "Iraqis celebrated after an American armored vehicle pulled down the statue of Saddam Hussein in the main square of Baghdad." Photo by Laurent Rebours/Reuters. Published in The New York Times. April 9, 2003. < <http://www.nytimes.com/2003/04/09/international/worldspecial/09WIRE-CENTER.html?ex=1085889600&en=b937ed6a66247c6a&ei=5070>>



Figure 2. "Staged 'Liberation' media event? The photographs tell the story... media manipulation on a grand scale. Yes, the occupation has begun." Posted by 'against occupation' on April 10, 2003 on Indymedia.org. < <http://dc.indymedia.org/newswire/display/63998>>

Issues of scale like these, and their implications for research, have come under scrutiny by both natural and social scientists. Ecologists and geographers in particular, with their shared focus on the distribution of organisms across space, have thought carefully about scale. Ecologist and complexity theorist Simon Levin explored the relationship between scale and pattern, introducing major issues for empirical research and applied ecology that are relevant for both natural and social sciences, in his landmark lecture delivered on the topic in 1989 (Levin 1992). Several decades earlier geographer Henri LeFebvre argued that scale is socially produced and politically contested, and

proposed a new appreciation for the dynamic, intersecting, indeterminacy of scale in social research (1991). Between the two of them, Levin and LeFebvre provide a range of conceptual approaches useful for exploring questions of scale arising in interdisciplinary fields such as those exploring the intersection of the natural and the social worlds, namely, environmental history, environmental anthropology, political ecology, and science studies.

What is scale? A map, for example of voter registration in the United States, suggests that scale means at least two related things: both the extent at which a subject or problem is apprehended (in this case the scope or scale of the problem is national), and the level of detail or unit of pattern at which it meaningfully occurs (in this case the resolution may consist ideally of individual voters, but due to constraints in how information is gathered the size or scale of the units are likely limited to some intersection of precinct and census tracts). In other words, the ultimate explanation for a problem will depend on the choice of scale – meaning both the extent at which we decide to observe the problem and the size of the units we render meaningful, and will be limited by the human-sized scale at which we are able to make the observations, and make sense of them (Levin 1992).

As in the photos described above, extent and level of detail are related: two pictures of similar size, one of a smaller space and one of a larger space, reveal different levels of detail, and therefore different patterns and stories. It is important to keep in mind that if the photo size itself varies, the level of detail can vary, too: there is more detail in a big picture of a small space and less detail in a small picture of a big space. Yet this is where the human scale comes into play, determining what we can observe and make sense of in a meaningful way: a map that is half the size of the United States will reveal many details and many patterns at many levels, but is not very useful.

This is not to say that the extent and level of detail that we observe is limited to the human scale: the power of human imagination and technology allow us to see and think about things on scales vastly larger and smaller than ourselves, from electron particles to galaxies, and beyond to the abstraction of infinity. It is pertinent to note that while natural scientists attempt to observe and theorize the entire range of possible scales including the infinite, social scientists tend to limit the scale of their research and theory to human dimensions – beginning with the body and ending with global social organization (Smith 1992). This is a significant point to keep in mind when thinking about how natural and social scientists might collaborate on solving environmental problems – or more pessimistically, why they have trouble doing so.

So far I have been discussing scale as if it is synonymous with *spatial* scale. Indeed, social scientists have a tendency to use the term scale to qualify only geographical and/or organizational space, as here, when cultural anthropologist Akhil Gupta contrasts scale to time: “Modernity’s scalar implications may be less clear than its temporal ones.... When we... endow modernity with a scalar dimension (global, regional, national, subnational, local), do we assume that all of these different modernities operate with the same temporal rhythms?” (Gupta 2003:68). Yet scale is more useful as an abstract concept that describes the relationship between the extent and resolution of any dimension: space, time, and organization are most common. Scale may also qualify less tangible things such as narrative and theory: consider narrative versus metanarrative and theory versus metatheory.

It would be fun to think about how radically different scalar dimensions might interact: what is the hourly scale of the earth? A metatheory of a pond? The evolution of a household? In general, however, scholars confine their thinking to the range of temporal, spatial and other scalar dimensions established by disciplinary conventions; for example, ecologists at the evolutionary and organismal scale and historians at the historical and human scale – and when they cross into each other’s scalar territory they get into trouble. Evolutionary biologist Jared Diamond attempts to explain human inequality from an evolutionary perspective, and runs into hot water with historians who are offended (I am guessing) by his choice of temporal scale and its deterministic implications (Diamond 1997; White, 2001).¹

Disciplinary Scales of Analysis

In order to understand the scalar complexities of interdisciplinary fields examining the human-environment relationship, and why these fields address issues of scale in particular ways, it is helpful to identify which traditional disciplines they draw from, assess why these traditional disciplines operate at specific ranges within the multidimensional and infinite extent of scalar possibilities, explore how interdisciplinary fields join disciplinary traditions together with new theoretical trends to create new approaches to scale, and note why certain scalar traditions, when joined together, may intersect more compatibly than others.

First, environmental history, environmental anthropology, political ecology and science studies all draw on the methodological and theoretical approaches of the more established disciplinary traditions of history, geography, and cultural anthropology, as well as other fields, in various ways and to greater or lesser degrees. They also draw from research approaches in ecology and other natural sciences, or make these their objects of study. Finally, these fields draw much inspiration from each other, making it impossible to sort them into strict categories. Nonetheless, it is possible to roughly trace the disciplinary influences on each field and thus to untangle elements of their scalar complexities, as follows:

In narrating the histories of material change, ideas of nature, and environmental politics, environmental historians “perform a delicate interdisciplinary balancing act in trying to reconcile the insights of their colleagues in history, ecology, geography, anthropology, and several other fields” writes William Cronon in a roundtable on the subject (Cronon 1990:1122 and fn 3). Environmental anthropology, as an umbrella term, includes archaeological studies of the prehistoric human-environment relationship, application of evolutionary and ecological theory to questions of human resource management and use, ethnoecology, or the study of traditional ecological knowledge and knowledge systems, and studies of the historical, political, economic and cultural aspects of contemporary environmental problems. The latter strand – what might be called the sociocultural approach to environmental anthropology - overlaps considerably with the field of political ecology (Townsend 2000:12). Political ecologists usually trace their roots to an intersection between cultural ecology and Marxist political economy (Blaikie and Brookfield 1987), that generated a wide-ranging and some would say unwieldy

¹ This debate was also raised in discussions in a graduate seminar on American environmental history at the University of Washington, led by Linda Nash.

research program, populated primarily by anthropologists and geographers, into the historical and contemporary social, economic and political factors driving environmental and social change and inequality, particularly in the third world (Neumann 1991: 86-88). Finally, science studies encompasses insights and scholars from a very wide– and not necessarily integrated - range of fields including sociology (e.g. Brian Wynne), anthropology (e.g. Bruno Latour), literature (e.g. Katherine Hayles), philosophy, and history, not to mention cultural studies and feminist studies, themselves interdisciplinary (e.g. Donna Haraway), in the investigation of the construction of scientific knowledge and the relationship between science and society (Bowden 1995). With recent attention to the study of environmental science, science studies now also captures the attention of geographers (e.g. Forsyth 2003).

From these brief genealogies, it is possible to tease out some major disciplinary traditions converging in these interdisciplinary fields, such as history, cultural anthropology, geography, and ecology. I will first discuss how these more established disciplines address scale before moving on to consider how scalar traditions intersect in the new fields. There are several things to consider when thinking about disciplines and scale: there are the possible scales at which research *could* take place, given subject matter and methodologies; there are scales at which research usually *does* take place, given the genealogy and political and epistemological orientations of the discipline; and there are the ways that the discipline tends to *approach* scale itself as an object of analysis.

History

History, as the narrative explanation of human-related events over time that are represented in written records, has a wide-ranging choice of temporal and spatial scales. Theoretically, historians can tell stories that span all or any time since the first written record; they could narrate fragments of an individual's biography or the history of the world as humans have known it. In practice, however, historians keep in mind what their audiences consider relevant, and focus on the histories of nations, predominantly, in addition to famous people, social phenomena such as Christendom, and regions and time periods with cultural, but primarily political significance (White 2003:2-3). The spatial and temporal extents are chosen carefully – often composing the title of a book - because they delineate the story that will be told. In choosing scales, one of the historian's goals is to “meet the narrative requirements of a well-told tale – organic unity, a clear focus, and only the ‘relevant’ details” (Cronon 1992:1364). On the matter of resolution, historians can freely zoom in and out as they choose - in to follow the biography of an influential person; out to report trends in prices of commodities; and even out beyond their scalar extent to analyze how events at other scales, especially larger ones, such as a world war, impacted their particular scale of focus. As Richard White notes, “it is impossible to look at one scale without encountering others” (2003:3). With their need to tell stories with appealing plots, and their freedom to choose between a wide array of scales, historians are in control of scale. They are also squarely in the business of *scale-making*², authoritatively defining the scale at which a particular phenomena is relevant, and therefore either reinforcing conventional notions of scale such as the nation, or advocating new ones, such as the city and its hinterlands (e.g. Cronon 1991).

Anthropology

² I borrow this term from Anna Tsing, 2000.

Anthropology, on the other hand, is faced with a very different set of limitations and possibilities regarding scale. The goal of an anthropologist, as an ethnographer first and foremost (as opposed to the multiple other identities an anthropologist might take on, such as historian or political scientist), is to understand the daily practices and, to borrow Clifford Geertz's phrase, "webs of significance" that tie people together. Despite the postmodern and reflexive turns in anthropology, the ethnographic method still limits the anthropologist to the theoretical scale of a village. The anthropologist herself is the instrument of data collection; field notes based on interviews and participant observation comprise the bulk of her data. Data collection takes place in real-time and in real-life (except perhaps for cyber-ethnography), so that the scale of the anthropologist herself – the spatial scale of her body and its movements, and the temporal scale of her life – determine the scales of research. The ethnographer's scale is limited to the number of people she can get to know relatively well during the course of roughly one year – whether they are located in a village, or scattered across a wider regional, transnational or cybernetic social network. The cultural anthropologist works at the smallest scalar extent of the social scientist, yet this small scale allows for a very high resolution in her understanding of language, rhythms of life, and social relationships at the village, family, and even individual levels.

In fact, while the scale of her research design is relatively fixed, a primary goal of the anthropologist is to try to understand the way the world looks from her informants' perspectives – and these perspectives lend the research a new dimension of scale: the emic dimension. At what scales do her informants apprehend the world? What temporal, spatial and organizational scales are most relevant to them in making sense of their daily lives, their work, their relationships with others, and their political involvement? What are their "scales of experience", as Levin would put it? Anthropologists are most adept at handling emic scalar complexity, recognizing that in contrast to the monochronic experience of Euro-Americans, for example, Chipewyans live a polychronic existence according to the indeterminate mythical time and space of the creator, as well as according to the linear time and Cartesian space of the West (Sharp 2001). In this way, the scale of anthropological research is limited only by the traditions and imaginations of our informants.

Geography

Geography, the study of the physical and human attributes of landscapes, is perhaps best known for the production and analysis of maps. In fact, maps demonstrate the most familiar use of the concept of scale, as in the scale of a map being 1:50,000, where 1 spatial unit on the map represents 50,000 units on the ground. The map is $1/50,000^{\text{th}}$ the size of the place it represents; a scale model. While geographers have ventured beyond maps, they are still preoccupied with them (now especially with Geographic Information Systems) and other modes of visual representation (e.g. Braun 2002). Geographers' obvious ability to scale up and down using real as well as conceptual maps gives them similar freedom to choose the extent and resolution of spatial scales as historians. The temporal scale of a map, however, is generally fixed to one temporal point, or possibly to an average across a certain time period. Multiple images representing a place at a series of particular times, like film, are required to give visual representation a sense of temporal depth.

Geographers' lack of temporal resolution, however, is made up in their relatively sophisticated theorizing about space and scale itself. French geographer Henri Lefebvre is perhaps most influential within geography and beyond regarding the concept of the production of space. Challenging the notion of absolute space, Lefebvre explains how people's work and ideas create social spaces; that spaces, such as the city of Venice, are the products of repetitive work over time. He notes that while we tend to take the identity of particular spaces for granted, every space has an "instant infinity" of content and social meaning, and to focus on only one layer of meaning is to isolate it from its relationship with all the others:

How many maps, in the descriptive or geographical sense, might be needed to deal exhaustively with a given space, to code and decode all its meanings and contents? ... What we are most likely confronted with here is a sort of instant infinity ... The idea that a small number of maps or even a single and (singular) map might be sufficient can only apply in a specialized area of study whose own self-affirmation depends on isolation from its context. (85-86)

Lefebvre explains that these social spaces do not coexist at the same scale (i.e. their full extents could not be contained all on the same map); rather an infinite variety of spaces, produced by temporal rhythms, at an infinite level of scales, interpenetrate and overlay each other. He prefers a hydrodynamic metaphor to think about the "roles played by scale, dimension and rhythm" in the production of space: "Great movements, vast rhythms, immense waves – these all collide and 'interfere' with one another; lesser movements, on the other hand, interpenetrate" (87). Yet he acknowledges the shortcomings of this analogy: it does not explain where the waves come from or how they are sustained, and not all spaces are necessarily fluid (in the material or metaphorical sense); and he warns against taking the metaphors of theoretical physics too far in their application to social phenomena. The major point is that social space is hypercomplex, "embracing as it does individual entities and peculiarities, relatively fixed points, movements, and flows, and waves – some interpenetrating, others in conflict, and so on" (88). This qualified hydrodynamic analogy is helpful because it challenges the assumption that space – and scale – are necessarily fixed. Rather, by analyzing one social space we will inevitably uncover multiple social relationships occurring at intersecting scales (Lefebvre 1991).

Despite such poetic acknowledgement of the infinity and complexity of space and scale, human geographers, while comfortable with the idea of intersecting scales, tend to focus on particular scalar dimensions, extents and resolutions, and primarily on those defined by Marxism. Lacking serious engagement with social theory until the 1960s, geographers embraced Marxism as their theory of choice, so that by the 1980s, Marxist theory was shaping geography to a degree "unprecedented" in the social sciences (Johnston et. al. 2000:489). With this in mind, it is not surprising that contemporary human geographers tend to work at the scales most germane for a critique of the inequities produced by modern capitalism: in the political and economic dimensions; at the global, hemispheric (i.e. first world/third world), colonial and state extents; and at the organizational resolution of class – producers and consumers; capitalists and laborers.

Ecology

Ecology, at its simplest, is defined as the study of the relationship between organisms and their environments. The scalar extents of ecological studies are defined by the various organizational groups that organisms are collected into: patches, communities, ecosystems, biomes, etc., themselves determined by the size and mobility of individual organisms composing them, from bacteria and algae to whales and Western red cedar trees. Most ecologists study *living*, as opposed to fossilized, organisms, *in situ*, so like anthropology, ecologists work in real-time and real-life, and their research designs are limited by the scale of their own lifespans, bodies and travel, yet are expanded through technological extensions, such as remote sensing instruments and radio-transmitters (Levin 1992). Indeed, the organisms under study themselves sometimes outlive the research project: according to my seabird biologist friend, it is still unknown how long an albatross can live, for example, since the radio-transmitters used to track them always give out before the birds do.³

Nonetheless, ecologists, despite being limited by their own human scale, almost always attempt to study patterns occurring on scales either greater or smaller than themselves. In other words, unlike historians, anthropologists, and geographers, ecologists make a significant effort, literally contorting their own bodies and lives, to *avoid* the human scale, since the organisms under their consideration operate on spatial and temporal scales very different from their own. This point was painfully brought home to me during my three-week tenure as a biological field assistant, when I spent 11 hours a day crouched in a 4-foot high blind watching the feeding, mating and rearing behavior of a seabird colony during chick-rearing season. Ecologists – it is plausibly an activist, biocentric point for them – attempt to understand the world in terms of the scale of the organism under study, recognizing that different species, due to their life-histories, sizes and ranges, live in different “scales of experience” (Levin 1992:1945). This resonates with the anthropologist’s attempt to achieve an emic understanding of the scalar perspectives and experiences of her informants.

Finally, while historians, cultural anthropologists and cultural geographers usually choose to explain their human-scale observations by referring to political, economic and cultural forces, the temporal framework that ecologists use to *make sense* of the variety of life and interrelationships they observe is evolutionary, including geological and climatological time-frames. Evolution through natural selection occurs with the transmission of genetic material across generations, hence evolutionary change does not necessarily take a long time; it can occur within a matter of hours for strains of bacteria, and years for mammals and trees. But to explain speciation and biodiversity, and the highly specialized relationships between groups of species (e.g. plant-insect interactions), generally requires a theoretical sense of geological time, on the order of millions of years, a temporal extent that tends to begin before the origin of the human species, and far earlier than what most social scientists and historians consider remotely relevant.⁴ This is the temporal context, however, in which ecologists continuously imagine and explain the

³ Nathalie Hamel, personal communication.

⁴ This is not to suggest that social scientists do not as a rule rely on evolutionary theory: archaeologists, ecological anthropologists, biological anthropologists and psychologists come to mind as social scientists relying on evolutionary scales of analysis.

diversity of life they observe: against this evolutionary imagination of time, the scale of human history appears quite short.

Like geographers, ecologists are sophisticated theorizers about scale. In fact Levin, writing later, makes similar points in his exploration of scale as LeFebvre. Yet, suggestive of the disciplinary gulf between them, Levin's lack of reference to LeFebvre's work suggests he is unaware of his geographer counterpart. Indeed, each claims scale and scalar complexity as a subject that is particularly relevant for his half of the academy without extending consideration to natural, or social, phenomena, respectively. LeFebvre contrasts the interpenetrating hypercomplexity of social places to fixed natural places that are "simply juxtaposed" (88) (however brilliant a geographer, he is awkward when it comes to nature), while Levin argues that scale is "the fundamental conceptual problem in ecology, if not in all of science" (1992:1944) (but does not include social science within his definition of "science"). Like LeFebvre, Levin disputes the notion that particular phenomena are contained within single scales: "virtually every ecosystem will exhibit patchiness and variability on a range of spatial, temporal, and organizational scales, with substantial interaction with other systems and influence of local stochastic events" (1960). It is these interscalar interactions that should be the focus of inquiry, Levin argues, rather than observations at some presumed "natural level of description" that does not exist (1947). Levin continues beyond this fascination with scalar complexity to guide researchers through the potential pitfalls of studying multiscale phenomena. He warns against the consequences of working with different levels of detail: "Models that are insufficiently detailed may ignore critical internal heterogeneity ... On the other hand, overly detailed models provide little understanding of what the essential forces are" (1960). Levin recommends that the research question should determine the appropriate scale and resolution of the study.

Where Levin clearly parts from his social science colleague is in his assumption that the goal of the researcher should be to choose scales at which particular phenomena become patterned and therefore quantifiable and predictable. At scales that are too small, phenomena may appear stochastic and unpredictable. However, on enlarging the scale, the researcher may observe a predictable pattern, ignoring heterogeneous details as outliers. He writes:

This is the principal technique of scientific inquiry, by changing the scale of description, we move from unpredictable, unrepeatable individual cases to collections of cases whose behavior is regular enough to allow generalizations to be made. In doing so, we trade off the loss of detail or heterogeneity within a group for the gain of predictability; we thereby extract and abstract those fine-scale features that have relevance for the phenomena observed on other scales. (1947)

Here, finally, Levin points to the relationship between epistemology and scale. Scholars working with narrative explanations, such as historians dealing with human intentionality and causality, may be satisfied with scales that do not necessarily produce the systematic patterns that ecologists like Levin seek. In the Weberian tradition, for example, it *is* the heterogeneous details that become, in part, the objects of study. These stochastic, narrative elements of life are what make it meaningful. In the Durkheimian

tradition, on the other hand, as well as in other systematic, scientific approaches, credible knowledge is not produced until a pattern is established.

It is not only what counts as credible knowledge that is at stake with the choice of scale, however; scholars subject different sorts of knowledge to moral evaluation, as well. Postmodernists, for example, tend to negatively associate systematic approaches with colonial systems of inventory, rationalization, and control (e.g. Pratt 1992). Scientists, on the other hand, tend to shrug off un-patterned, narrative explanations as dangerously “anecdotal”. Timothy Mitchell illustrates the epistemological and moral distinctions between the Weberian and Durkheimian approaches in his exploration of colonial Egypt. He describes the European’s need to view Cairo from a minaret, where the city can be apprehended all at once, laid out below him in a viewable, and controllable (though jumbled) ”map”, and he contrasts this European, colonial vantage point to the local Egyptian’s private, narrative passage through the streets (1991).

A consideration of different disciplinary scalar traditions, and their implications for what kind of knowledge is produced, and valued, helps explain why history, anthropology and geography, as disciplines involving human-oriented scales and epistemologies, integrate more compatibly with each other than any of them do with ecology.⁵

Interdisciplinary Scales of Analysis

Environmental History

What happens when history encounters the environment? First, it should be noted that for certain kinds of environmental histories, i.e. those that deal mainly with cultural and political trends such as environmentalism and environmental politics, choice of scale does not differ significantly from dominant modes in history, describing ideas and social movements within a politically defined, and usually national region, such as Samuel Hays’ work on the conservation movement in the United States (1959; 1987). It is the historians who track the relationship between social changes and material changes in the land who are confronted with less familiar scalar choices.

Environmental historians vigorously debate the scalar extents and resolutions at which their stories should be told. In 1990 a roundtable on environmental history was published in *The Journal of American History* that provided a window onto the contours and internal disagreements of the field at the time. Donald Worster begins the conversation by arguing for environmental histories of “modes of production” and their interrelationship with ecological phenomena and social change and inequality, particularly with respect to agriculture and agroecosystems. He would like to see environmental historians tracing capitalism’s impact on agroecology, “both in general planetary terms and in all its permutations” (1990:1097). Worster proceeds to outline the world-wide need for these histories, speaking in terms of farmers, commodities, market economies, capitalism and science. (Note the orientation toward a Marxist scale). Alfred Crosby responds in agreement, only reframing the problem of agroecology as one of the “longue duree”, that takes place on huge spatial and temporal scales and that will require

⁵ These scalar and epistemological dissonances also present a major challenge for interdisciplinary, collaborative research on problems that are inherently natural and social and multi-disciplinary, such as environmental problems.

long, patient work in the archives – a nod to the human scale that also limits historians (1990). In contrast, Richard White protests that the scales of analysis that Worster and Crosby propose are much too large, and their subject matter too narrowly defined. Working at the scale of capitalism is too simple and instrumental an analysis that can “obliterate local understandings and adjustments” and miss the significant agency of “value judgements and beliefs” (1113). As an example, White explains how agroecological change in the Great Plains depended on different and changing cultural meanings of livestock held by Indians and settlers as much as it did on material forces. White points to the value of working closer to the scale of an anthropologist. Similarly, William Cronon advocates working “below the level of the group to explore the implications of social divisions for environmental change” (1990:1129) and criticizes Worster’s overemphasis on the capitalist scale that smooths the complexity of cultural and environmental phenomena into a single explanation. He would prefer to see “well-focused monographs analyzing particular social and ecological changes, without worrying as yet about their proper place in a larger metanarrative” (1130).

But Worster counters that working at the scale of a monograph is to reduce environmental history once again to the scale of social history, with its particular “causal arguments and moral concerns” (1990b:1144). Worster wants to make a different moral and philosophical point with environmental history. Rather than “put nature into history” as Cronon advocates, Worster would prefer to put history into nature, or in his words, to “locate the realm of nature into which we can once more put our human history” (1147). Assuming that ecological scales are necessarily broad (Levin would disagree), Worster advocates working at a large temporal and spatial scale that would instill in readers a deep respect for the agency of nature as a “self-managing set of patterns and processes” (1144) that “both do and ought to set a course for our lives – not the only course, or the only possible course, but a reasonably clear course that wise societies have followed in the past, foolish ones have scorned” (1145). From Worster’s materialist perspective, the environmental historian’s challenge is to step beyond the “nihilism, relativism, and confusion” of modernity to recognize an objective world that we have “not created nor ever fully controlled” (1146). (A social constructivist’s goal may be to demonstrate the opposite, however, and lead her to choose a different scale at which to do so.) On the other hand, Mark Fiege demonstrates that working at a small ecological and social scale does not sacrifice ecological pattern; it just reveals new and different ones, as Levin would predict. In contrast, in fact, to Worster’s own *Rivers of Empire*, in which dam-building overwhelms the nature of the West, Fiege’s detailed exploration of Mormon farmers’ attempts to irrigate the arid lands of Idaho tells a different story: how nature played a crucial role, both mythical and capricious, in the irrigation, farming practices and social organization of the West - and still does (1999).

Finally, resonating with LeFebvre and Levin, White criticizes Worster’s Marxist-like hierarchical scheme of material and ideological structures, advocating instead Anthony Giddens’s and Braudel’s concerns with “the patterning of social systems in time and space” and attention to “the interplay of ideational and material elements”; a historical approach that he suggests, and Levin would agree, would be “more in tune with current trends in ecology” (1116). White articulates this line of thinking more clearly in a paper published 13 years after the roundtable in 2003 that draws directly from LeFebvre and echoes Levin:

...a historical study ...presents the historian with a choice of scales. Movements from one scale to another change the array of problems under examination. There are scales appropriate to problems – there are better and worse choices – but there are no absolutely right and wrong scales, no automatically dominant scale, per se. Each scale reveals some things while masking others. The social space of each scale focuses attention on a set of relationships between people and things... the real choice is not finding the single historical scale that reflects the world in which we now live, but instead understanding the multiple scales upon which ... lives have been lived and how such scales have merged and intersected. (3-8)

Here White's vision for environmental history begins to incorporate the emic scales of anthropology ("understanding the scales upon which lives have been lived"), the idea of the social production of scales from geography ("social space of each scale"), and the chaotic intersection of multiple scales from geography and ecology – an interdisciplinary approach to scale that does seem appropriate for a field that examines the history of the relationship between dynamic cultural beings and their dynamic environment.

If nothing else, this debate reinforces the idea that historians have a great degree of scalar freedom in the dimensions of time, space and narrative. Despite the debate and prescriptions, however, environmental historians continue to re-center their narratives at the scale of the nation – at least for the early modern and modern eras, when the state system was emerging (White 2003). They typically choose a spatial extent corresponding to a defined geographical feature, such as an island (White 1980), river (White 1995), forest (Langston 1995), or ecoregion, that is contained within or cropped by a political boundary, usually at the national or subnational level, such as the forests of Bengal (Sivaramakrishnan 1999), or by a region meaningful to the national imagination, such as the arid American West (Worster 1985) or the temperate woods of New England (Cronon 1983). While the spatial extent is based in part on an ecological scale, the temporal scope most often reflects a scale relevant only to national history, such as land use changes due to the introduction of colonial administration in India (Sivaramakrishnan 1999, Cronon 1983), American colonial settlement (White 1980) or industrialization (Worster 1985, Cronon 1991, White 1995), or something more subtle, like reforms in American forest management science (Langston 1995).⁶ Together, these kinds of spatial and temporal extents, representing political and cultural regions meaningful to contemporary readers, help the historian tell a good, and relevant, story.

While the scope of the actual history may be smaller than the nation, the historian's goal is not only to tell a story about a small island off the Northwest Coast of the United States, such as White's *Land Use, Environment and Social Change: The Shaping of Island County, Washington*; rather, these histories are metonymic for the nation - in this case, to track changing land use and ideas of nature in America in general, from the interdependent relationship between Native Americans and American settlers to

⁶ It is interesting to note that few environmental histories refer to an ecological temporal frame. Nancy Langston's history of the Blue Mountain ponderosa pine forest, and its ecological interaction with silvicultural practices is the closest possibility that comes to mind (1995). Not surprisingly, Langston began her career as an ecologist.

contemporary ecotourism developments (White 1980; 2003:4). Cronon's focus on the scale of a city and its hinterlands is unusual, but refreshing (1991). More commonly, environmental historians write monographs whose conclusions are intended for extrapolation to the scale of the readers' national imagination. In doing so, however, they reinforce the idea that the "nation" is a natural scale of time, space, social organization, and narrative. It is understandably more straightforward and makes a satisfying story to focus on geographical areas subsumed within national borders. Yet environmental history has the potential to de-center the nation and re-center ecology, and yet not lose sight of the importance of the nation; for example, environmental historians could examine the influence of nation-building and different national environmental policies on two sides of a cross-border ecoregion.

Political Ecology

Political ecology as an academic field emerged at the intersection of development studies and environmentalism. It also stemmed from broader criticisms on the part of Marxist scholars that ecological anthropologists and cultural ecologists working in the late 1970s, while drawing useful connections between ecological systems theory, human behavior, and traditional knowledge, failed to see how small-scale societies' cultural practices were linked to a larger global political economy (Peet and Watts 1996). Development scholars in primarily Third World agrarian places began to trace how environmental problems were linked to broad political, economic and social dynamics, in order to challenge prevailing biological, economic, and technological models that blamed environmental degradation on such monolithic, endogenous and predictable factors as Malthusian overpopulation, "tragedy of the commons", market imperfection, economic and technological dependency, or inappropriate technology. Instead, early political ecologists proposed a more contingent, historical and regional approach for understanding environmental degradation (Hecht 1985). Suzanna Hecht modeled the new approach of political ecology in her study on the relationship between the social and political conditions of capital accumulation and deforestation in the Eastern Amazon basin (1985). She used a "middle-level" analysis to explore the international and national politics, as well as internal social dynamics and ecological particularities affecting environmental degradation at the regional level.

In 1987, development scholar and political economist Piers Blaikie, and cultural ecologist Harold Brookfield, helped define and catalyze the new research program of political ecology in their book, *Land Degradation and Society*, in which they characterize and promote the "nested scales" approach taken by Hecht. Like others discussed earlier, Blaikie and Brookfield do not prescribe a correct scale for research in political ecology; rather they recognize that different scales are appropriate for tackling different questions. They do insist, however, on using a "multi-scalar" approach to describe the social causes of environmental change. They advocate integrating chains of causality operating at multiple scales in multiple dimensions: from geographical scales relevant to "the decision-making process over land use", beginning with a micro-focus on the unit under the direct control of the local land manager (e.g. field or farm) and working up through watershed, landscape, region and nation (64); to multiple scales of social organization, such as person, household, village, regional land tenure and settlement patterns, and "the spatial unfolding of political economy" on national and international scales (66); to temporal scales that incorporate the historical origins of degradation, the lag-times

between social or environmental causes and consequences, and different rates at which ecological change takes place, such as variable rates of soil erosion (67-68).

In contrast to this spiraling, multi-scalar descriptive program, Blaikie and Brookfield offer a relatively simple theoretical approach with which to analyze this interscalar complexity. They suggest using a “core-periphery” model aimed at the regional scale, that focuses on the role of the state in the unequal allocation of resources, resulting in detrimental affects on its social and environmental margins (17). The authors emphasize that choice of analytical scale is important because it will influence the way that environmental degradation is explained, and these explanations will affect policy decisions. Government watershed planners, for example, tend to focus on the relationship between land use and landscapes, a scale at which the explanation for land degradation “is largely a physical and technical one provided by the natural sciences” and is much larger than the local land-user’s “scale of experience” (to borrow Levin’s phrase)(66). They imply that it is the political ecologist’s job to demonstrate how research at scales other than those deemed relevant by the state and the natural scientist are essential in order to explain environmental change. At the same time, Blaikie and Brookfield call for joint research between social and natural scientists, who, they argue, will need to be open to a plurality of rationalities and methodologies, in order to avoid “single hypothesis explanations” of degradation (16).

Given such an ambitious yet undertheorized vision, it is not surprising that the resulting field of political ecology is often considered unwieldy, and, disappointingly, the joining of natural and social scientists in research is as yet its “unfulfilled promise”.⁷ Instead, political ecology strongly reflects multidisciplinary roots in development and agrarian studies, anthropology, geography, and Marxist-inspired political economy in its scales of description and analysis. In particular, political ecology’s heavy focus on the mid-range scales of state and class organization reflects its Marxist analytical orientation. By 1992 Neumann criticized the new field for focusing too heavily on class-level, rather than on daily, local-level politics, and argued that therefore, “the informal, micro-level political arena where much of the defense and negotiation over access to land and resources occurs remains hidden in political ecology studies” (87). He proceeds to include a limited ethnographic analysis of Tanzanian villagers’ resistance to the formation of a national park in his article, nested in the contexts of regional history and political economy.

Instead, political ecologists increasingly focused on even broader, international scales of analysis. This was coupled with a reflexive turn with which they began to question the legitimacy and impact of the Northern, NGO-driven, international environmental movement that had in part sparked the initiation of their field. For example, with a predominantly international and national level of analysis, Nancy Peluso examines how global environmentalist ideology was strategically used to legitimate state violence over resource control in the face of local opposition to conservation policies in Kenya and Indonesia (1993). In addition, with this critical look at their environmentalist roots, political ecologists began to ask not *how* environmental degradation was occurring, but, in fact, *whether* it was occurring. In a rare case of combining multiple scales of description and analysis, including ethnographic and historical research and social and ecological analyses, James Fairhead and Melissa Leach demonstrate how embedded,

⁷ Paul Robbins, personal communication.

erroneous assumptions about deforestation in West Africa rationalized a strict, sometimes lethal ban on tree-felling that undermined local subsistence and cultural practices (1996).

Responding to the post-modern turn in the social sciences that underscored the constructed “nature” of scientific knowledge and biodiversity conservation (“nature” used in several senses here), and addressing the theoretical shortcomings of political ecology, Blaikie attempted a re-characterization of the field in 1995. He urged scholars to pay more attention to the discursive constructions of environmental problems and scientific knowledges in the daily meaning-making activities of multiple actors involved in development or environmental conservation projects, such as the “local people, government servants, politicians, scientists and development experts” (204), and to the unequal social contexts in which these multiple meanings did or did not gain political legitimacy. Blaikie implicitly calls for smaller-scale, ethnographic research in order to access daily meanings and emic perspectives. Yet in embracing discourse analysis, political ecologists tend to rely on *written*, rather than oral and lived discourse, and in particular on the written discourses produced at the national and international levels (e.g. Peluso 1993; Zerner 1996; Adger et. al. 2001). Thus, ethnographic description and analysis at the local level remains persistently thin in political ecology.

Peet and Watts combine Blaikie and Brookfield’s original focus on the regional scale of environmental change with the approach of discourse analysis to propose the exploration of “regional discursive formations”⁸ in space and time. They term this discursive, yet still Marxist, approach to political ecology “liberation ecology” (260). They claim, vaguely, that these regional discursive formations are identifiable at the confluence of “certain physical, political-economic, and institutional settings” as the “modes of thought, logics, themes, styles of expression and typical metaphors” as well as “the absences, silences, repressions, marginalized statements” that “run through the discursive history of a region” (1996:16). Critiquing classical Marxist analysis for overemphasizing class, Peet and Watts turn their attention to populist social movements as their preferred level of analysis. One gets the sense, however, that they have not had to adjust their range of vision very much in order to make the conceptual shift from *class* to *civil society* as the scale at which a revolution will be recognizable. Nonetheless, they recognize that the discursive turn does demand “nuanced, richly textured empirical work,” a sort of “political-ecological thick description” (38).

Perhaps Peet and Watts’s persistent interest in the scales of region and civil society stems from their background in post-Marxist geography. Maybe the predominant scales used for research and analysis in political ecology depend on the disciplinary training of the researchers involved. In contrast, do anthropologists working in the field of political ecology respond better to persistent calls for local-scale, ethnographic work? Does ethnographic research, and the elicitation of plural, “local” perspectives on the causes and consequences of environmental change and social inequality offer alternative scales of analysis than those suggested by a Marxist framework? A look at the work of anthropologist and political ecologist Arturo Escobar is equivocal on these points. Escobar consistently refers to ethnographic field work on the Pacific Coast of Colombia

⁸ Political ecologist Peter Walker argues that these regional scales of analysis should also challenge the implicit “hemispheric” framework persistent in the field since its inception, that divides the globe into the First and Third worlds (2003).

in his articles, yet in his analysis persistently dwells on new social movements as potential sites of resistance (e.g. 1997).

More significantly, Escobar is hailed as the scholar who most convincingly pushed political ecology in the poststructural direction (Bryant 2001:162), urging scholars to focus on language, “not as a reflection of ‘reality’ but as constitutive of it” and on discourse as “the process through which social reality inevitably comes into being” (Escobar 1996:46). Though Escobar credits this discursive turn to poststructuralists such as Foucault and Deleuze as well as Edward Said, the idea that language creates different cultural realities has long been a tenet of the discipline of cultural anthropology, and is an analytical orientation that an anthropological political ecologist is particularly well-positioned to offer. The turn towards discourse analysis does not focus research at the ethnographic scale, however. Rather, discourse analysis tends to free research from the constraints of real-time work. As I noted earlier, scholars pursuing a discursive analysis often rely on documents, and are thus freed, like historians, to zoom in and out of different scales, the international and global scale being particularly popular. These global discourses that prescribe changes for wide swaths of the globe, such as people-free biodiversity zones, are then contrasted to the presumed practical existence, heterogeneity, marginalization and resistance of locals (e.g. Zerner 1996).

By 2000, Blaikie, again taking it upon himself to light the path of the field, identifies several major shortcomings with the deconstructive approach for political ecology, as well as for broader scholarship. First, he contends that focusing on the sweeping scales of discourses of power tends to reify the local as a “romanticized ... site of resistance” and argues that the local scale remains ethnographically “unexamined and ‘thin’,” allowing scholars to retain a “naivety or deliberate myopia about some of the more questionable social agendas that appear at local sites of power.” Finally, he is concerned that the fragmenting effect of the postmodern project leaves few pieces with which to move forward in a practical way (1038). Political ecology, despite its professed concern with the local land manager, appears persistently resistant to actually examining the complexity of the local scale, possibly due to its preoccupation with the mid-range and global scales of its Marxist roots and more recent turn to postmodern deconstruction.⁹

When anthropologists finally do examine, and analyze the “local” scale, they shake up both the ideas of “local” and “scale”, and how to approach them. Ann Arbrecht Forbes observes that a disparate range of groups involved in a dam-building project in Nepal may all be considered “locals” depending on whether the observer is the president of the World Bank, a Kathmandu activist, or a villager (1999). Forbes chastises both scholars and activists for searching out and reifying the authentic “local”. But instead of advocating closer ethnographic work among “local” communities, she suggests that the concept of the local should itself be scrutinized. Nepali NGOs based in Kathmandu, as well as village residents claim “localness” strategically for themselves. She notes that “calling something ‘local’ or indigenous implies a fixed category that designates a static and bounded identity” (320). Instead she observes that identities are “multiple and malleable; they change in time and space”. Rather than a set of nested boxes she

⁹ Or could it possibly be due to the fact that working at the ethnographic scale takes a lot of time and work? Making critical arguments based on government documents is frankly easier and still gets published; another way the human “scale” – i.e. the short temporal demands of publishing - influences the scale of research!

conceptualizes dynamic, intersecting identities - even at the smallest “box” of the local, like LeFebvre’s hydrodynamic metaphor. Echoing Levin, Forbes urges scholars to shift their focus from fixed identities to dynamic agencies, and from categories to “movements across categories” (338). Rather than searching for the “legitimate” local, she recommends that scholars analyze the strategic use of “local” identity, and create “mechanisms that give voice to the different actors in all the different places involved” (338).

In a similar vein, Anna Tsing critiques the ubiquitous rhetorical use of the “global” scale, and, resonating with LeFebvre’s concept of the production of space, she recommends attending to how the global – and other - scales are *made*: “through what social and material processes and cultural commitments do localities or globalities come, tentatively, into being?” (2000a:348). She urges analysis of ideological scale-making and attention to contestations over what should be the appropriate scale, such as the choice of “bioregion” for the scale of environmental policy-making (348). Like Forbes, as well as LeFebvre and Levin, Tsing calls for research on *movements* across and between scales - in the sense of both travel and social movements – that cross-cut conventional scalar categories and bring together such a “motley coalition” as indigenous leaders, scientists, and international environmental activists (349). Furthermore, Tsing observes that anthropologists tend to view the global and the local scales at different resolutions, with local ethnographic detail contrasted against a global “blob.” By allowing globalization to appear homogeneous in this way, Tsing argues, “we open the door to its predictability and evolutionary status as the latest stage in macronarratives” – i.e. globalization (2000b:119).

The question becomes, then, how to critically apprehend the global scale? Tsing recommends attending to transnationalisms, cosmopolitanisms, the “scapes” and “routes” of Arun Appadurai and James Clifford, as well as projects of scale-making (2000b:120). Forbes recommends following George Marcus’ conceptual shift away from “two-dimensional Euclidean space with its centers and peripheries and sharp boundaries to a multidimensional global space with unbounded, often discontinuous and interpenetrating sub-spaces” (Marcus 1995, quoted in Forbes 1999:322). While some achieve this by focusing their research on boundaries and borderlands (e.g. Gupta and Ferguson), Tsing follows Marcus’ suggestion to “follow the conflict” by working with multiple groups in multiple sites over time (322). Anthropologists engaging with political ecology finally envision a way for the field to move beyond its fixation with the Marxist and global scales by releasing its metaphor of the nested box for something more fluid and more meaningful.

Finally, having agonized over the lack of attention to ecological data and the unfulfilled promise of joining natural and social scientists in collaborative research, it seems like the subject of *scale* itself would be a fruitful point of departure for a constructive engagement between political ecologists and ecological scientists.

Science Studies

Science studies encompasses such a diverse conglomeration of disciplinary approaches that it would be difficult to characterize its dominant methodological or theoretical approach, and hence its dominant scales of analysis. Indeed, it is argued that to define an appropriate methodology for science studies would be to presume a definition of the “pandemonious” field (Bowden 1995). Early historians, philosophers

and sociologists looked at the logic of scientific inquiry, the development of scientific concepts and technologies, and the organization of scientific institutions, through quantitative, qualitative, sociological and philosophical approaches (70). A major break came in the 1960s when scholars began to analyze the relationship between science and its wider social context. Then in the 1970s another influential trend emerged examining the sociological investigation of how scientific knowledge is made. Scholars still tend to approach the study of science from the perspectives of their own disciplines, although there is clamoring for interdisciplinary integration (72).

Bowden suggests that one question that could direct science studies in a more coherent direction is that of how science attains its dominant status in society (75). Both waves of science studies since the 1960s aimed to challenge its dominance by “destroying the epistemological privilege that has traditionally justified that authority” (71). The corollary becomes then, however, that it is hypocritical to use scientific methods to challenge scientific hegemony. Thus, it is unsurprising that the inductive, hermeneutical approaches of philosophy, history and cultural anthropology currently dominate the field of science studies. The intersection of insights from history, anthropology and philosophy led to an acceptance of methodological relativism in the field as well as a demand for empirical research. In particular, the confluence of the narrative approach to explanation in history and the theory-driven approach in the social sciences led to a “widespread acceptance of explanation at the level of thick description” (72). Anthropological methods play a central role in science studies, particularly the combined use of ethnographic and historical research and discourse analysis. In order to limit this discussion to a manageable scope, I will therefore focus on the way in which anthropologists in particular have approached scale in science studies.

Emily Martin provides a nice field guide to the range of approaches that anthropologists and their colleagues have used to study science in society (1996). Not surprisingly, the scale at which sciences studies takes place shadows the scale at which scientists do their research. One of the only science studies scholars to prescribe a method for the field is anthropologist Bruno Latour, who advocates “following scientists in action” (1987). Anthropologists of science generally take this to heart, though follow not only scientists, but also the discursive products of their research; moving from the “village” scale of traditional anthropology in order to study a lab, for example, to the “multi-sited” scale(s) characteristic of the reflexive and postmodern turn in order to study flows of people and ideas. In her ethnographic study of the “non-culture” of high-energy physicists, published in 1988, Sharon Traweek sought to “offset the unfamiliarity” of the anthropology of science by working at the very recognizable, conventional scale of the ethnographic monograph, immersing her work entirely within the walls of the laboratory (Franklin 1995:174n13). Martin calls this circumscribed subject the “citadel” of science (1996). Ironically, this was the same moment at which anthropologists were subjecting their discipline to a critical and reflexive reinvention. Hence, Franklin argues, Traweek’s study “instantiated the ethnography of science in the very same period that ethnography-as-science began to be dismantled” (1995:174n13).

Martin observes that Latour and Rayna Rapp extend the scale of analysis to include the landscape beyond the walls of the citadel, and show that those walls are in fact “porous and leaky” (102). They include in their scope the various groups that dot “the landscape” around the citadel, and who interact in mutually influential ways with the

scientists: allies gathered in government, industry and the media, and interest groups such as genetic counselors who themselves influence the knowledge-making process (101-102). Leaving behind the concentric circles of citadel and landscape, Martin is most taken by Giles Deleuze's metaphor of the rhizome that captures the way in which the scientists' citadels as well the hamlets and villages surrounding them are "embedded in the same countryside" (Martin 102). In other words, multiple nodes of society, including scientists and non-scientists, respond to similar subterranean roots of logic, such as the non-linear impulses underlying both chaos theory and poststructuralist literature. The rhizome also captures those "discontinuous, fractured, and non-linear relationships between science and the rest of culture" that Donna Haraway explores in her research on primatology (103) (and apparently attempts to reproduce in her writing style). Martin chooses the rhizome as the "scale" (if we may view it that way) for her own work. Unlike Hayles and Haraway who are not trained in anthropology and rely substantially on texts, Martin conducts rhizomatic field work on the social imagination of immunology that takes her to a proliferation of sites: immunology labs, HIV clinics, AIDs activist branches, urban neighborhoods, and corporate offices. While multi-sited research is necessary in order to grasp the increasing interconnections of the world, some of the "thickness" in resolution of village-scale ethnography is lost in pursuing ethnographic detail at each node of the rhizome (Martin 1994).

Latour's advice to follow the scientist is not the only way he has influenced the approach to scale in science studies. While controversial, his more significant effort has been to analyze the way in which scientific knowledge itself gains what Haraway variously calls its "God's eye view" or "view from nowhere" (1991). How does science achieve its universalizing presence? How do micro-activities in a laboratory lead to macro-effects in the outside world, such as policies to "pasteurize France"? Latour essentially argues that the truth status of scientific knowledge in society depends on its ability to *make* its own universal scale. Scientists must gather allies – funders, industry leaders, political contacts – in order for their "objective" discoveries to take root in the social and political imagination. In addition, the scientist must extend to the world the rules of his laboratory in order for his laboratory successes to succeed in the world: he must classify, label, and effectively reduce the messiness of the outside world to mimic the ordered environment of the lab. Finally, the scientist, using data collection instruments and chains of representations, must abstract the chaos of the world into a small, low-resolution "referent" (e.g. a graph) that not only refers to the universally accepted standards of science (built up over a long temporal period) but can also travel easily around the world on paper and now via the internet.

While Latour spent much of his career focused on laboratory science, some of his recent work explores what he calls this "abstracting and amplifying" process in environmental science. In *Pandora's Hope* Latour presents an example of what happens when science studies meets both the environment and the discipline of ecology (1999). He accompanies a group of soil scientists on a scientific expedition to the Amazon where the scientists observe the forest-savannah transition and Latour observes the scientists. Before beginning field work the scientists consult two "maps" – one representing the entire Amazon forest, and the other an aerial photograph of their field site; a patch of the forest reduced to the size of their table. He notes that these soil scientists' maps are the products of colonial explorers, geographers and cartographers, built up over a vast history

that went before them. Scientists require these “inscriptions” in order to “master the world”, Latour argues; erase them, and the scientists would be lost (29). The soil scientists rely on the grand temporal scale of history of scientific research distilled into the map in order to locate and make their own knowledge of the forest’s soil. A single pointed finger allows them to reconvene later at a meeting place in the actual forest. With the map, the forest is both very far (abstracted) and very close (under hand).

Next, Latour notes that the local botanist has created a laboratory in the forest by demarcating her field site and marking trees in a Cartesian grid – presuming the universal scale at which their pattern will inevitably emerge. Evidence for the patterns can be recorded in a notebook according to her spatial framework. She gathers a “bouquet” of leafy plants that she will bring back to her botanical collection at the university, where they will be made visible through drying, pressing and labeling in the comfort of an air-conditioned room. The forest is much more manageable at this human scale, Latour observes. In her office, the temporal and spatial chaos of the forest is squeezed into the size of the room: “specimens from different locations and times become contemporaries of one another on the flat table, all visible under the same unifying gaze” (38). For the botanist, the chamber is a metonym for the forest, “by which a tiny part allows the grasping of the immense whole” (36). At this human scale, and with parts of the forest individuated, stripped of soil and worms, the botanist can move them around into new juxtapositions, searching for patterns that she would be unable to grasp in the heat and real-time of field work. “In losing the forest, we win knowledge of it,” Latour remarks, and continues: “In a beautiful contradiction, the English word ‘oversight’ exactly captures the two meanings of this domination by sight, since it means at once looking at something from above and ignoring it” (38). By sampling the botanical complexity of the forest in order to apprehend it at a human scale, we lose the richness of the forest itself.

Back in the forest, Latour helps the scientists collect soil samples into tiny empty boxes held in a briefcase. The boxes pre-set the scale at which the forest will next be apprehended. These empty categories are “set up behind the phenomena, before the phenomena manifest themselves, in order for them to be manifested,” Latour writes. The boxes make the samples standardizable and comparable. The researchers color-code each sample by holding them under small holes punched in a color guidebook – an internationally recognized, numerical index of colors. Standing in the Amazon forest with this universal guide, Latour writes, “the threshold between local and global can now be crossed instantaneously” (59). The small boxes allow the samples of soil to travel: “the instrument has given us a handle on the earth” (51). In the comfort of a restaurant the team of scientists draws a vertical cross-section of the forest-savannah soil transition based on the transect coordinates at which the samples were taken. On paper and by fax, the soil profile can now travel much farther and faster than the briefcase of samples, and it can reproduce easily. This drawing becomes the referent for the forest in the final article that is published based on the research. From the forest to the article, Latour observes, there is an “unbroken series of well-nested elements”. No element can be superimposed on another, but each refers to the other elements in both directions. This, finally, is what Latour means by reduction and amplification: at each stage of research, the forest loses “locality, particularity, materiality, multiplicity, and continuity” but gains “compatibility, standardization, text, calculation, circulation, and relative universality”

(71). After being *reduced* to a credible sign, the final referent - the drawing of the soil transition – can *circulate* anywhere and anytime, *amplifying* the relevance of the patch of forest-savannah for the wider scientific community. While Latour is mainly interested in making a philosophical point in this chapter about how getting from things to words takes a long and contorted a road, in doing so he demonstrates the power of science studies to examine in close detail the *scale-making*, and I would argue *scale-management* projects at work in the environmental sciences.

But in observing the scientists as if they were members of an alien species doing bizarre things in the forest, Latour misses a major potential contribution of anthropological research: attempting to understand the world from the perspective of the “natives”.¹⁰ While he has discussed at length the perspectives created by sedimented layers of *science*, we do not hear about how the scientists themselves talk about the forest, what the forest or their work means to them, how they imagine themselves in relation to each other, to inhabitants of the Amazon, nor to other scientists. While this was perhaps not the point of Latour’s article, the emic perspectives of scientists, including scientists’ *lived scales of experience* are not fully explored in Latour’s science studies.

Environmental Anthropology

Environmental anthropologists are frequently multidisciplinary in their research approach, part environmental historian, part political ecologist, part science studies scholar (e.g. Sivaramakrishnan 1999). Hence, they are faced with similar advantages and disadvantages in their choice of scale as scholars in those fields, as characterized here. The one major difference is that anthropologists are consistently limited by, and valued for, ethnographic work at the smallest scale. In situating their ethnographies in historical, geographic and political contexts, anthropologists need to choose scales relevant to their ethnographic narratives and desired analyses. In doing so, they may want to question the nation-making tendencies of environmental historians and the persistent Marxist-scale analyses of political ecologists. They may want to experiment with the ways that scales intersect and interpenetrate in chaotic and complex ways. In turn, anthropologists have offered these fields ideas for how to approach scale itself as an object of analysis – Forbes’ exploration of the strategic construction of “local” identities; Tsing’s inquiry into the scale-making processes of globalization, and Latour’s analysis of scientific processes of scale-making and scale-management.

But as ethnographers, environmental anthropologists’ most exceptional contribution to these fields would be the exploration of different local “scales of experience”. The advantage of the ethnographic method is its ability to access multiple cultural perspectives on the world. Anthropologists can attempt to understand the scales at which their informants live – how small or large are their social networks and spheres

¹⁰ I would add that Latour also misses an important point about the relationship between choice of scale, emergence of pattern, and ecological research: arranging the soil samples in the boxes was not the first instantiation of pattern: the researchers probably deliberately chose a transect length at which they *imagined* a pattern would most likely emerge - if one did not, their data would be considered irrelevant by the scientific community, and they would have to imagine and choose another scale (e.g. a longer or more closely sampled transect length) until a pattern was identified/created. In other words, it was likely between the reality of the forest and the scientists’ sliding-scale imagination that the soil profile pattern first emerged.

of influence? Are they place-bound dairy farmers tied to the daily schedule of milking, or rhizomatic, internationally recognized scientists who spring up in conferences around the world? In addition to their lived scales of experience, the ethnographer can attempt to grasp the scales at which different informants make sense of changes in their world. Do informants believe declines in salmon populations began with the invasion of white settlers in the 1800s or with the Boldt decision in 1974? Do they blame it on “Indian netting” in the river, or on international commercial fishing in the oceans? These explanatory narratives bump up against each other in the Skagit controversy. Their incommensurability can be explained in part by their differences in temporal and spatial scale.

Scale and the Skagit

To address the question of scale in my research on the conflict over salmon habitat restoration in the Skagit Valley, I plan to draw on many of the models explored here. To begin with, the study design is admittedly a project of scale-making. I will be reinforcing, though also challenging, the *watershed* as a relevant geographic and political unit and level of analysis. In addition, the research will be a process of scale-management, in which I will need to scale down to a manageable, human size the “forest” of details and complexity, and the infinitely interpenetrating, interscalar social, cultural and ecological processes.

I have selected the watershed as the boundary, albeit porous, for my ethnographic research for a variety of reasons. First, the watershed represents both geographic and political regions relevant to the controversy. Hydrogeologists and other natural scientists who comprise, in part, my informants as well as audience, recognize the watershed as the land surface drained by water running to a particular point (the mouth of the Skagit River), and therefore containing all of the tributaries and streams that are home to the salmon that enter the river. Environmentalists recognize the watershed as an ecological region, but also as the unit by which Washington State organizes voluntary salmon protection efforts; each watershed in the state has a designated “lead entity” that coordinates local restoration efforts. Contemporary Coast Salish Native Americans in the valley observe that historically the watershed served – and in some ways still serves - as a vertical unit of social organization, in which upriver deer and elk hunters traded with downriver salmon fishermen and shellfish collectors. Skagit residents in general commonly identify themselves as coming from “the Skagit Valley”, hence it may be seen as the site of an imagined place-based “community”, although a large, unwieldy and contentious one. Finally the watershed is, luckily, roughly coterminous with the borders of Skagit County. The County is the government entity responsible for implementing the State’s salmon habitat protection plans, and it is these plans, and local peoples’ responses to them, that constitute the focus of my research.

The watershed, by Blaikie and Brookfield’s scheme, is one of the most significant scales at which land management is focused in this region. As they predict, environmentalists and natural scientists alike tend to observe and analyze the watershed as a natural geographic feature, for which ecological methods and analyses are most appropriate. My goal, as Blaikie and Brookfield, and Levin and LeFebvre suggest, is to challenge this single hypothesis and single scale explanation, by exploring the multiple

social scales that intersect in this place: the political, economic and cultural processes, and the local experiences of scale and scale-making projects that transect the watershed, or operate within small subsets of it. Since Skagit County is a large geographic area (24 by 95 miles) with a relatively large population (approximately 112,000), my research will be limited by my ability to do meaningful ethnographic work within a year. Thus interviews will be dispersed widely throughout the valley and participant observation will take place at multiple sites: on farms, in scientific research centers, on fishing boats, on the reservation, in town, etc. In tracking rhizomatic meanings, I may venture out of the watershed to scientists' offices, government agencies, or Indian reservations that are located within the broader Puget Sound-Georgia Straits region.

Interviews, document analysis, and participant observation form the bulk of my ethnographic methods. From these I may identify people's scales of experience – the spatial and organizational scales in which they live and communicate, the spatial and temporal scales operating in the fragments of cultural narratives they rely on to explain the controversy, and the ways they attempt to manipulate the scale of the problem. For example, what scales of experience and cultural narratives do federal resource managers refer to when imagining the watershed? What scales do tribal fishermen, commercial fishermen, commuter residents, dairy farmers, and environmentalists refer to? Do scales of experience and scale-making projects differ among groups? In what ways do they intersect compatibly? In what ways do they diverge drastically? In what ways are they mutually exclusive? Do local residents understand their predicament as the consequence of local, regional, national or international forces intersecting and impacting people and the places they find meaningful? Exploring the scalar complexity of the salmon habitat restoration controversy may be one useful way to understand it. Do local scales of experience and imagination reinforce the contours of the watershed, or do they make them dissolve into a mirage of intersecting ripples and waves?

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