2 Politics, ecology and livelihoods

> Perhaps, when the new Bible of Science is written, one may read of man as the prodigal son of mother nature, flouting for a time her admonition and her wisdom, spending his heritage in riotous living; but at last reduced to the husks upon a barren waste of his own making, he crawls back to his Old Mother's fire-side and listens obediently to the story of a certain wise man whose name was Ecology (Wissler 1924, p.317)

2.1 Introduction

This chapter introduces a theoretical framework for the thesis that draws together key areas of social research into a geography of living aquatic resources. The basis of such a geography is not only the need for social research but also a socially mediated understanding of the physical and biological components of human-environment interaction. In order to draw out some of the main features of this interaction three bodies of literature are reviewed. The first is human ecology, which investigates the interaction between humans and their environment. The second is political ecology, which concentrates on the historical context of environmental degradation while also focusing on the material and discursive struggles over environmental problems. Finally, the sustainable livelihoods approach is outlined, which focuses on the decisions, structures and processes through which rural communities secure their daily subsistence.

Underlying these three areas of theory, and forming the basis of a geography of living aquatic resources, is ecology and ecological thought. The underlying argument, embodied in the opening quote, focuses on the role of ecology in providing an heuristic model which embraces complexity whilst also providing adaptive and predictive information. The following introduces key elements of the history of ecological thought and the formation of key ecological concepts which directly influence both human and political ecologies. The chapter then argues for placing ecology first in the investigation of human-environment interactions. This is especially argued for political ecology where wider issues of politics and conflict over natural resource use have overshadowed the need for grounded investigations.

2.2 Social science and fisheries

Social science has not traditionally been associated with fisheries research. However, it is increasingly recognised that 'fisheries management is people management' and the

future sustainability of living aquatic resources is more a function of mediation than technocratic management (e.g. Blaber 1999; Oh 1997). The following outlines the areas of research that social science has contributed to covering both aquaculture and wild capture fisheries. Discussion starts by outlining how social science has been a forced addition rather than a central focus of environmental impact studies. Attention is then given to more nuanced understanding of fisheries issues within academic disciplines such as anthropology, sociology, and geography. This academic knowledge has incorporated a higher level of understanding of the complexity of fisheries than that achieved by traditional areas of research within biology and other associated environmental sciences. Finally it is argued that such analysis is well suited to geography, especially in the investigation of inland fisheries which are spread across complex physical, as well as social, cultural and political landscapes. Therefore, a geography of living aquatic resources is proposed to take into account these complex factors and the relationships between them.

2.2.1 Environment, aquaculture and capture fisheries

A range of concerns about the environmental issues surrounding aquaculture and fisheries have been documented over the last half century. These critiques have focused on either the environmental impact *of aquaculture* on the surrounding environment and fishery, or the environmental impact of aquaculture and human activities *on fisheries*. As such, most studies have a 'development' orientation, focusing on the cause and effect of specific impacts from specific sources.

Environmental impact

The impacts of aquaculture on the environment are scale dependent, identified as both global and local. In tropical areas a large proportion of impact-oriented studies have focused on mangrove degradation associated with inland and brackish water shrimp culture (Flaherty and Vandergeest 1998; Bailey 1988; Hannig 1988; Phillips 1988; Muluk and Bailey 1996; Primavera 1997; Thanh-Be *et al.* 1999; Lang and Pugh-Thomas 1994; Beveridge *et al.* 1994; Menasveta 1997). Wider critiques have focused on the impact of aquaculture on coastal waters both aesthetically, through cage culture, and biologically, from effluent pollution (Odum 1974; Dwire 1996; Katranidis *et al.* 2003; Folke and Kautsky 1992; Nowell 1990). Universal impacts of aquaculture include: exotic species invasion, the risks associated with the introduction of genetically and

hormonally modified organisms, associations between aquaculture and disease outbreaks such as Epizootic Ulcerative Syndrome (EUS), high Feed Conversion Rates (FCR) of carnivorous species, nutrient pollution, habitat degradation, and water diversion from small streams and other aquatic habitats (Crawford *et al.* 2003; Pillay 1992; Fernando 1991; Welcomme and Vidthayaonon 1999; Barg and Phillips 2000; New 1999; WRI 1999.; Baird 1999; Folke *et al.* 1998; de Moor 1996; Barnabe 1994; Stickney 1994; Phillips *et al.* 1993; Austin 1993; Pullin 1993; Costa-Pierce *et al.* 1993; Csavas 1993; King 1993; Lingeswara Rao 2002; Anderson *et al.* 2002; Holmer *et al.* 2002; Graslund and Bengtsson 2001; Senarath and Visvanathan 2001; Tovar *et al.* 2000).

The Lower Mekong Basin

All of these impacts remain potential threats for the Basin. However, it is increasingly recognised, by governments and researchers alike, that these impacts will increase as aquaculture becomes more prevalent, especially in countries such as Laos (Tan et al.1999, cited in Guttman and Funge-Smith 2000). For example, *Cyprinus carpio* (Common Carp) and Tilapia spp. (predominantly *Oreochromis niloticus*) are the main aquaculture species promoted in the Mekong Basin, already established in many riparian waterways (Welcomme and Vidthayaonon 1999). From experience in other parts of the world both fish have shown to be persistent, invading exotic species with direct impacts through habitat alteration and competition with native species (Powell and Powell 1999; Noakes *et al.* 2000; Moreau and Costa-Pierce 1997; Costa-Pierce *et al.* 1993; Zambrano *et al.* 1999; Economidis *et al.* 2000). Yet, the impact on native fish populations has so far been assessed as minimal in areas such as Northeast Thailand (De Iongh and Van Zon 1993). In Laos there is already evidence for breeding populations of *C. carpio* in the mainstream Mekong as mostly small (<50g), as well as some large specimens (between 1 and 2kg), are recorded in CPUE studies in Khong District (Warren 2001). In Northern Lao fishing communities along the Ou River Common Carp is considered one of the most important species caught (ibid).

These studies are geographically isolated and only touch on the motivations and consequences - either positive or negative - for adopting and managing the impacts of aquaculture on capture fisheries and fishing communities. There is a strong need for a more socially nuanced research to investigate these and other impacts on living aquatic resources, especially in inland areas.

2.2.2 Society, aquaculture and capture fisheries

Social science research on fisheries has been developed in anthropology, sociology and, to a lesser extent, geography. Collectively these areas have focused predominantly on coastal communities involved in marine fisheries, raising the profile of community management institutions and local ecological knowledge. There is also a growing area of interest in understanding the role of aquaculture and capture fisheries in rural communities in developing countries.

Capture fisheries

Fisheries social science has been predominantly conducted by anthropologists and sociologists in Africa, North America and South Asia. The work of researchers such as Fikret Berkes (1985; 1987; 1993; 1999), Bonnie McCay (1987), Robert Johannes (1981), James Acheson (1987) and Svein Jentoft (1995; 1998; 2000; 1999; 2000) has been instrumental in drawing attention to the link between resource access, indigenous ecological knowledge and co management institutions. Building on this research, attention has focused on living aquatic resources along the full extent of the aquaculture-capture fisheries continuum (Chapter 1). Research has focused on systems ranging from industrial marine systems (e.g. Acheson and Taylor 2001) to subsistence based artisanal systems (e.g. Baird 2000; Branch *et al.* 2002; Crook and Mann 2002; Warner 1997; Kalikoski *et al.* 2002). The focus of fisheries research has, therefore, diversified away from positivist investigations of the resource itself to the wider linkages between social and ecological systems.

Aquaculture

There is a dearth of social enquiry into aquaculture. The need for social research has been noted most extensively by a small number of researchers including Conner Bailey (e.g. 1988), Kenneth Ruddle (e.g. 1993; 1996), Elizabeth Harrison (1994), Priscilla Weeks (1990) and Phillip Kelly (1996). Their research has focused on the politics of aquaculture development in the Third World. As Bailey *et al.* (1996) outline in their ground-breaking collection *Aquaculture Development: social dimensions of an emerging industry*:

> … aquaculture development is a political process in which governments, as the ultimate level of force, clearly have a part to play. The extent to which governments are willing to exercise this force is an important topic for social inquiry. The history of aquacultural development suggests that governments have often refrained from making the decisions that would benefit those living on the margin (p. 16)

Aquaculture as a panacea for the global fishery crisis is beginning to come under scrutiny. Enquiry has drawn attention to issues of equity in rural development including issues of food insecurity, land tenure and access, as well as changing social and labour relations within communities (Primavera 1997; Adger 1999). The failure of aquaculture development is increasingly seen as a combination of political, historical, economic and social factors, such as kinship relations, taboos and solidarity, rather than a culmination of technical constraints (Crewe and Harrison 1998). Social science research is therefore poised to further stress the importance of not only biological and physical processes, but also complex interactions of society-nature relations.

2.2.3 Fish and Geography

Geography offers a source of integrative analysis that incorporates both social and environmental investigation. This section outlines the geographical study of aquaculture and capture fisheries and identifies how geography, as a discipline, can contribute to an integrative analysis of inland fisheries.

Geography is well placed to investigate the relationships between complex social and ecological systems. This is especially relevant to fisheries in developing countries where information is scarce and fisheries decline is seen as a combination of biological, social, political and economic pressures (Coates 2002; Blaber 1999). While the strength of geographical research is the integration of biological, physical, and social sciences, there have been few studies that achieve this. This is especially the case for inland fisheries where living aquatic resources are embedded into wider social and physical landscapes of river basins.

In 1965 the French geographer Jaques Besancon stated in his book, *Geographie de la Peche,* that fisheries was one of the areas that human geographers had not yet tapped into as a field of research (cited in Barton and Staniford 1998). Academic work of geographers has addressed issues of access to fisheries through the introduction of quota

systems (see Symes and Crean 1995; Symes 1996; Bradshaw *et al.* 2001) and has examined the sustainability of fisheries from politico-social perspectives (Drummond and Symes 1996). More recently geographers have offered critical insights into fisheries in international development, as well as more technical GIS-based assessments of fisheries and aquaculture (Ross *et al.* 1993).

Transition

Geographers have also investigated the influence of fisheries in regions and countries in transition. James Coull (1999; 1988), for example, showed how international investment and changing market opportunities for both culture and capture fishery products in peripheral regions of Scotland have effected the place of local communities and resources in the global economy. While Lloyd (1991) focused on locational strategies of aquaculture and environmental impacts in these areas. Shinohara (1994), in a structural analysis, proposed the concept of a 'modern fisheries space' to investigate the commercial and industrial transition of Japanese fisheries. He extends the notion of the fishery area beyond fishing grounds to include distribution networks to consumers with fishing ports acting as the physical and conceptual central node of terrestrial-aquatic space.

Markets and trade

Markets and commodity chains have been common areas of geographical fisheries research. For example, Adams (1985) investigated the role of markets in changing fishing practices in the Caribbean. Holly Hapke (2001) looked at the impacts of mechanization and modernization on female dominated trade in Kerala, India. She concluded that these traders have been excluded from the development process and trade system. Bush (2002; 2004) looked at changes in trade networks as a result of modernization in one of the largest artisanal fisheries in Lao PDR. Other authors have investigated changes in the global commodity chains of fishery products (MacMillan 2003; Mansfield 2003, 2003; Phyne and Mansilla 2003; Skladany and Harris 1995). These studies show how the geography of markets and trade extends our knowledge of how economic systems integrate local resources into wider scales of consumption.

Social change

Critical geographical studies of aquaculture have focused on two areas: social change and technology transfer, and linkages between fishers and aquaculturalists (Weeks 1992). Central to both areas of study has been the issue of equity. Questions have focused around whether changes in production lead to higher or lower levels of equity, in terms of labour, land and nutrition. Kelly (1996), for example, critiques the legitimacy given to coastal aquaculture as a development activity in the Philippines by comparing its importance at the community level with the importance given to it in the development rhetoric of the government. He concludes that "the environmental transformation resulting from fishpond development implies a change in the social relations embedded in that environment and a negative impact on the livelihoods of those local people who depend on natural aquatic resources" (p. 53). The failure of aquaculture is therefore as much to do with development politics as it is with physical, social and cultural factors - a point well illustrated through geography.

Development and politics

Geographers have also begun to assess the constraints and restrictions to fishery management and development faced by resource users. Peter Vandergeest *et al.* (1999) looked at how land tenure is politicised through the development of shrimp aquaculture in coastal areas, drawing in a range of government and local level interests. Susan Stonich and Conner Bailey (2000) broaden their analysis of shrimp aquaculture to investigate resistance and counter-resistance to shrimp aquaculture in highly contested coastal areas. Their analysis includes local, national and international coalitions of actors who both oppose and support shrimp culture. In earlier work Bailey and Skladeny (1991) investigated the emphasis placed on aquaculture for export earnings by both governments and aid organisations in developing countries. Later Bailey (1997) critiqued the role of aquaculture in local development, finding the overall economic goals of shrimp farming - including employment, food security and rural development - are rarely achieved. An example of mal-development caused by a misunderstood export orientation of shrimp aquaculture for rural development was shown by Stonich (1995) in Honduras. She showed how the government and development organisations' promotion of non-traditional products for export, including shrimp, led to social dislocation, conflict and environmental degradation.

All of the studies are examples of how fishers and fishing communities are placed within a wider geography of rural and national development landscapes, incorporating both local level realities and wider political and social pressures. There has been, however, a preoccupation in this literature with the environmental and social impacts of shrimp aquaculture in coastal areas. There is a distinct need for critical reflection of the process of aquaculture development in other environments, especially inland areas experiencing rapid growth such as the Mekong Basin.

2.2.4 An aquacultural geography

Drawing together local, national and global scales into a coherent analysis which takes into consideration social, economic, political and environmental factors, is a major challenge of geographical analysis. Barton and Staniford (1998) propose that up to this point in time, technological impacts and changes, expectations of aquaculture, and the blurring between capture and culture fisheries have all been ignored by geography. They believe that, in this sense, the discipline could "raise questions about the ability of aquaculture to meet future onerous demands, and about the sustainability and desirability of aquacultural development" (p.148). They call upon geographers to emphasise place and space and to use holistic or hybrid research. In particular they encourage an integrated analysis of economy, society, policy and the environment (see also Norgaard 1994; Batterbury *et al.* 1997). To this end they offer a research agenda for an aquacultural geography based on environmental impact, social context, economic development and political intervention.

Barton and Staniford's aquacultural geography is a worthy framework, however a key assumption is that there is a 'net deficit' in world fishery production and geography can guide better development of aquaculture to realize a 'blue revolution' (cf. New 1991; Coull 1993). As introduced in Chapter 1 these assumptions are fraught with contradiction, misperception and *mis*-reporting of inland capture fisheries. Barton and Staniford also do not give enough attention to the diversity entailed by 'aquaculture'. This thesis builds on an aquacultural geography by introducing a geography of living aquatic resources. This gives closer attention to the complexity and diversity of living aquatic resources across complex landscapes at multiple scales, and highlights the interaction of economic, political, social and environmental influences, impacts and developments. As a research agenda it aims to better understand the role and meaning of

living aquatic resources, the activities carried out to exploit them and their importance in contributing to diversified, and sustainable, rural livelihoods (see Allison and Ellis 2001). The various activities along the aquaculture-capture fisheries continuum, outlined in Chapter 1, are placed within a complex understanding of diverse human-environment relationships.

The purpose of a geography of living aquatic resources is the same as that proposed by Barton and Staniford (Figure 2-1). Within this research place and space are implicit, drawing together analyses of living aquatic resources from local to global scales and in doing so provides critical analysis at different scales of interaction between humans and nature. The agenda therefore covers both the subtleties of human-nature relations within fishing communities, and the instrumental role of fisheries in the livelihoods of fishers, farmers and their communities. Most importantly this analysis perceives aquaculture as only one activity within a widely conceived base of living aquatic resources.

Similar analysis has been attempted by a small number of researchers. Systems ecologists and ecological economists increasingly view aquaculture within wider social and ecological contexts. For example, Miriam Huitric *et al.* (2002) investigated the changing policy environment associated with the success and failure of shrimp aquaculture in coastal areas of Thailand. Håkan Berg *et al.* (1996) also assess the sustainability of aquaculture in its wider context, starting from its sustainability as an enclosed farming system. Others have looked at the development of aquaculture in terms of its needs from surrounding ecosystems, such as water, feed and effluent dispersion (Folke and Kautsky 1989; Folke and Kautsky 1992). Others still have integrated aquaculture within its wider environmental context by identifying its impact on wider ecological scales through the concept of 'ecological footprint' (Folke *et al.* 1998; Kautsky *et al.* 1997).

Combining both social and ecological systems into a wider field of investigation through a geography of living aquatic resources requires consideration of some underlying concepts. Debates surrounding human-nature interaction are not new, nor are debates surrounding suitable research agendas to further an understanding of this interaction. A geography of living aquatic resources enters this debate by trying to integrate social science research of fisheries, environmental characteristics of the inland fishery

environment and wider social, political and economic forces influencing both fish and fishers. In doing so the concept of ecology and ecological thought is employed, but before this can occur the contested concept of ecology must be defined.

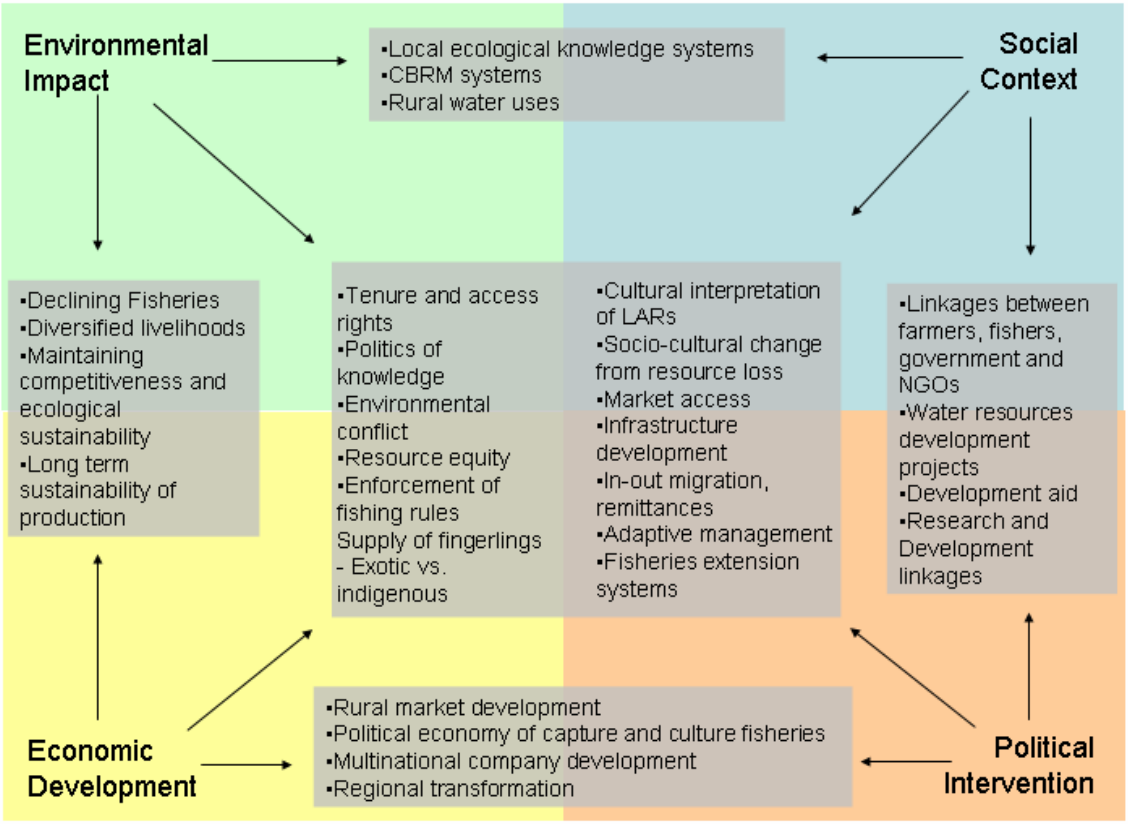

Figure 2-1 Research agenda for a geography of living aquatic resources. Adapted from Barton and Staniford (1998) Figure 4, p.151. (LARs – Living aquatic resources)

2.3 "Nature's Economy": Putting ecology first

This thesis proposes that ecology and ecological thought are critical to a more informed geography of living aquatic resources. An exhaustive history of 'ecology' is too involved to deal with here, nevertheless some core themes in the development of ecological thought are beneficial in developing an epistemological basis for understanding human-nature relations.[2] This section outlines the importance of holism in ecological thought, how ecology breaks down nature/society dualisms, and also how ecology has become an important heuristic for negotiating complex geographic research.

[2] For a detailed history of ecology and ecological thought see Robert McIntosh (1985), Donald Worster (1994), Anna Bramwell (1989), Tim Hayward (1994), and Caroline Merchant (1994)

The value of ecology in constructing a geography of living aquatic resources is especially important in an information-poor country such as Laos, where bio-economic modelling and fisheries statistics are severely restricted and highly inaccurate (Coates 2002). There is, therefore, a need for more human focused research. The following discussion is also an important precursor for defining the role of ecology in the more specific sub-disciplines of human and political ecology.

2.3.1 The beginnings of ecological thought

As Donald Worster (1994) identifies, the concept of ecology predates the term itself. In western philosophy it has been linked to Ancient Greek Metaphysics of essentialism (Simberloff 1980). However, the first records of a united and interrelated system of biotic and non-biotic entities are recognised to be the writings of the 17th century Vicar of Selbourne, Gilbert White (Johnson 1982; Worster 1994). European development of ecology is attributed to Linnaeus through his academic thesis, "The Oeconomy of Nature", written in 1749 on the water cycle (Worster 1994). The melding of humans and nature, as both these writers had done, was challenged by earlier writers during the Enlightenment. Sir Francis Bacon, 100 years before Gilbert White, argued for the triumph of science and reason, championing experimental analysis whilst reconciling it as a means of mastering nature provided by God for human use (see White 1962). René Descartes then furthered Bacon's cause through his mechanistic philosophy which both removed humans and objectified nature as machines for manipulation (see Coates 1998; Hayward 1994). The Enlightenment is therefore seen as the beginning of the dualism of nature and society that underlies both science and capitalism today (Merchant 1990).

Ernst Haeckel coined the term *Oecologie* in 1866. He constructed this word from the Linnaean 'Oeconomie of nature' and *Oikos*, an ancient Greek word referring to the maintenance of the household. The concept was eventually termed 'Ecology' in 1893 through the International Botanical Congress (Worster 1994). Anna Bramwell (1989) argues that Haeckel used the term *Oecologie* to refer to a contextual and holistic biology. She also argues that it was used synonymously with ethology, the study of character that leads to the adaptation and socialisation of animals. As such, ecology had both social and biological origins before it was adopted in a scientific context by plant biologists. The Haeckelian concept of ecology was however part of a holistic world view, or what Haeckel called Monism – the atheistic belief that the spiritual and material worlds exist

on only one level removing the dualist notion of 'man' versus nature. The Monistic movement, Bramwell argues, was the first move to the ecologism of the 19th century and to central ecological tenet – 'balance of nature'.

Through the 20th century the science of ecology developed a series of principles which saw much debate over what Worster calls the 'New Ecology'. McIntosh (1982) suggests that this new ecology was recognisable during the second half of the 20th century as a discipline mainly concerned with the development of quantifiable and statistical sampling methodologies to deal with principles developed in the first half of the century. Many of the founders saw ecology as a base for resource management and human affairs. Frederic Clements described grassland communities as a *superorganism* in 1905, which entailed the development of single species into well defined entities that develop over time into a climax community (a later concept of Clements more commonly known as the mono-climax theory). Following this, Arthur Tansley rejected the Clements theories of a single unitary state. Instead he argued that the superorganic whole is made up of a series of associations to explain the system of interaction of these biotic and non-biotic entities over a range of scales into a common framework. Tanlsey's ecosystem was later developed into a mechanistic system of energy exchange (Lindeman 1941 cited in Malpartida and Lavanderos 2000). Eugene and Howard Odum (1971) then extended the ecosystem concept to:

> … any unit that includes all of the organisms in a given area interacting with the physical environment so that a flow of energy leads to clearly defined trophic structure, biotic diversity, and material cycles within the system (p.8).

Both the Odum brothers (1971; 1975) used the ecosystem concept to include society through a fuel energy budget which situates society as a part of ecosystems as both producers and consumers of energy. They argued that better use of this budget can be mediated through better economic management, employing economic valuations of energy expenditure. This was expressed as *biogeocoenosis* meaning "life and earth functioning together" and the management of life through *bionomics*.

Daniel Simberloff (1980) provided one of the first critiques of this paradigm. He argues that a balance of nature concept refers back to Greek metaphysics and essentialism,

where nature is seen as a reflection of an ideal state. In doing so he argues that the ideas of 'mono-climax' and 'ecosystem' have at their core the same paradigm of 'balance of nature'. He also argues that Odums' systems ecology is too limited and simplistic, dealing with a predetermined bounded system that is underwritten by a preordained 'balance'. Instead he argued for an ecology more influenced by chaos theory, which involves not ordered systems but ecological systems constantly in flux and diversity. Similarly the social ecologist Murray Bookchin (1994 [1981]) argued that ecology should not focus on an 'immutable homogeneity' but rather a dynamic unity and diversity.

Despite this argumentation within biology, the concept of 'balance of nature' and its association with ecology was built up through the apocalyptic environmental literature, more commonly known as the popular ecology literature. The first publication in this genre was Rachael Carson's *Silent Spring* (1962), a treatise of human induced global environmental impact through chemical pollution. Other books focused on Malthusian population forecasts (Ehrlich 1971; Ehrlich and Ehrlich 1972). The 'balance of nature' theory culminated within popular ecology through the Gaia theory of James Lovelock (1979), with many of these concepts forming the basis of contemporary ecological thought.

However, the balance of nature metaphor persists to the point that it is considered the first "theory" of ecology (Edgerton 1974). It remains a contemporary theory that Gary Cooper (2001) argues is analogous to the scientific paradigm for ecology that is never empirically tested or refuted. As such he sees it as holding ecological science hostage. He concludes that the reason that ecologists cling on to the metaphor as an *a priori* argument "traces back to the fact that it seems to be required…for the possibility of general ecological knowledge" (p.500). Kim Cuddington (2001) argues that the metaphor has turned scientific ecological enquiry into a value laden study which adheres to a divinely determined stability, orderliness and predictability in natural systems. This value laden nature remains central to popular forms of ecology that and continue to influence those working within the paradigm.

The dominance of the 'balance of nature' metaphoric paradigm has three consequences. First, it divides humans from nature. Second, it has meant that natural resource

management based on bio-economic modelling is anthropocentric, seeing 'the balance' as human's interaction with the resource, i.e. with no internal variability. Third, it has supported the understanding of human's dominance over nature.

The ontological division of humans from nature stems from both cultural and scientific constructions. European history shows nature was considered as 'other', 'wild' or 'untamed' (Coates 1998). As such humans were seen outside of nature and nature itself was seen as something to be feared. The 'balance of nature' implicit in the writings of White and Linnaeus is underwritten in the European psyche as not including humans. Subsequent understanding of how humans cause impacts *to* ecosystems rather than *on* ecosystems then became an important distinction that is implicit in most environmental, geographic and biological writing in the late 20th century (Cuddington 2001). Bradshaw and Bekoff (2000) argue that these scientific disciplines have to move beyond the disciplinary divisions and come up with holistic responses to holistic problems. These solutions must, however, be cognizant of how humans act upon a metaphoric ecology of a 'balance of nature', and also how they act within the balance. The focus then becomes placing humans *within* nature and *within* ecosystems.

The remaining challenge is then to use the culturally and scientifically normative metaphor of the 'balance of nature' to address the position of humans within ecosystems at different scales and with different levels of power and influence, thereby fostering better use and management of environments and resources. To this end, Alejandro Malpartida and Leonardo Lavanderos (2000) see the unit of ecosystem as inadequate as an organising principle that can delineate cause and effect. They make the distinction that environment is "all the parameters distinguished by an observer without considering the organism constitut[ing] the environment" (p.91). They consider everything constituted by the organism as *entorno* - a Spanish word implying a situatedness and product of circumstance - and is expressed by their current behaviours in response to their historical interaction with their environment. A society, as an organising set of relations that are both determined and determine the interaction with the environment becomes the society-*entorno*. This concept cannot be reduced any further as it is produced by the organism rather than existing *a priori*. The concept of ecosystem has been used as an *extra*-society concept, i.e. something that occurs in nature. As a result Malpartida and Lavanderos coin a new term, *Ecotomo*. They define *ecotomo* as

> … the whole of the relations that is capable of maintaining the emergent organisation of the society-nature complex unit, which at the same time is capable of re-organising and reproducing itself in a manner that permits its energetic and informational sustainability along the space-time axis (p.91).

The term *ecotomo* is an organisational unit, but it does not break down the essentialist notion of a 'balance of nature' because in order to be sustainable, flows of energy and information must reach a predefined steady state. It does, however, provide us with a strongly geographical concept that delineates spatial and temporal scales in conjunction with a society/nature holism.

Scientific ecology, based again on the paradigmatic metaphor of equilibrium, also contributes to anthropocentric modelling in natural resources management that identifies human intervention in a resource as the major source of variability, rather than also acknowledging natural internal variability. Not surprisingly fisheries science went through a period of equilibrium modelling at the same time as the science of ecology. Chaos theory in fisheries management as outlined by James Wilson *et al.* (1994), Wilson and Peter Kleban (1992), and Estellie Smith (1990) focused on returning management back to people and their relationship with the resource being a better judge than that of the fishery science of 'facts' that are repeatedly found wanting and open to an entirely different set of interpretations (e.g. Finlayson 1994). The mechanistic, bio-economic management of fisheries, so abhorred by researchers like Peter Larkin (1977), who saw it as a simplistic and potentially dangerous method of management, and also within ecology during the mid 20th century, still remains. Today experimental ecology is characterised by probabilism firmly situated within positivist science that does not entertain an integrated *entorno*-like holism.

Science-based ecology has led to a wider debate over the domination of humans over nature through increasing moral and ethical debates over ecology. Domination of nature over humans was a persistent view until the Frankfurt school philosophers proposed and extended the concept of human domination over nature (e.g. Marcuse 1994). In the second half of the 20th century the idea of domination and crisis was elaborated by a number of authors. William Leiss (1994), drawing on the work of Karl Marx and Max

Horkheimer argues that domination is not a technical project but rather a function of a larger social task (see also Capra 1983; Bookchin 1980). Deep ecologists, led by Arne Naess (1973), drew an even deeper moral distinction than 'man-in-nature', so that there is no distinction between nature and humans. To counter this domination of nature critique *deep ecology* was developed as an egalitarian philosophy of nature that extended principles of diversity and symbiosis to a social critique of class, local autonomy and equitable resource use. These views, starting with the popular ecology literature, begin to take a balance of nature view to a new level. This develops a scepticism of any form of mechanistic concept of ecosystem or scientific ecology, instead developing an egalitarian ecological philosophy – *ecosophy* - at the core of which are concepts of harmony and equilibrium which appeal to social and moral control (Lowe and Worboys 1980). This philosophy has also been taken into other areas such as ecofeminism (e.g. Merchant 1990), ecological economics, (e.g. Daly and Cobb 1989; Daly 1977) and contemporary political economy critiques of environment (e.g. Eckersley 1995; O'Connor 1994). The range and scope of ecology therefore appears endless, falling between positivist, post structural and post modern philosophies and precariously poised over intellectual denigration.

2.3.2 The 'New*est* Ecology'

Within the biological sciences debate continues as to whether there are laws of ecology, a need that ecology and ecologists have had a number of years (the so called 'physics envy') (Simberloff 1980). As such ecology has been both a malleable word and concept. It emerges as more of an investigative heuristic which draws on ecological thought, ecologism and the principles of ecology such as balance of nature and equilibrium state. It builds on a complex, co-evolutionary science, the realisation that systems, either social or natural, cannot be reduced to a single explanation, instead drawing on uncertainty, scale, emergence and self-organisation (Costanza *et al.* 1993; Norgaard 1994; Folke *et al.* 1996; Berkes *et al.* 2003). Recognition of complex science has meant a melding of both qualitative and quantitative methods of inquiry (Berkes *et al.* 2003). Highlighting the diversity of opinion Mark Sagoff (1992) argued through an ecological viewpoint that art has much in common, drawing in complexity of landscapes and environment and synthesising observations through symbols and representation.

Ecology is included variously by landscape ecologists and ecological economists, however, all of these disciplines are constrained by the continuing adherence to the balance of nature metaphor. Ian Scoones (1999) argues that the social sciences have generally been slow in accepting the 'new ecology', based on multiple equilibriums rather than a single monolithic balance of nature. This, he argues, is evident in the work of ecological anthropologists, political ecologists, ecological economists and nature-culture debates. The incorporation of social sciences into informed ecological discourses requires better recognition of three concepts (ibid.). Firstly, the concern with spatial and temporal dynamics of "people in places" focusing specifically on the historical context of those places. This he argues emphasises diversity and complexity of social change which reflects ecological themes of multiple limits and nonlinear dynamics. Secondly, is the appreciation of the dynamic between humans and nature as a two way process of change, linking structural analysis of environments with human agency, similar to the mutually constitutive process of Richard Norgaard's coevolution. Central to this analysis is the concept of scale through which environments are both the product and template for human action, whereby Scoones (1999) outlines there is:

> … an appreciation of the interaction of structure and agency across scales must be the centrepiece of a dynamic understanding of people-environment interaction. (p. 493)

Lastly, is the appreciation of complexity and uncertainty in social-ecological systems, which is central to an understanding of ecology and the human agency within site specific, dynamic systems.

Incorporating complexity, uncertainty, agency and scale into social science based analysis of human-nature relations is central to the emerging ecological thought and analysis of social-ecological-systems. Crawford Holling (2001, based on Gunderson and Holling 2001) presents the notion of hierarchical and adaptive cycles operating to maintain ecosystem integrity based on the concept of *panarchy* which:

> Describes how a healthy socioecological system can invent and experiment, benefiting from inventions that create opportunities while it is kept safe from those that destabilise the system due to their nature or excessive exuberance (p. 402).

They argue that ecosystem management must build and maintain ecological resilience as well as the social flexibility needed to cope with, innovate, and adapt.

Berkes and Folke (1998), building on a complex, co-evolutionary, systems ecology, developed the concept of *social-ecological systems* (also see Norgaard 1994; Holling 2001; Costanza 2003; Odum 1975). This concept is an integrated heuristic for the management of natural resources which places humans-in-nature. It has emerged from a combination of contemporary fields such as ecological economics, human ecology and local ecological knowledge systems. Berkes and Folke also focus on social-ecological linkages, therefore concentrating on the 'betweeness' described by Malpartida and Lavanderos' *entorno*, placing the analysis firmly between society and nature. As such the emphasis is placed on change, feedback and adaptation of both social and ecological systems. The concept used as a scoping device to achieve such analysis is resilience (Berkes *et al.* 2003).

Resilience has emerged as a central concept in ecology, but as Neil Adger (2000) points out, is ambiguous and contested. Berkes *et al.* (2003) in their formulation of social-ecological systems define resilience as "…concerned with the magnitude of disturbance that can be absorbed or buffered without the system undergoing fundamental changes in its functional characteristics" (p. 14). Traditionally, however, resilience in ecology has referred to the stable functioning of the system as a whole. Holling (1973) made the distinction between stability of the system, as the maintenance of a predictable world with little fluctuation, and resilience as persistent, complex heterogenous systems. Holling *et al.* (1995) has since identified two distinct definitions of resilience. The first refers to stability of a system around a predefined steady state or single equilibrium. The second definition of resilience focuses on the conditions that lead to a shift from one equilibrium state to another. This means that there are multiple equilibrium states existing sequentially or possibly simultaneously at different spatial and temporal scales.

In a social-ecological system viewpoint the conditions for lowered resilience leading to an equilibrium state shift can arise from either social or natural perturbations. Intervention by management tries to minimise these perturbations by minimising variability in resource supply. As Berkes and Folke (1998) state:

> … resource management tries to control a target resource (e.g. supply of fish or timber) by reducing the variability of the target resource. This helps meet production targets and economic objectives (e.g. revenue and employment). The management policy is successful in the short term, but its very success causes inadvertent changes in the functioning and resilience of the ecosystem. (p.11)

The disturbance could be either to an ecological or social system. Under this concept a perturbation in livelihood is managed in the same way, by reducing variability in supply. If livelihoods are considered in a single equilibrium state, not able to adapt to change, then it will collapse. However, if a livelihood strategy is seen in the context of multiple equilibriums, then adaptation and renewal from one equilibrium to another will see the persistence of that livelihood. In a social system the multiple equilibriums of livelihoods differ for each household and, as is central to the social-ecological system, are directly related to the natural system.

These systems are not isolated from external influence but linked or co-evolved across social and ecological scales and units (Norgaard 1994; Pickett *et al.* 1997). However, the locally developed system of social-ecological systems can be threatened, put out of equilibrium instead of shifting equilibrium, by external systems. As Folke *et al.* (1998) argue:

> … for social-ecological systems to persist, the integrity of locally adapted systems in which the practices and mechanisms are embedded needs to be protected (but not isolated) from external driving forces (p.416)

The adaptation and response to change in complex social-ecological systems led Adger (2000) to conceive the concept of social resilience. His basic premise is that social systems based on ecological systems cannot succeed if the natural system is stressed. He focuses on resource dependency as a central component of social resilience and argues that dependency has negative consequences for economic specialisation. Therefore it relates to a community's livelihood strategy and social stability which will allow for co-evolution with the ecological systems on which these communities rely. In subsistence based rural communities, who rely on ecosystems rather than single resources, the notion of a diverse base of livelihood is central to strong social resilience. Adger illustrates the point with environmental and institutional change in coastal areas of Vietnam where

mangrove conversion to aquaculture has weakened social resilience. Government land zoning, distorted power relations and inequity among land owners in coastal communities in these areas led to a decreased ability to deal with subsequent ecological degradation. The aquaculture systems in place were more prone to pests, caused inundation and flooding and, as a result, differential impact on farmers in those communities. Therefore, the co-evolutionary nature of social and ecological resilience was made evident. This has also been identified in broader resource systems, such as oceanic fisheries, which are under threat from poor management if the complexity of the resource is not taken into consideration (Low *et al.* 1999; Wilson 2000).

'Ecology' and social-ecological systems then become an heuristic, which interconnects co-evolved social and natural systems, embracing both complexity and uncertainty (see Figure 2-2). As such, humans are part of ecosystems, adaptively responding and influencing change. Ecology is sensitive to both spatial and temporal scales. As such, social-ecological systems are not closed but instead loosely bound within each scale, yet at the same time open to outside influences. Furthermore, the outcome of such an heuristic model should adhere to what Robertson and Hull (2001) call a public ecology producing knowledge that is integrated, evaluative, contextual, multi-scalar, adaptive and accessible.

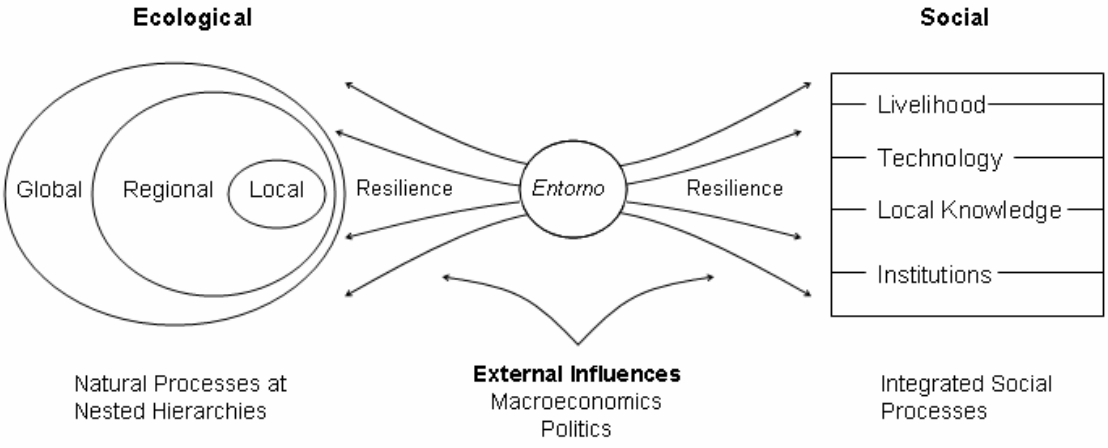

Figure 2-2 An heuristic model for social-ecological systems analysis. Adapted from Berkes and Folke (1998) and Berkes *et al.* (2003).

Ecology and ecological thought directs a geography of living aquatic resources to focus not only on the social science of fisheries, or stock enhancement, but instead develop a holistic worldview which focuses on the interaction of humans and their environment - the *entorno*. Two sub-disciplines of ecology and geography best suited to such analysis are human and political ecology. These two areas build directly on both the practical issues of how humans interact with their environment and in the case of political ecology, the conflict, control and domination over the environment. Each are now discussed.

2.3.3 Human Ecology

Human ecology is the study of human-nature relations at various scales of interaction. It has its roots in a number of disciplines including sociology, anthropology and geography (Bruhn 1974), distinguishing a nomothetic, realist viewpoint of human-nature linkages (Entrikin 1980). It has therefore provided an often reductionist, pragmatic research area working not *within* any notion of e*ntorno*, but rather on the linkages that pass through it. As such, it is a descriptive, relational framework, rather than a predictive and adaptive ecological framework. However, as it is practically impossible to avoid reductionist research within holistic ecology (Bergandi and Blandin 1998), human ecology provides a practical basis for understanding multi-scalar interactions between natural and social systems. This is the pretext for the development of agroecosystems analysis, sustainable rural livelihoods analysis and its relevance for a geography of living aquatic resources.

The roots of Human Ecology are generally traced to Robert Park (1925), a sociologist interested in human relations within urban environments. His ecology was based on the notion that human organisation derived out of communication and competition between individuals. As such it was viewed as a perspective, method and body of knowledge essential for studying relations not between humans and their environment but rather between humans. This was later developed into a 'scientific' human ecology that took into consideration social life as an interdependent whole, influenced by both material conditions of existence and determinants of social structure (Wirth 1945).

Anthropological studies moved the emphasis away from sociological functionalism, to a consideration of cultural influences over human interactions with ecosystems (e.g.

Sponsel 1995). The ecological approach to anthropology was adopted on the basis of a human ecology:

> … concerned with the adaptive ordering of the relations of human groups to the natural environment and with the demographic and sociocultural conditions and consequences thereof (Helm 1962, p.638).

This was the pretext for a locally focused human ecology that was predominantly developed through rural anthropology. Clifford Geertz (1968), for example, based his study of Javanese farmers on cultural ecology rather than a sociologically based human ecology, developing a seminal study of the linkages between culture and ecosystem productivity. More recently James Fairhead and Melissa Leach (1996) have advanced an ecological anthropology incorporating wider influences in the creation of narratives of environmental degradation and local communities. Anthropology therefore places emphasis on direct linkages between nature and communities, however, as an anthropocentric discipline, reduces nature to resources.

Debate and discussion of the place of human ecology in the biological journal *Ecology* in the early 20th century shows the connection between early perceptions of integrated ecological thought. At the annual meeting of the Ecological Society of America in 1921, President Stephen Forbes called for a humanizing of ecology through increased consideration of economics influencing human-nature interrelations (Forbes 1922). There was much influence from environmental deterministic writings on the influence of resource abundance on human populations (Novakovsky 1924, 1922; Wissler 1924). Influence over the direction of the humanist ecology was also derived from anthropology as evident in the study of polar Eskimo communities and their environment (Ekblaw 1921). Adams (1935) noted the applicability of ecological concepts of the time – such as succession, inheritance, social behaviour – to human ecology. Hollingshead (1940) also saw the application of plant and animal ecology as central to the development of demography, migration, organisation, dominance and succession in human ecology. The result was a human ecology that was seen as observable in much the same way nature was in plant and animal communities. However, these saw humans as a topic of research and reflected much of the already discounted environmental determinist literature.

There has been much debate within geography on the place of human ecology. The early holistic orientation of early geographers was noted by John Bruhn (1974), as a forerunner for some of the first ecological-like studies of humans. Early writers like Harlan Barrows (1923) identified geography as the 'mother of all sciences' because, in the form of human ecology, it describes the patterns of humans on natural landscapes. He argues however, that description of these places alone is insufficient. Instead, he suggests that where "Geography is concerned with *place* relations; ecology may well be its organizing principle" (p.6). Indeed much early biological and sociological human ecology included a large spatial component in their work. For example, Charles Thornthwaite (1940) who argues that human ecology includes geographical notions of areal differentiation and integration of physical and social sciences on an order of magnitude greater than even geography attempted to do at the time. Therefore, geography offered a sense of embeddedness of not only social relations, as in sociology, or socio-cultural relations, as in anthropology, but a tangible explanation for the dispersion of humans and human activities across landscapes in response to a diversity of landscapes.

In recent times there have been two branches of research for human ecology. The first is the wider earth systems approach to resource use, derived from biological ecology, and the second is rural studies, derived from sociology, anthropology and geography. Both are influenced by a systems approach of ecology, starting with the notion of a bounded, 'balanced' system with humans as the dominant source of impact and influence over natural resources. The earth systems view of human ecology developed from the environmental apocalyptic literature and Odum's work on systems ecology. For example, in their book *Human Ecology* Paul and Anne Ehrlich (1973) argued the cause and effect human transformation of the earth. It uses concepts such as exponential growth, carrying capacity and technological intervention as a basis for describing the impacts of humans on the earth. Their work is underwritten by an earlier thesis based on Malthusian population forecasts (Ehrlich and Ehrlich 1972). Paul Ehrlich (1985) later described human ecology as interested in the population-resource-environment-dilemma. These are large scale interactions, however not easily related to local cases.

Southeast Asian development work and research filled the gap between large and small-scale human ecology studies. These were originally based on agro-ecological analysis and later incorporated Farming Systems Research and Participatory Rural Development.

Agroecosystems are defined as streamlined natural ecosystems that are bounded by human control, and characterised by short term homeostasis, sustainability and equitability (Marten and Saltman 1986; Conway 1984). Agroecosystem research adopts a holistic concept of agriculture in subsistence or semi-subsistence economies, stressing the interrelations of natural resources and rural communities. Central to these interrelations is the division of scales into a hierarchy, differentiating between social and natural scalar units and the links between them (Rambo and Sajise 1984). This scalar framework was adopted by subsequent agroecosystem studies (Rambo 1991; Lê *et al.* 1990). Lê *et al.* (1990) make reference to scales of control such as in the tax system, comparing the disjuncture between political boundaries and across natural systems such as soil, water, land and agriculture. No causal linkages, however, are drawn between scales. Likewise, Terry Rambo (1991) describes the agroecosystems of Northeast Thailand, and the management of the resources, but makes no linkages between scales. Kanok Rerkasem and Benjavan Rerkasem (1995) looked not only at the place of the local village but also proximity to other villages, provincial and national units in their examination of montane communities subject to transitional economies. Unlike Roy Rappaport (1971; 1984), who used a system approach focused on energy flows within limited, self regulating agricultural community, these later studies tend toward a systems approach to describe productivity, sustainability, stability, autonomy, equitability, solidarity, diversity and adaptability within the human-nature dynamic.

Human ecologists now not only focus on ecosystem function but on specific relations between humans and selected environmental features that suit their specific studies (Bates and Lees 1996). This includes power relations as one of the main distinctive features of human ecology as opposed to biological ecology (ibid.). Many contemporary human ecological studies are more adept at description of natural resource settings, often in subsistence communities (e.g. Marquette 1998; Reenberg and Lund 1998; Laris 2002). Other research incorporates wider political and institutional analyse that is less narrowly focused (e.g. McDaniel 2002; Ross and Pickering 2002). These studies offer a practical understanding of the social and resource functioning of rural communities. However, better understanding of social-ecological systems requires more emphasis on the interaction of a number of external influences as well as local realities, the examination of which is better achieved through political ecology.

2.3.4 Political Ecology

In its broadest sense political ecology is an outgrowth of ecological and social science research that combines social and political investigation with environmental process (Bryant 1992; Batterbury *et al.* 1997; Belsky 2002). Richard Peet and Michael Watts (1996) argue that political ecology stems from the critique of dislocation from customary forms of resource management and self determination by resource users as a result of market integration and commercialization, rather than simple cause and effect investigations of human ecology. The classic definition of political ecology given by Piers Blaikie and Harold Brookfield (1987) is as follows:

> The phrase 'political ecology' combines the concerns of ecology and broadly defined political economy. Together this encompasses the constantly shifting dialectic between society and land based resources, and also within classes and groups within society itself (p. 17)

The studies on which this definition is based are now commonly referred to as the land-based explanation of environmental change. The main feature of which is a 'chain of causation', linking socio-political and environmental factors into an explanation of environmental degradation. Contemporary political ecology still draws strongly from this concept, embedding local environments within a wider political economy of environmental degradation. However, as an area of study, political ecology has branched into a number of new critiques and modes of investigation.

Putting politics or ecology first?

Recent political ecology research has concentrated more on power relations surrounding highly politicized environments. The range of studies incorporating political ecology has meant that it has become a highly contested term with wide ranging definitions and aims. For example, Adrian Atkinson (1991) building on the notion of a broadly defined political economy sees the role of political ecology as building a new social order out of the ruins of the old one. This radical standpoint, borne from deep and social ecology, sees environmental catastrophe as avoided by establishing new economic and social systems that "incorporates a sustainable relationship between society and nature" (p.2). The strong political focus is carried on by Raymond Bryant (1998) who sees political ecology focusing on the "political dynamics surrounding material and discursive struggles over the environment" (p. 89). Most recent definitions have moved away from

this sharp political focus to more discursive relations between humans and their environment. For example, Philip Stott and Sian Sullivan (2000) see political ecology interested in the narratives that support power relations which in turn maintain hegemony over people and the environment. Karl Zimmerer and Thomas Bassett (2003) introduce a geographical political ecology that is centered on the two themes of nature-society interaction and geographic scale. They argue that by doing so geography focuses political ecology on social and ecological processes and their interactive effects on environmental problems and policies. Within ecological economics, Garry Peterson (2000) draws together both discursive and causal linkages, seeing political ecology as:

> "[An] approach that combines the concerns of ecology and political economy to represent an ever-changing tension between ecological and human change and between diverse groups within society at scales from the local individual to the Earth as a whole" (p.324)

Generally speaking these definitions refer to the social and political conditions that involve and explain causes, experiences and management of problems surrounding the 'environment' (Forsyth 2003). However, together these approaches place different emphasis on either social and political factors, or ecology.

Traditionally political ecologists have placed less emphasis on ecological process and more on political control over natural resources. This stems from the lack of ecological understanding of change inducing environmental factors in early or latter political economy of environment research. Early political ecology research did however begin to incorporate socio-political influences with, for instance, local environmental change emphasizing environmental conditions. Bryant (1991) on the other hand argued that the natural and social sciences have extended an understanding of human environment relations but have not focused on the "political sources, conditions and ramifications of environmental change" (p.165). He argues, therefore, for political ecology to put politics first in the analysis of environmental change (Bryant 1992, 1991; Bryant and Bailey 1997). This is common to earlier work such as Michael Redclift (1984) who outlined socio-political aspects of control over environment and development, as well as later work such as the edited collection of Philip Hirsch and Carol Warren (1998) that focuses on political conflict over natural resources without a strong reference to ecological processes.

Most recently, however, there is a backlash to this view of 'putting politics first'. This backlash is central to Zimmerer and Bassett's (2003) call for a more integrative geographical political ecology which focuses on balancing cultural and social deconstructivism of nature. Instead they argue for a "natural turn" in political ecology based on the critical realism approach within geography argued for by Sally Eden (2001). This draws attention to environment as an agent of change while also understanding nature's agency as socially mediated. Tim Forsyth (2003) argues that the lack of such reflection within social sciences has meant that political ecology has proceeded without questioning the fundamental role and political construction of 'ecology' in science. He calls for the re-introduction of ecology within a *critical* political ecology. Similarly, Sullivan (2000) argues that a 'post-structural political ecology' (cf. Escobar 1996) could benefit from acknowledging the conceptual thinking of integrative realist science and constructivist social theorizing. However, finding a place for ecology and ecological thought in political ecology, especially in its post-structural form has rarely, if ever, been achieved (Scoones 1999; Zimmerer and Bassett 2003). The emphasis has been on incorporating complexity within social-ecological systems, but research has faltered in finding common ground between holistic and reductionist epistemologies.

Contesting political ecology

In the process of negotiating between internal dualisms such as structural or post-structural and ecological or political, a strong critique as also developed as to whether political ecology fits the role of a theory or research framework. The diversity of definitions of a concept such as political ecology is referred to as "academic hitchhiking", whereby scope and definition are manipulated by a diverse group of researchers (Belsky 2002). Watts (2000) argues that the sub-discipline is "An approach to, but far from a coherent theory of, the complex metabolism between nature and society" (p.590). Nancy Peluso (1992) argues that political ecology is more of a method of analysis than a theory, while Carney (1993) and Bryant (1992) suggest that political ecology is more of a research framework or agenda. Andrew Vayda and Brad Walters (1999) argue that political ecology focuses on the control or contest over resources *a priori* without examining how the resources are affected by these contests or controls. Instead they propose an event ecology that looks at concrete occurrences and the concrete outcomes from these events, building on Vayda's earlier work on 'progressive

contextualization' (Vayda 1983). Other criticism comes from Peet and Watts (1996) who suggest that political ecology has moved to a post-structural critique of environmental change, focusing on discourse theory, investigating meanings, beliefs and situatedness. They add, however, that in providing a rich, nuanced form of environmental research, political ecology can provide emancipatory and 'politically transformative' liberation ecologies.

The outcome of these core debates has been a growing diversity of political ecologies, including: feminist political ecology, liberation ecology, third world political ecology, first world political ecology, local and regional political ecology, and finally critical political ecology. Instead of discounting political ecology outright, as Watts, Vayda and Walters do, it is more expedient to focus on the strengths of political ecology that can contribute to an informed analysis of social-ecological systems and a geography of living aquatic resources. This is a central part of Zimmerer and Basset's geographical political ecology. They see the diversity and plurality as a strength and encourage the productive tensions that emerge from multiple approaches and disciplines. This thesis draws on this geographical notion of plurality by focusing on three main areas of political ecology:

- first, historical contextualization of contemporary environmental problems,
- second, the use of scale, and
- third, the application of critical thought.

Historical political ecology

Political ecologists have embraced the importance of historical context of contemporary environmental problems. In his history writings of ecological ideas Worster (1984) recognises that there has neither been much consideration of history in the study of nature, nor nature in the study of history. There has however been a major change in recent times to see history as central to understanding ecological problems (Scoones 1999). Bryant's study of the historical development of forestry in Burma from 1826 to 1994 epitomises such research (Bryant 1997). By outlining the political, ecological, social and economic context of forestry development and exploitation over more than 150 years he has been able to contextualise access and control of forest resources as well as framing current resistance to state policy by local communities. A number of other studies have highlighted the value of historical context in understanding environmental

change in diverse settings such as forest exploitation, mountain landscapes and water management (e.g. Fairhead and Leach 1996; Forsyth 1998; Mosse 1997). The history of social, economic, cultural and ecological factors in both local and wider contexts are therefore central to understanding contemporary problems.

Scale – regional and local political ecologies

Scale is also a central concept used by political ecologists to highlight different power relations affecting environmental change. The use of scale is common to biological and human ecology whereby systems are open to external change, embedded in wider hierarchies of social and ecological relations (see above). Bryant (1992), for example, introduced the relevance of temporal scales - episodic and everyday – in the analysis of environmental change. Structural scale was first incorporated through Blaikie and Brookfield's (1987) 'regional' political ecology, incorporating a 'chain of causation' between farmers and their natural environment seen in their wider historical, political and economic context. This built on the work of Blaikie (1985) who saw scale as central to the process of local, small-scale farmers losing control of their livelihoods as they were incorporated into a global economy. His work has been incorporated by Zimmerer and Bassett (2003) in their geographical political ecology which emphasises the central "… importance of ecological scale in shaping political-ecological dynamics" (p.3), by arguing that:

> Diverse environmental processes interact with social processes, creating different scales of mutual relations that produce distinctive political ecologies (p.3)

Within geography, such scale integration bridges the gap between fieldwork and theory, bringing into sharp focus the implications of over-arching hegemonies on locally specific environments (Black 1990). This is both a central organizing and analytical concept throughout this thesis.

Embedding local environments into wider hegemonic structures is a major focus of third world political ecology enquiry. Central to the third world political ecological process is the study of how "unequal power relations enable and constrain actors *vis-à-vis* each other, and in relation to the physical environment" (Bryant 1997, p.16). These power

relations are inclusive of a wide range of actors operating at different scales, from local through to global (Bryant 1992; Bryant and Bailey 1997). The emphasis is drawn away from 'land based' environmental problems to socially mediated, political problems (Bryant 1998). As such politics is placed at its core, taking more from 'a widely conceived political economy' than a study of human-nature relations.

In response to the lack of local specificity in the broadly defined third world political ecology, Batturbury *et al.* (2001) promoted a 'local political ecology' approach, focusing attention on local decision making processes and contextualizing these decisions in wider social and political systems. They recognise that villagers do not operate in isolation from the wider economy however the decisions they make are in response to the local availability of natural resources. They place local political ecology in the context and diversity of local rural livelihoods as discussed below.

Critical political ecology

Stemming from a perceived loss of science and 'ecology' from political ecology, Forsyth (2003) has recently developed a 'critical' political ecology. The primary concern of this research is the construction of knowledge surrounding environmental degradation. According to Forsyth critical political ecology is an analytical approach that is "biophysically grounded yet conscious of social and political constructions" (p.20). He argues for the reintegration of 'ecology' through the critical analysis of the construction of environmental problems. He calls these constructions "environmental orthodoxies", which have also been variously referred to as "myths", "truth regimes" and "environmental narratives" (Sullivan 2000; Leach and Mearns 1996; Adger *et al.* 2001). They refer to sets of "institutionalized, but highly criticized conceptualizations of environmental degradation" (Forsyth 2003, p.37). These orthodoxies are created through what Forsyth terms *coproduction* of knowledge through a combination of science and socially mediated interests. As such, these orthodoxies provide a variety of vague statements, sometimes supported with pseudo-statistical information and then supported through a truth regime in the guise of epistemic or expert communities (Fairhead and Leach 1998).

A critical political ecology is concerned with how orthodoxies are translated into environmental policies and subsequently how these environmental policies may impose unnecessary restrictions on the livelihoods of marginalized people. Although not under the banner of critical political ecology, Fairhead and Leach (1996) provide one of the best examples of a critique of how politics, bureaucracy and ideology produce environmental orthodoxies that are rarely challenged. Using an example of deforestation in West Africa they deconstruct orthodoxies of what constitutes deforestation by revising equilibrium based ecology. They argue that by incorporating alternative understandings of human-environment relations, such as those of resource users, perceptions of environment and resource use become more complex. An ecological perspective that incorporates multiple equilibriums, based on multiple perceptions, therefore breaks down the fundamental dualism which divides humans and nature. That is, peoples interaction with the environment shapes sociality. Central to a critical political ecology is their assertion that:

> The political economy of 'truth' concerning environmental change is intimately linked with a very material political economy concerning who manages whose environment and in whose 'interests'. (p.293)

This is a critical area of research that this thesis works within, stressing the implications of myths on different perceptions of 'reality', and the implications they hold not only for society but also for nature. It therefore goes a long way to operating within the *Entorno*, through structural and post-structural, political and ecological environmental understandings.

These 'myths' draw on early anthropological understanding of social charter, referring to stories that justify or rationalise of a groups customs or behavior (Malinowski 1948). As a charter it is not important whether these myths are true or not. They offer justification for groups to act in a certain way and as such direct a diverse range of human activity including environmental use, management and development. How a myth gains prominence through the collective knowledge, beliefs and political agenda of different groups is centrally important to a critical political ecology.

The tensions within political ecology are numerous and provide fertile ground for theory to progress. The diversity of perspectives that seek justification through competing myths and narratives offer a platform for the incorporation of the "new ecology" by placing social and natural systems within a common framework of analysis. Political ecology therefore incorporates core geographical and ecological concepts of complexity, uncertainty, agency and scale into a social science based analysis of human-nature relations. Political ecology offers a means of understanding wider interactions of a 'broadly defined political economy' of environmental change as well as the localised changing tensions between humans and nature.

A political ecology of living aquatic resources

This is immediately applicable to a geography of living aquatic resources. Social science critiques of aquaculture have focused on government and development politics. Bailey *et al.* (1996) note for example that:

> … the power of social groups interested in aquaculture production comes to be reflected in its organisation. Thus, aquaculture development is a political process in which governments, as the ultimate level of force, clearly have a part to play. The extent to which governments are willing to exercise this force is an important topic for social inquiry. (p.16)

In a development setting however, national development agendas for aquaculture development are mediated by external agencies. Ruddle (1993) notes that within single resource systems that do not fit into complex ecological systems there is a need to incorporate analysis of the wider politics of rural resource development programmes. If the politics of such systems are not taken into consideration, including all external actors, then there is a risk that a single resource system such as aquaculture may become "… a fashionable term entered into national policy documents merely to satisfy the policies of donors or assistance agencies" (Ruddle 1993).

Critical analysis of how aquaculture becomes a dominant policy objective is also a case in point. Kelly (1996) outlined the importance of deconstructing myths surrounding aquaculture development. In the same way that Forsyth stresses how this process does not run counter to the original environmental problem at hand, neither does the argument against some reasons for aquaculture.

The remaining problem is, however, how to address external influences in a structured local system in rural communities that are only beginning to be articulated into a wider system of politics and economics. Human ecology provides some of the analysis, as does a local political ecology. A structured appreciation of how livelihoods are maintained in a transitional system and to determine, in the case of this study, where living aquatic resources fit across different places and scales of interaction, a livelihood analysis is employed.

2.4 Poverty, ecology and sustainable rural livelihoods

A key role of political ecology is to highlight the role of external influences on local environments. The decisions that people make in order to carry out their livelihood are tempered by these external forces, however, they are also strongly influenced by individual agency and local factors. In semi-subsistence rural societies, these decisions are linked to the use of natural resources. As such their relationship with the environment can be seen through a social-ecological systems approach, whilst operating in the *Entorno*. The composition of any number of livelihood activities that one household has both contributes to and is influenced by the natural environment. Therefore, both ecology and ecological thought have relevance to the analysis of these communities beyond understanding the interactions that people have with their environments and the wider power regimes which lead to environmental degradation. The central part of the relation of rural people to their environment is the decisions they make which in turn influence the livelihood activities they adopt.

This section builds on the central concepts of the new ecology, human ecology and political ecology and outlines the relevance of these conceptual areas to what has become known as the sustainable rural livelihoods framework (Carney 2001; Ellis 2000; Chambers and Conway 1992; Scoones 1998). The framework was developed in response to the need for holistic mechanisms for identification of the causes of poverty and as an heuristic that has received much attention as a donor 'tool', breaking down complex, diverse and risk prone livelihoods into definable assets and capital (Chambers and Conway 1992; Ellis 2000). The following outlines the epistemological roots of the sustainable livelihoods framework from the poverty literature outlining relative deprivation through to Amartya Sen's work on entitlements and capabilities. The

sustainable rural livelihoods framework is then described. Finally the section outlines the linkages between human and political ecology and its relevance to a geography of living aquatic resources.

2.4.1 The 'Poor', relatively speaking

Early scholarship of the causes of poverty focused on measurement rather than developing an understanding of the root causes and circumstances of the people studied (Townsend 2000, 1993). During the 1950s and 1960s the measure of poverty became increasingly important as recognition grew of the arbitrary nature of the assignment of poverty with no real measure (Townsend 2000). The assignment of a level or line of poverty became a distinctly political process based (ibid.). This began a series of debates on the possibility of the measure of poverty beginning with further development of the idea of relative deprivation by Peter Townsend (1979) as a way to measure poverty by looking at more than just income levels. Subsequent research has concentrated on the material and social circumstances of how people survive, rather than how they should survive (Escobar 1995).

Although moves to incorporate the causative factors of poverty are not new (see for example Kurtz 1973, for a presentation of the 'poverty habitat') more contemporary definitions of poverty are entrenched in holism and wider political, social and economic settings. As Townsend (1993) describes a person is relatively deprived if "… they cannot obtain, at all or sufficiently, the conditions of life" (p.36) including sufficient food, amenities, standards and services which in turn constrain them from following customary behaviour expected of them by their membership of society. He goes on to explain that a person can be relatively deprived without entering into poverty. Poverty is only reached at the point where the deprivation grows disproportionately to the loss of resources. By using such a definition both *material* and *social* deprivation are addressed. In the case of rural subsistence communities, these material and social deprivations are consistent with the decisions made about livelihoods activities which are contingent on both nature and society.

2.4.2 Entitlements and capabilities

Amartya Sen (1981; 1983) argued that the relative concept of poverty is useful for measurement but it can detract from the notion of absolute poverty. In his book *Poverty*

and Famines (Sen 1981) Sen introduced the concept of 'entitlements' to discussions on poverty and food security. He argues that a person has a certain endowment, a bundle of skills or capital, which can be exchanged to provide an equivalent bundle of goods for survival, which he calls their entitlement. Sen takes this concept beyond simple equation of income and purchasing power by considering a broad set of influences over a persons endowment and entitlement relations, such as market, political and social forces that influence the ability of a person to command adequate food (or resources/capital to produce food).

The concept of 'entitlement' is based on the premise that certain rules are in place that mediates asset accumulation, ownership and exchange. Gore (1993), in a critique of Amartya Sen's work, questions the narrow definition of rules. He argues that Sen conceptualizes the rules of entitlements in terms of state law only. He also argues that the rules of entitlements, beyond the state, are limited to household negotiation. Gore, extends entitlements to non-government sites of rule making and enforcement. In doing so he extends analysis to include power relations as entitlements in that they are outcomes of active processes of negotiation and in subsistence communities incorporate a wider understanding of control over natural resources.

Sen's argument for an entitlement approach meant that income based classification and aggregation of 'poverty' and poor people moved beyond basic indicators of a person's ability to acquire income. Instead it placed poverty in a wider framework of interrelated factors ranging from international trade to local governance. He used this to explain a fundamental dilemma in food supply: why people starve when there is enough food to eat. Based on a broader range of factors causing poverty and famine the concept of capability emerged, which entails a measure of poverty as neither commodities nor characteristics, but rather the capability to *function* (Sen 1990). This concept addresses both cause and effect, or poverty as 'means' and poverty as an 'ends'. That is, the capability of a person to acquire enough capital, or substantive endowment, to have an adequate entitlement exchange, which in turn provides enough capital to perpetuate this process. That is, avoiding diminishing returns of an entitlement bundle.

In conjunction capability is framed as *well-being*, a term referring to the ability of people to define the criteria which are important to the fulfilment of a sustainable livelihood

(Chambers 1997). This includes factors such as self-esteem, security, happiness, stress, vulnerability, power, exclusion and other material concerns (Chambers 1989). Most recently Sen has argued for a version of well-being expressed as *freedom* (Sen 1990). He extends the notion of capability beyond cause and effect to analyse the desires and aspirations of a person, elements of personal development that have not as yet been incorporated into wider understandings of national economic development.

Influenced by Fred Hirsch's (1976) concept of positional goods, Sen (1983) makes a distinction between absolute and relative deprivation in terms of capability and commodities.[3] He argues that both relative and absolute measures of poverty are relevant, depending on the space of analysis. That is, whether analysis refers to commodities and income or capabilities. He explains that "*absolute* deprivation in terms of a person's *capabilities* relates to *relative* deprivation in terms of commodities, income and resources" (p. 153) and this concentration on commodities as a measure of wealth led to a shift from absolutist to relativist views of poverty. Therefore, a person's entitlement is ultimately a function of capabilities that both influence and are influenced by their assets in a natural resource setting.

Although capabilities and well-being are important components of a holistic, inclusive definition of the causes of poverty and (in the case of Sen) famine, measurement, comparison and structural understandings of poverty are more suited to the sustainable livelihoods framework. In a pragmatic approach Frank Ellis (2000) argues that:

> While undoubtedly there are some elements of livelihoods that involve rights and claims, for example, rights established by ownership of land or claims on family members based on custom or reciprocity, it is not always the case, overall, that livelihoods can be characterized solely on the basis of rights and claims. Rather they are constructed … from assets, and activities, and differential access to these based on social and institutional considerations. (p.17)

This concentration on more reductionist forms of research is reminiscent of the dilemma faced by ecology as discussed above. While rights and claims are important, contemporary rural livelihoods analysis has concentrated more on the assets, activities

[3]Where absolute advantage (e.g. best livelihood) of an individual depends on the relative position (e.g. accumulation of specific knowledge) of that person to others.

and institutional arrangements of natural resources use. This more pragmatic research agenda stems from what Ellis (2001) has identified as the small-farm orthodoxy, the attention given to agriculture by international donors and development agencies as a starting point of rural development and poverty alleviation, that has dominated rural studies in developing countries over the last 50 years.

2.4.3 Sustainable rural livelihoods

The term 'sustainable livelihood' was first used by the World Commission on Environment and Development (WCED 1987). Their definition focused on meeting basic needs through security and risk reduction. They use the term sustainable to mean the maintenance or enhancement of resource productivity. Since then there has been confusion over the diversity of intellectual frameworks that exist around poverty and livelihoods (Longhurst 1994).

Robert Chambers and Gordon Conway (1992) summarised the concepts within an holistic view of poverty incorporating the sustainable livelihoods framework, while also drawing on concepts of poverty, well-being and capability. In integrating these three concepts, Chambers and Conway, like Sen (1981) before them, see capabilities, equity and sustainability as a means and an end. Integrating these concepts they come up with the following definition:

> A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes to other livelihoods at the local and global levels and in the short and long term. (p.6)

Rural livelihoods are also understood to be characterised as complex, risk prone and diverse (Chambers *et al.* 1989). This highlights important features of ecological thought: the interaction of humans with their environment is in a constant state of flux rather than balanced in an equilibrium state. Understanding this also emphasises the role of multiple livelihood activities as opposed to a narrow understanding of livelihoods based on, for example, a narrow cash cropping model. The interdependence of both livelihoods on changing available natural resources and the influence that these have in turn on the livelihood decisions is a central concept of this constant state of flux. Anthony

Bebbington (1999) for example, outlines that assets, including natural resources, are not only essential for making a living but also give meaning to the livelihoods themselves, allowing them to exercise an adequate level of capability.

The term 'capability' in sustainable livelihoods is adopted from Jean Dréze and Sen (1989) and is used is by Chambers and Conway (1992) to emphasise the ability of rural communities to cope with stress and shock. They identify access to information, ability to experiment and innovate and the ability to exercise foresight as central to exercising 'capability' in rural livelihoods.

Rural communities that have the assets as well as the capability to utilise those assets are able to anticipate, cope and recover from stress and shocks. This means they are able to adapt to stress and shock but remain in poverty. Caroline Moser (1998), building on the social-ecological systems work of Folke *et al.* (2003), identifies two parts of vulnerability: resilience and sensitivity. Resilience here refers to the ease and rapidity of a system's recovery from stress, while sensitivity refers to the magnitude of a system's response to an external event. In a rural livelihood sense, vulnerability is related to the ownership and diversification of assets, which provide a capacity to respond to both internal and external changes in the environment.

Sustainability is "the ability to maintain and improve livelihoods while maintaining or enhancing the local and global assets and capabilities on which livelihoods depend" (Chambers and Conway 1992, p.5). As such Chambers and Conway (1992) determine both environmental and social sustainability as integral to sustainable livelihoods, identifying a sustainable livelihood as "… those that can avoid or resist such stresses and shocks and/or that are resilient and able to bounce back" (p.11). Simplifying these to a simple model they suggest environmental sustainability concerns the external impact of livelihoods while social sustainability concerns their internal capacity to withstand stress and shock to maintain a level of capability. In terms of rural environmental sustainability they identify the need to distinguish between negative practices that contribute to resource degradation and positive practices that enhance production and reduce degradation of the resource base. Such a distinction links human activity in rural communities to environmental sustainability and again reflects environmental sustainability as both means and an end to perpetuating a natural resource based

livelihood. This marks out a separation between society and nature. Human interaction with their environment is seen in terms of cause and effect. There is no recognition of the complexity of socio-ecological systems, with humans as *entorno*, a product as much as an influence on the environment.

The logic behind the sustainable livelihoods framework is best defined by Scoones (1998). He says:

> Given a particular ***context*** (of policy setting, politics, history, agroecology and socio-economic conditions), what combination of ***livelihood resources*** (different types of 'capital') result in the ability to follow what combinations of ***livelihood strategies*** (agricultural intensification/extensification, livelihood diversification and migration) with what outcomes? Of particular interest in this framework are the institutional processes (embedded in a matrix of formal and informal institutions and organisations) which mediate the ability to carry out such strategies and achieve (or not) such outcomes.

This is expressed graphically by Scoones (Figure 2-3) and has since been emulated and adapted by a number of authors (Dorward *et al.* 2001; Ellis 2000; Scoones 1998; Carney 1998, 2001). Each keep to the basic model first given by Scoones, yet differ by placing emphasis on different components. For example, Andrew Dorward *et al.* (2001) stress the role of market and non-market demand to emphasise the role that livelihood outputs can place on livelihood strategies, whereas Ellis (2000) places more emphasis on assets being the platform from which livelihoods are based. Scoones sees assets (or livelihood resources) as immediately influenced and directed by contexts and conditions. Ellis also divides livelihood strategies into natural and non-natural resources based elements, whereas Scoones does not. This is a very important distinction. Natural resources are an important, and little recognised feature of sustainable livelihoods. This is actually the case with Ellis also, who includes collection of natural resources (presumably forest materials and living aquatic resources), however also places agriculture as a natural resource based activity. This is an accurate assertion. However, drawing out collection of natural resources from agriculture is a more realistic representation of rural livelihoods for two reasons. First, collection of natural resources and cultivation of natural resources are often quite distinct activities for rural people, with associated levels of importance placed on them. Second, collection of natural resources and agriculture can be competing activities that directly influence each other's adoption in a livelihood

portfolio. This analysis is enhanced through a distinction between farm and non-farm based activities, natural resource and non natural resource based activities and the distinction of gender roles within them.

In addressing society-environment relations the sustainable livelihoods approach can be applied at a range of different scales – from individual, to household, village, region or even nation (Scoones 1998). However, such scale sensitive analysis has been lacking in livelihood analysis. Twyman *et al.* (2004) argue for the inclusion of complex 'day-to-day' incongruities of local operation as well as operation at national or regional levels. This, they argue, is applicable for livelihoods as well as policy analysis. Others have looked at the influences that international policy has on the local level, however there has been little research on the dynamic relations between local and higher levels over natural resources (Baumann 2000).

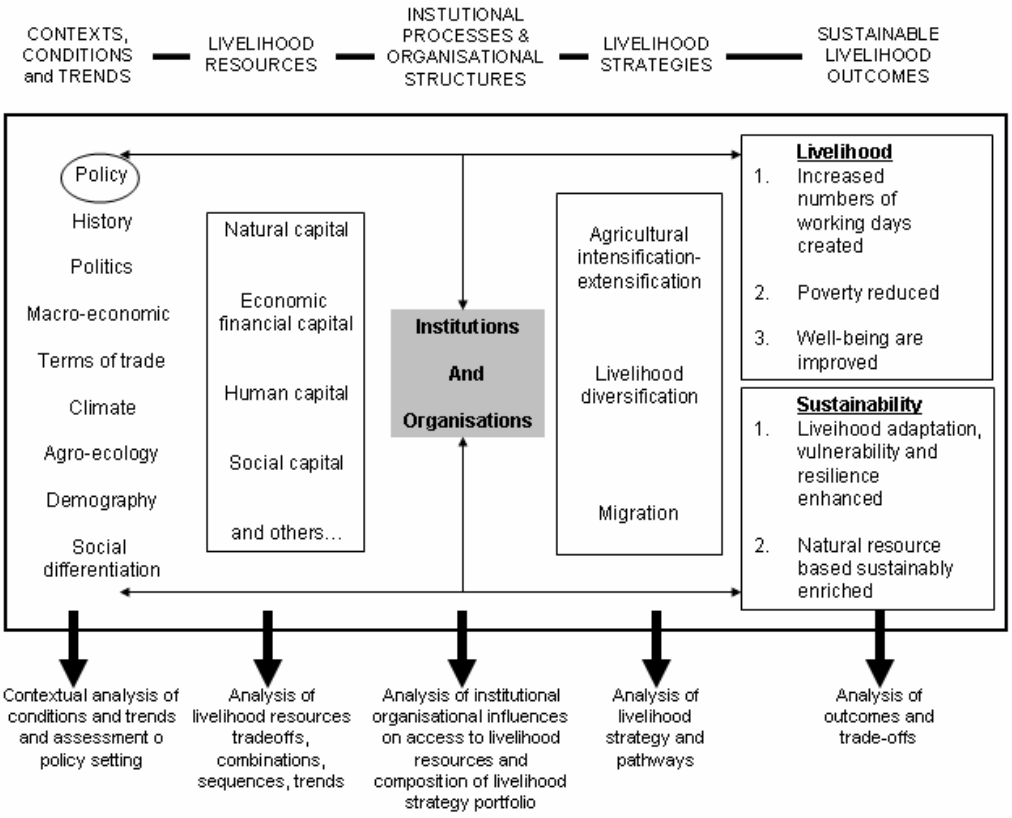

Figure 2-3 Sustainable rural livelihoods framework, from Scoones (1998, p. 4)

Most rural livelihood analysis has focused on the role of institutions through the build up of social capital in local level natural resource management (e.g. Pretty and Ward 2001). There is a call for wider, scale sensitive analysis by two camps. The first are those wishing to extend the framework to include policies (Shankland 2000; Thomson 2000; Roe 1998). The other reason is to increase an understanding of the transition costs of policies from government to the local level (Baumann 2000). This later analysis has led to the need for a more politically aware sustainable livelihoods framework, drawing not only social relations at the local level, but also the wider influences of multiple stakeholders often operating at a distance. For example at a wide scale the sustainable livelihoods approach can link national and international pressures and processes, outlining the external pressures that the local level has to face such as structural adjustment, government fiscal decentralisation and World Bank poverty reduction strategies (Orr and Mwale 2001; Ellis *et al.* 2003; Ellis and Mdoe 2003). Alternatively, the household is the smallest appropriate scale of analysis as an individual's actions cannot be seen outside the context of the people that 'share the same hearth' (Ellis 2000; Chambers 1983). The household unit is also dynamic, with internal gender and generational politics and conflict and often wide geographical dispersion as a result of remittances from migrant labour.

The sustainable livelihoods framework therefore provides a framework of analysis underscored by the heuristic of 'ecology'. It takes into consideration the interrelations of different temporal and spatial scales and has at its core the complexity and diversity of rural livelihoods. The framework is also adaptive and predictive whilst providing a realist understanding of the society-nature relationship. This is directly applicable to the diverse ways in which living aquatic resources are exploited along the aquaculture-capture fisheries continuum. As Allison and Ellis (2001) outline:

> Fishing families are no less prone than other rural dwellers to adverse events and trends, with natural fluctuations in fish stocks being especially critical for them. Finally fishing families engage in diverse activities in order to achieve livelihood security (p. 380)

Fishers' livelihoods are therefore subject to complexity, diversity, and risk. On this basis alone the framework is inherently geographical and as such applicable to this thesis investigating social-ecological systems exploiting living aquatic resources. The basis of

sustainable livelihoods are combinations, trade-offs and sequences of assets and activities subject to external, macro-influences and mediated by household, community and state institutions. The various activities and assets are discussed below.

2.4.4 Capitals and capabilities

By breaking down assets into investments, stores and claims, Jeremy Swift (1989) argues that they buffer livelihoods against vulnerability by addressing immediately variable processes such as production, exchange and consumption. He breaks down the function of assets into investments (human investment and physical investment), stores (consumables and financial capital), and claims (on family, community, and government). Likewise, Simon Maxwell and Margie Smith (1992) identify five sources of entitlements as productive capital, non-productive capital, human capital, income and claims. All of these asset categories are not stable, working to a single livelihood equilibrium. Instead multiple equilibria exist, with each asset category operating in isolation yet with influence from other categories. Therefore, complexity becomes a central means and ends of achieving a sustainable livelihood. The following presents this complexity and diversity.

Moser (1998), in an "asset vulnerability framework" for urban areas, identifies not only well known tangible assets but also intangible assets such as labour, household relations and social capital. Craig Johnson (1997) identifies two types of resources: social and natural. Natural resources are the "physical inputs which generate value and productivity in people's lives." (p. 4), and social resources are the "social institutions and relationships that facilitate this process" (p.4) of generating value and productivity. Johnson goes on to argue that capital can also be accumulated and generate value and productivity in someone's life. Once capital has been actively utilised to realize this value and generate productivity it becomes a resource. So, capital is a store of resources, both social and physical, and can be used to generate productivity and contribute to a person's livelihood. Johnson goes on to explain that livelihoods are only sustainable "when they promote an accumulation of all forms of capital." (p. 7). A combination of different livelihood resources, or 'capitals' means that there is no set formula, the combination of resources used changes over time according to needs and responses (Scoones 1998). A number of livelihood capitals have been identified including: financial capital, human capital, natural capital and social capital. Recognition of

political capital within the livelihood framework is also emerging, assisting a wider understanding of influences over livelihoods and agro-ecosystems.

Financial capital

Financial capital refers to economic assets that are essential for the pursuit of any livelihood strategy (Scoones 1998). This mainly comprises the stocks of money that a household has access to, either in the form of savings or credit (Ellis 2000). Ellis (2000) argues that the value of financial capital is not production but rather its fungibility (the ease of switching between uses), into other forms of capital or directly into consumption. He also rightly recognises that in a lot of cases financial capital is not in the form of cash but rather in livestock or some other easily traded item (e.g. Dercon and Krishnan 1996, cited in Ellis 2000)

Physical capital

Physical capital is comprised of capital that has been created by the economic production process (Ellis 2000). It is 'man-made' capital that is used to create a flow of outputs, they are therefore producer goods or infrastructure rather than consumer goods (ibid.). In a rural setting these include irrigation, roads, dams and fish ponds. Moser (1998), within an urban setting also includes housing (diversified household industry and renting).

Ellis (2000) notes that physical capital can be a substitute for natural capital. This is based on technological advancement and can "potentially help to take the pressure off natural resources that are being depleted in local contexts" (p. 33). He uses the example of water pipes replacing open canals and therefore reducing evaporation. The model of replacement is relevant for fisheries and aquaculture. This argument is fundamental to Sen's notion of entitlement exchange, where one entitlement endowment (capital) is exchanged for another which contributes to productive capacity. The notion of substitutability is also outlined by Scoones (1998) who argues that one type of capital can be substituted for another when needed for the pursuit of particular livelihood strategies.

Human capital

Human capital refers to the skills, knowledge, health and physical capability which determine their return to labour and successful pursuit of different livelihood strategies (Moser 1998; Scoones 1998). Moser (1998) distinguishes labour as an important part of human capital as it is often the first response to crisis. Households can be seen as 'groupings' of human capital (Ellis 2000). They are more resilient as they diversify occupational strategies and reduce the risk of illness (ibid.).

Knowledge is also a valuable form of human capital. This includes local ecological knowledge in artisanal capture fisheries and technical capacity in aquaculture. Where the later can be taught and learned quickly, there is an argument that the former cannot limit its use as a development intervention. Berkes and Folke's (1994) definition of cultural capital fits into this version of human capital. They define cultural capital as the factors that provide human societies to adapt to the natural environment and actively modify it, therefore turning it into capital and assets.

Natural capital

Natural capital refers to the natural resource base including soil, water and air and environmental services such as air quality, flood protection, water quality. The importance of natural capital is dependent on the agro-ecological conditions. As such place becomes a central component of analysis. There has not been enough attention to natural capital. Natural capital has been addressed in the literature through environment-poverty relations. Thomas Reardon and Stephen Vosti (1995) outline that poverty and environmental degradation is not a cause and effect relationships. Instead they argue that the link between poverty and environment is mediated by the type of poverty, the level of poverty, the distribution of poverty across communities and the type of environmental problem. The type of poverty is central to their analysis and related to livelihoods approach. They argue that a central question is "poor in what? A household or community could be poor in one type of capital which affects their capabilities and forces them into a certain action which adversely affects the environment: they may become investment poor (the inability to make an investment in the protection or enhancement of natural resources) rather than welfare poor (a lack of income and nutrition to meet daily needs) (Reardon and Vosti 1995). Aquaculture, for example, could be seen as a type of investment in the enhancement of 'fisheries'. However, this is

too simplistic because the motivation to invest in aquaculture is based on incentive and capacity, both of which may not incorporate any notion of protecting natural capital.

William Cavendish (2000) outlines the relationship between poverty and environment in terms of the patterns of conversion of capital in the use of environmental resources. He argues that rural communities use these resources extensively for food, income, asset formation and agricultural production input and that these resources, despite making up a large portion of rural people's livelihoods have not been included in economic surveys and an understanding of rural livelihoods.

Non-timber forest resources are a case in point. They have been shown in numerous studies to be an important resource for rural communities around the world (e.g. Barham *et al.* 1999; Byron and Arnold 1999; Warner 2000; Danks 2000) and especially in Lao PDR (Foppes and Dechaineux 2000; Foppes and Ketphanh 1997; Krahn 2002). Neil Byron and Michael Arnold (1999) argue that forests are a buffer to fall back on for poor people. Warner (2000) agrees with this important role of forests and adds that, as a natural resource, forests are playing an increasingly important role in diversified sustainable livelihoods.

Social capital

Social capital refers to the social resources on which people draw when pursuing different livelihood strategies (Scoones 1998). The term draws together community and social relations that individuals can draw upon by virtue of their inclusion in a group to varying degrees and society as a whole (Ellis 2000). It has also been described as formal and informal networks of trust. Hugh Ward (2001) addressed the role of social capital in conjunction with human capital working toward collective action for the improvement of natural capital. They argue that the main features of social capital are relations of trust, common rules, norms and sanctions, connectedness through networks and groups and finally reciprocity and exchanges.

The inclusion of individuals can be in reciprocal networks that are either hierarchical or horizontal (Putnam, 1993 cited in Ellis 2000, and). One of the best examples of reciprocity in a rural setting is described in Scott's (1976) moral economy, through which communities are mediated. Such relations are evident in Laos, for example

through reciprocal labour activities in irrigation (Ireson 1995, 1996). Reciprocal relations can also be beneficial in achieving positive environmental outcomes (Platteau 1997). Again in Laos such relations have been propagated between communities in the management of fisheries (e.g. Baird 2000; Noraseng *et al.* 2001).

Bebbington (1997; 1999) argues that livelihoods and entitlements have focused too much on natural resources, or the livelihood resources, the assets, instead of other factors such as access. Most of the natural resource literature focuses on common property resources (e.g. Beck and Nesmith 2001), and the re interpretation of local people as contributing the environmental sustainability rather than degradation (e.g. Leach *et al.* 1999; Fairhead and Leach 1995). There has been less emphasis on reciprocity as it is difficult to describe especially in relation to social exclusion (Ellis 2000; Bebbington 1999). There is also a need for more geographically sensitive analysis of reciprocity within households and between households in terms of labour migration and remittances within family networks.

Political Capital

Political capital draws together issues of access and power into wider issues of governance policy. Pari Baumann (2000) argues that the focus on structures and processes that the sustainable livelihoods framework takes provides no space for consideration of politics and power relations. He therefore argues for the inclusion of political capital which includes rights, claims over the access and assets. Ellis (2000) embeds politics as one of the mediating process of sustainable livelihoods, along with institutions and organisations. However, Scoones (1998) more accurately places politics as a trend or condition and not within these institutions. This means that politics and power become more than a construct of state rules, but rather become an asset local level actors use in their daily access of natural, human and social capital, therefore contributing to the rules through which they exercise their entitlement to a sustainable livelihoods.

2.4.5 Diversification and rural livelihoods

In terms of rural livelihoods, diversification implies a process through which livelihood strategies are diversified away from only agricultural activities and in doing so increase income and reduce environmental risk (Hussein and Nelson 1998). For Sen (1981)

sustainable livelihoods are resilient because of the diversity of activities that go together to make up what an individuals entitlement bundle. Ellis (2000) defines livelihood diversification as:

> Rural livelihood diversification is defined as the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and to improve their standard of living. (p15)

Diversification assumes no one area of a livelihood to be more important than another. Just as bio-diversity, livelihood diversity assumes that the more diversified livelihood is more resilient to change. For example, Christina Gladwin *et al.* (2001) outlined how women farmers in Africa area able to become food secure not through increased production but through diversified income sources. David Smith *et al.* (2001) identify that there are specific external determinants of diversification including favourable agro-ecology and market links. Other studies show the importance of livelihood diversification for rising out of poverty and as an area that should be focused on in policy (Sen 2003; Bryceson 1999). Others still give precedence to the balance of on and off-farm sources of income facilitating diversification (Reardon 1997; Barrett *et al.* 2001; Block and Webb 2001).

2.5 Conclusion

Fishery management is increasingly cognizant of the fact that equilibrium models of fisheries management are not sufficient. The incorporation of chaos in fisheries has emphasised people's involvement in fisheries management. This has moved thinking into post-structural realms, where social systems are seen as increasingly important, shifting attention from equilibrium to uncertainty, as reflected in the concept of 'ecology'. It gives rise to an understanding of not only the resource but also the users of that resource.

This chapter proposes a theoretical and methodological framework for the investigation of a geography of living aquatic resources. This moves the analysis of inland fisheries into an integrated research agenda, incorporating a political and human ecology of living aquatic resources. The epistemological basis of the research is the heuristic of ecological thought, integrating social and environmental epistemologies into a holistic research

framework. Practical limitations are, however, recognised. It is proposed that the sustainable rural livelihoods approach provides a means by which to investigate social-ecological systems, incorporating household level decision making within the context of interaction with the local environment while also placing them within wider social institutions and political contests.

Political ecology is central to the framework of this thesis, as it attempts to draw together a broad mix of social, political, economic and environmental factors from different spatial and temporal scales that influence social-ecological systems. It therefore provides a means of analysing the context in which individuals interact with the environment to meet their livelihood needs, while also analysing influences by wider processes. Political ecology is also sensitive to the incorporation and diversification of the different forms of livelihood 'capitals' to avoid risk and vulnerability. Access and entitlement to these capitals becomes a central question as farmers engage not only with their immediate environment but also with processes of contestation over the environment and the natural resources on which their lives depend.

Reinterpreting ecology within political ecology, as a means of overlaying understandings of history and place of living aquatic resources across the highly contested landscapes of river basins, is therefore central to the development of a geography of living aquatic resources. Attention is given to analysing the complexity of human-society nature relations along the aquaculture-capture fisheries continuum. As such, living aquatic resources are seen as a social-ecological system in a constant state of flux between ecology and sociality. Understanding how these complex systems are simplified in wider orthodoxies enables a clearer understanding of the disparity between ecological realities faced by resources users in balancing their livelihoods, and allows critical assessment of the wider political economy of knowledge and management.

This scale sensitive mix of political ecology underwritten by the key heuristic of social-ecological systems and rural livelihoods is applied throughout the rest of this thesis.