

8 A geography of living aquatic resources

This thesis aims to understand how living aquatic resources contribute to rural livelihoods in Lao PDR and how this contribution is understood and translated to national development and management agendas. In doing so the thesis contributes to understanding how complex human-environmental systems are perceived and represented in development policy and wider orthodoxies in a developing country context.

The preceding chapters have shown how living aquatic resources provide an imperative source of food and income to rural communities through diverse and complex human-environment interactions. In contrast, government and non-government organisations operating at regional, national and local scales of policy and planning simplify these relationships, drawing on wider orthodoxies of aquaculture and capture fisheries development. Plagued by a lack of empirical information, living aquatic resources management and development has become highly politicised. The outcome is policy and planning that reflect the interests and beliefs of development organisations, government and non-government, rather than the realities of resource users.

This thesis has adopted an ecological approach to investigate how living aquatic resources are framed within wider development narratives, how they are understood by various actors, how they contribute to rural livelihoods and finally, how they are promoted in development policy and planning. Central to this approach is the adoption of a multi-linear system of analysis, whereby simple explanations of aquaculture and capture fisheries are replaced with a more nuanced understanding of complex, diverse and resilient living aquatic resources. This approach seeks to extend the aquacultural geography of Barton and Staniford (1998) by placing a critical investigation of aquaculture within a wider geography of living aquatic resources. Central to this has been a critical political ecology which has questioned the assumptions and orthodoxies that surround the promotion of aquaculture over capture fisheries. This ecological approach attempts to investigate complex human-environment relations by looking at 'everyday' interaction and the construction of knowledge at different scales using a range of qualitative and quantitative methods.

The following presents the conclusions drawn from the four research questions presented in Chapter 1 before focusing on the theoretical implications of an ecologically enhanced political ecology. Finally, reflections on the use of integrative methodology in a holistically based political ecology are presented before discussing the implications of the research findings for living aquatic resources policy in Lao PDR. As such, the thesis critically employs political ecology as a theory, methodology and as a process of action and advocacy.

8.1 A political ecology of living aquatic resources

This thesis employed a political ecology of living aquatic resources in Lao PDR by critiquing the key development and management orthodoxies that influence policy and planning through a detailed empirical investigation of human-environment relations in rural communities. This builds directly on the work of, amongst others, Fairhead and Leach (1998) and Stott and Sullivan (2000) in systematically questioning key assumptions of resource degradation that lead to the construction of environmental crisis narratives and orthodoxies that influence policy and planning. The research also builds on the critical political ecology of Forsyth (2003) by analysing how ideas and assumptions surrounding environmental crisis and degradation are *co-produced* by a combination of political and social processes.

The central questions of this thesis address the practical and conceptual divide within living aquatic resources between aquaculture and capture fisheries. Questioning the validity of this divide draws in a wider critique of the global fisheries crisis and its production-oriented responses. Following on from Johnson (2002) the thesis critiques the applicability of a global scale problematisation of fisheries by examining the complexity, diversity and resilience of locally contingent responses. Specific attention is given to the historical context and importance of living aquatic resources, the multiple scales of human-environment interaction and finally a critical analysis of the production and re-production of policies in planning and action. The four key research questions addressed by this thesis form the basis of the following summary:

- What is the role of government and non-government organisations in framing knowledge of living aquatic resources, and how has this established knowledge influenced the management and development of aquaculture and capture fisheries

in Lao PDR?

- What is the nature of environmental, economic and social influences on the broad scale development of aquaculture, and how does this relate to the existing role of capture fisheries in Lao PDR?
- What is the role and importance of living aquatic resources in the livelihoods of rural Lao communities comparing the difference between adopters and non-adopters of aquaculture?
- How are living aquatic resources framed and represented within wider development agendas of conservation, poverty alleviation and rural development of government and non-government organisations, and how do these relate to the role and importance given to aquaculture and capture fisheries in rural communities?

These questions follow a logical progression which not only emphasises central theoretical problems of human-environmental interaction but also the practical application of a political ecology of living aquatic resources in a developing country context. The first question establishes the historical context of knowledge over living aquatic resources in Lao PDR. The second and third questions then gradually ‘zoom in’ on empirical examination of these resources. The second question looks at the broad scale influences of aquaculture development while the third question addresses the role of these resources at the village and household levels. The final question then ‘zooms out’ to examine the relevance of current policy and planning to poverty alleviation, rural development and conservation.

8.1.1 Knowledge, power and ‘fisheries’ development

A major conclusion of this thesis is that knowledge of living aquatic resources in Lao PDR does not reflect the needs and realities of resource users but instead are negotiated through the beliefs and interests of the government and international NGOs. In practice, this has led to the promotion of aquaculture over capture fisheries.

Knowledge of living aquatic resources in Lao PDR is constructed and controlled by a small number of both government and non-government organisations. Limited public debate means that policy and planning reflect knowledge that has gained political prominence rather than the needs of resource users. As government funds are limited, data collection often reflects the agendas of externally funded projects rather than the need for a broad and detailed understanding of the importance and extent of natural resources. In response, both government and non-government organisations defer policy and planning to a global base of generic 'fisheries' knowledge. The outcome is what Forsyth (2003) refers to as *coproduction* - the production of knowledge by a combination of political and social processes.

The history of living aquatic resource development in Lao PDR highlights the agency of external actors in the process of knowledge coproduction. Both government and non-government organisations have drawn upon the belief that small-scale rural aquaculture is a commonsensical approach to the development of 'fisheries' with little supporting empirical evidence. Globally, aquaculture is supported within the wider context of the 'blue revolution', a technologically driven response to a perceived crisis in world protein supply. In contrast capture fisheries are often marginalised as a resource in decline with little or no hope for increases in production. Aquaculture has therefore become a powerful agenda supported by international orthodoxies whereas capture fisheries are often framed as a resource in decline, a contributor to poverty, and therefore marginalised within conservation. Conservation is a problematic concept in Lao PDR as it is seen as the antithesis of maintaining access to natural resource use. Moreover, capture fisheries management has not gained recognition as an activity that is compatible with national development agendas, such as poverty alleviation and rural development, which further promotes aquaculture.

In the absence of empirical information, the complexity of living aquatic resources has been simplified through linear cause and effect models under the broad title of 'fisheries'. This is what Johnson (2002) outlines with respects to the global fisheries crisis. The complexity of local fishery resource use is not understood and often simplified. Living aquatic resources in Laos are a case in point. The result is conceptual downsizing of what constitutes living aquatic resources to 'fisheries'. Aquaculture has

replaced fisheries as increased production capacity has emerged as a development imperative by both government and non-government organisation alike.

In information-poor environments, management and development orthodoxies are formulated at wider scales and frame how problems are addressed at national and local scales. Aquaculture has become prominent because of the historical context of fisheries in development and the need for national government to foster productive agricultural systems. In turn this has influenced the rhetoric of local communities. It is therefore necessary to base decisions on empirical research that takes into account the power relations when ideas are framed as ‘truth’ and used to justify development decisions.

8.1.2 Integrated geography of living aquatic resources

Living aquatic resources use, management and development in Lao PDR are integrated across multiple scales. The results of meso-scale economic and environmental processes at both provincial and district levels highlight the circumstances of natural resources decisions in rural communities. In contrast to the narrow, linear view of development orthodoxies these multi-linear influences are locally contingent and complex. This builds on Guttman’s (1996) aquaculture-fisheries continuum by not only recognising the multitude of living aquatic resource activities that occur simultaneously in rural communities, but also introducing wider influences of land use, infrastructure development and market competition.

The decision to develop and invest in fish ponds is not made in isolation from wider environmental and economic factors. Instead there are distinct relationships between the level of investment and the pattern of fish pond development and use. The results of the GIS based survey in Chapter 4 refute notions of a linear progression, or *ladder of intensification* (Setboonsarng 1993), of aquaculture from capture fisheries. Instead investment is shown to reflect surrounding local conditions including landuse, available water resources and road construction. In rural communities, where land is rarely sold and traded, these external influences are environmental constraints, and therefore outside the control of farmers. Recognising these constraints is an important step in understanding the role of fish ponds within a wider geography of living aquatic resources and has implications for the development of policy and planning that focuses on aquaculture as a panacea for rural development.

Development orthodoxies propose both direct and indirect benefits of aquaculture including the provision of nutrition to poor consumers through the market, as well as decreasing the pressure on capture fish. These assumptions again provide a narrow view of the role of aquaculture within a broader geography of living aquatic resources. Furthermore, the results of Chapter 5 show that these assumptions do not reflect the complex market interaction between capture and culture fish in Savannakhet. The survey shows that culture fish make up a high proportion of total trade and that the average price of culture fish is lower than capture fish. On this basis culture fish appear to provide a cheap, abundant and, as such, more important source of fish. However, on closer inspection aquaculture fish are made up of distinct subcategories, including intensive production systems not employed by rural Lao communities. The fish from small-scale rural aquaculture ponds have limited market penetration. Instead, markets are dominated by Sex Reversed Tilapia from intensive cage culture. In contrast, small capture fish provide a cheaper source of protein for consumers. Once again, these results show that farmer's decisions to carry out either capture or culture fish are embedded within a broad scale integrated geography that does not reflect the simplified orthodoxies.

An integrated geography of living aquatic resources carried out at an intermediate or meso-scale analysis contextualises both aquaculture and capture fisheries within wider social, environmental and political influences not evident in simplified development orthodoxies. This is especially relevant to Laos where policy and planning traditionally focus on the household, village and national scales. In reality the observations that inform policy and planning of natural resource management are made by managers across provinces and districts. An integrated geography of living aquatic resources therefore highlights the complexity of the multi-linear aquaculture-fisheries continuum and shows how, in contrast to the dominant orthodoxies, the importance of resources is locally contingent.

8.1.3 Role and importance of capture and culture fisheries to rural communities

The capacity of the government to penetrate and influence the day to day management of natural resources in Laos is extremely limited. Historically the government has co-opted existing village-based management systems and this remains a key feature of the

decentralisation policy. Understanding the role of and importance of living aquatic resources in rural communities is therefore important on two levels. Firstly, resource use is locally contingent. As shown by both the meso and local scale studies in this thesis, people are extremely pragmatic in the use of available resources. Therefore a detailed understanding of how living aquatic resources contributes to the material or instrumental well-being gives an insight into how resources are used, managed and developed. Secondly, local communities are not passive recipients of assistance and extension services. Despite the biases in government and non-government organisations outlined above, rural communities' perceptions and representations of the importance of resource use guide development agendas.

The results of the livelihood analysis in Chapter 6 show how the perceived and actual importance of capture and culture fisheries differ considerably. The material importance of capture fish is, overall, much higher than culture fish. The consumption survey found that families with fish ponds eat a comparable amount of capture and culture fish, while those without ponds eat very little culture fish. In contrast to the wider orthodoxies it appears that culture fish provide only a supplemental source of protein while capture fish, and other aquatic animals, remain an imperative in food security. Further investigation of these households reveals that capture fisheries provide the basis of natural resource dependent livelihoods, exploited by all demographics and socioeconomic groups. In comparison, aquaculture plays a specific role for those families with fish ponds, but does not provide an extensive source of income and nutrition for the community as a whole.

The material importance of these resources is not commensurate with the social, cultural and political importance of capture and culture fisheries. Capture fisheries are represented as a central feature of rural Lao culture and society but not equated with community development. In comparison aquaculture is represented as an aspirational asset that builds on existing political, cultural and social power structures within communities. This is self replicating in that those households with fish ponds are wealthier and often hold a position of power in the community. The narratives of resource use extended to by communities through these individuals to planners therefore support aquaculture. Because there is little empirical information on the specific role of

capture fisheries these narratives gain prominence so, like the wider orthodoxies, ‘fisheries’ becomes increasingly synonymous with ‘aquaculture’.

This representation of aquaculture overshadows the diversity of living aquatic resources and the complexity of human-environment relations evident in Laos. Like the production-based rhetoric of the ‘green revolution’, aquaculture is presented as an activity that is modern and inherently ‘better’ than natural resource based subsistence. Capture fisheries do not fit within the rhetoric of modernisation and, as a central activity of the natural economy, the resource is perceived as less important. This division between material and perceived importance of living aquatic resources is not recognised by planners and policy makers. It is neither culturally, socially nor politically expedient to promote capture fisheries over aquaculture as natural resource use does not appeal to the wider socio-political role of fish ponds in rural communities and the production oriented development agenda of the Lao government.

The in-depth community and household analysis presented in this thesis therefore highlights the pressing need to develop clearer understandings of living aquatic resources beyond the simple linear discussion of capture and culture fisheries. This requires the inclusion of diverse influences over the instrumental role of these resources stemming from the socially, culturally and politically contingent nature of rural livelihoods.

8.1.4 Fish, conservation, poverty alleviation and rural development in policy and practice

In addition to providing an important empirical record of aquaculture and capture fisheries this thesis has also critiqued how the use and importance of these resources are reflected in policy and planning. In an information-poor environment, such as Lao PDR, policy decisions are often based on the interests and beliefs of development organisations, both government and non-government, to instruct policy and planning. The policy analysis presented in Chapter 7 found that three dominant development narratives - poverty alleviation, rural development and environmental conservation – are most influential in living aquatic resources development and management. These development narratives are common to both international organisations and the socialist rhetoric of the Lao government. However, poverty alleviation and rural development have a production focus that supports aquaculture. In contrast capture fisheries are

marginalised within conservation as a resource that is in decline and not compatible with wider development agendas.

Most development organisations include living aquatic resources within their development planning and policy based on a different world-view or episteme that instructs how the resources and their use are framed. These epistemes are diverse ranging between Christian, humanitarian, disaster relief, education, drug control and environmental conservation. The lack of empirical information available to policy makers in Laos means that these epistemes become an important source of international experiences that guide policy and planning. Development organisations and the individuals working for them therefore constitute an expert community that reproduce ideas from global orthodoxies and experience to instruct development in the Lao context. With respect to living aquatic resources these ‘ideas’ act as a surrogate for empirical information, often reflecting the agenda of the organisation rather than existing patterns of resource use.

Within the Lao policy environment, characterised by complexity and uncertainty, ideas become powerful and self-affirming. Ideas are implemented as activities and then reproduced as development narratives that reiterate their importance, reproducing themselves as ‘truth’ and thereby promoting continued support with little monitoring or evaluation. This creates a circular process of affirmation between global orthodoxies and ideas based policy. This thesis has shown how this process has developed within living aquatic resources development and management. As emphasis is placed on poverty alleviation and rural development, living aquatic resources are problematised within a limiting scope of production, which is directly compatible with the grand narrative of a world fisheries crisis. The outcome engenders strong support for aquaculture couched in the ‘blue revolution’ rhetoric of crisis and technology. Aquaculture is therefore an idea that is self serving. It is compatible with the prevailing interests and beliefs of various development organisations that apply it as an activity to meet the overall development agendas of poverty alleviation and rural development. However, as this thesis has shown, replacing complex and diverse living aquatic resources with aquaculture does not reflect the subsistence based strategies of rural Lao communities.

In contrast capture fisheries are problematised as a declining natural resource, feeding directly on the orthodoxies surrounding the global fisheries crisis. In Laos the only native capture fisheries management initiatives currently being undertaken are through the major conservation organisations. This association has further marginalised capture fishery activities within the government. As outlined in Chapter 7, conservation is a problematic term in Lao policy and planning as it is seen as in opposition to the constitutional right to access and use natural resources such as fisheries. Framed in these terms capture fisheries are not seen as compatible with the overall poverty alleviation and rural development agendas focusing on increasing income and nutrition to the Lao population. Instead capture fisheries are the basis of welfare, supporting but not developing the rural population. As such the resource is seen as firmly entrenched in the natural economy, not able to assist national agendas of market transition.

A geography of living aquatic resources approaches both aquaculture and capture fisheries as interrelated activities along the full spectrum of the aquaculture-fisheries continuum. As such, aquaculture becomes one activity within a mosaic of living aquatic resources. There remains a disjuncture in policy between aquaculture and capture fisheries that does not reflect the complexity and diversity of living aquatic resources. Aquaculture remains a panacea for poverty and rural development, meeting the wider agendas of national development and regional economic integration, while capture fisheries are limited within notions of conservation.

The political, social, cultural and economic links between rural development and poverty alleviation have been extensively examined, most notably through the modernist critiques of the green revolution. There is a lack of critical examination of the links between conservation and poverty. Conservation is often seen as anti-development and anti-poor and as such not relevant to the maintenance of rural livelihoods (e.g. Gilmour 1995). Alternatively, there is poor understanding of the importance of conservation for rural livelihoods. This has to be resolved and the contribution of conservation to rural development and poverty alleviation must be better understood and articulated into policy and planning. In order to move beyond these rigid policy areas an integrated approach is needed that recognises the complexity and diversity of activities and the importance of living aquatic resources. Furthermore, this approach must provide a

strong knowledge base for Laos that challenges and critiques the wider orthodoxies in which current policy and planning is so entrenched.

8.2 Implications of research

A geography of living aquatic resources reveals the complexity of human-environment relations in rural Lao communities and how they are influenced by wider processes. This thesis has drawn upon the theoretical contribution of a number of scholars of political ecology, including Scoones (1999), Bryant (1992; 1997), Blakie (1987; 1985), Zimmerer and Bassett (2003) and Forsyth (2003), through the application of historical contextualisation, scale and critical thought. The results not only highlight the complexity and diversity of human-environment relations but also reveal new patterns and explanations through an ecological, holistic mode of investigation. The following section argues for an ecologically enhanced political ecology that adheres to notions of multi-linear social-ecological systems. This not only has implications for political ecology theory and methodology but also practical relevance to policy and planning of living aquatic resources.

8.2.1 Theoretical insights – the role of ecology

The results of this thesis draw on the aquacultural geography of Barton and Staniford (1998) in broadening the analysis to economic, social, cultural and environmental forces, whilst at the same time showing that aquaculture is part of a much wider resource base. The following discussion argues for the development of a geography of living aquatic resources. In order to provide a holistic, scale sensitive analysis, an ecologically enhanced political ecology as an heuristic for holistic research is needed. The benefits and pitfalls of such a political ecology are now discussed.

Putting ecology first

Ecology has become synonymous with complexity in both social and environmental systems. Political ecology has increasingly sought to recognise complexity by emphasising the inherently political nature of human-environmental relations. This was most explicitly stated by Bryant (1991) and then later by Bryant and Bailey (1997) as ‘putting politics first’. This emphasis has subverted the substantive meaning of ecology making it become a surrogate for environment. By re-emphasising ecology the importance of political dynamics surrounding environment is not refuted. What is

argued is the value of ecology as an heuristic for holistic research that can assist in describing patterns of complex social-ecological systems. A major conclusion of this thesis is that ecology, as a theory for investigating human-environment relations characterised by complexity, diversity and resilience, must be better incorporated within political ecology research.

Increasing recognition is given to the need for a more ecologically aware political ecology inclusive of complex and diverse human-environment relations. These include the hybridity thesis of Robbins (2004) which emphasises the interaction of humans and non-human nature. More specifically he refers to the how the characteristics of what constitutes 'nature' change from these interactions, taking on new roles, forms and importance. This is similar to what Batterbury *et al.* (1997) propose through their hybrid research emphasising the link between the historical and sociological origin of knowledge and contemporary environmental problems. Similarly, Zimmerer and Bassett (2003) promote an integrative, scale sensitive political ecology that focuses on a "natural turn" in political ecology. They argue that scale is socially-environmentally produced and contributes to the dynamic role of environment in mediating knowledge and representations. Most relevant to this thesis however, is the work of Forsyth (2003) who focuses on the production and reproduction of knowledge and representations of human-environmental interaction, emphasising the need for a contingent, non-linear understanding of historically rigid representations of human-environment interaction. These approaches provide a basis for an ecologically enhanced political ecology by combining integrated, holistic notions of human/non-human networks, critical social science and the geographical imperatives of place and scale.

Ecology is particularly important for a critical political ecology in improving understanding of how knowledge of environmental crisis, development and management is co-produced by political and social processes. The results of this thesis have highlighted the interrelated nature of global orthodoxies and the ideas that instruct policy and planning of living aquatic resources. An ecologically enhanced political ecology moves beyond a purely discursive analysis to compare these orthodoxies and ideas with empirically grounded research. Emphasis is placed on the importance of ecology in revealing the complexity of multi-linear human-environment interactions, contingent on a range of cultural, social, environmental and political factors.

Political ecology must therefore move beyond putting politics first, to re-establish the importance of ecology and how it instructs a wider understanding of human-environment interaction. In a non-ecological approach aquaculture and capture fisheries are framed as discrete activities that are neatly packaged in policy and planning. Framing both activities within a wider resource base of living aquatic resources shows them to be discrete components of a wider set of human-environment activities each with their own complex ecologies. Such patterns are not explained by a linear chain of causation (cf. Blaikie and Brookfield 1987). Instead analysis must be cognizant of the multiple, simultaneous processes that influence how aquaculture and capture fisheries are adopted and used. Furthermore, analysis must integrate this understanding within a wider critical political ecology of how information is produced and reproduced within policy and planning highlighting the disjuncture between myth and reality.

Complexity, diversity and resilience

Key concepts within an ecological approach are complexity, diversity and resilience, all of which were addressed in this thesis. This is not only applied to direct relations of humans and living aquatic resources but also in the production, comprehension and translation of knowledge into policy and action. This is closely related to the social-ecological systems of Berkes *et al.* (2003) whereby humans are seen as a part of ecological systems and the sustainability and resilience of those systems is contingent on multiple human and non-human based equilibriums. Ecology not only identifies a relationship between humans and their environment but also critically assesses the complexity, diversity and resilience of society-environment interaction.

The complexity of living aquatic resources and their use by rural communities is a recurrent theme throughout this thesis: aquaculture and capture fisheries are not discrete, linear activities, but are instead components of a wider multi-linear living aquatic resource base. Understanding the internal complexity of aquaculture and capture fisheries emerged as a common theme throughout the proceeding chapters. By assuming social-ecological systems are complex a research agenda is set that critically assesses the validity of simplistic or linear representations of human-environment relationships, such as the division between aquaculture and capture fisheries. The outcome is a more nuanced, locally contingent understanding of the role and function of a wider variety of

living aquatic resources. However, describing a system as ‘complex’ is not an end in itself. By refuting simple linear systems of human-environment relations a space is created in which to reveal emergent patterns of resource use. This is central to an empirically based critical examination of the orthodoxies that underlie environmental and developmental policies and planning.

Social-ecological systems and an ecologically enhanced political ecology also assume diversity. This includes the diversity of environments that humans interact with, as well as the diversity of practices that exist within each of these environments. This again is a recurrent theme in this thesis. An ecological perspective breaks down simple responses of aquaculture and capture fisheries into locally contingent activities with a high level of diversity expressed in both temporal and spatial patterns of resource use. This is expressed in this thesis through the mosaic of fishing activities and fish ponds across socio-economic and demographic groups. Spatial diversity is also evident in the non random pattern of fish pond development based on the distribution of inputs such as feed and water and the location of roads. An ecological perspective that has a clear understanding of diversity is more adept at providing alternative grounded responses to dominant orthodoxies and agendas.

The importance of resilience to the sustainability of social-ecological systems is a recurrent theme in the preceding chapters. Management decisions that reduce the variability in an ecological system can reduce the resilience of that system to environmental perturbation. Understanding the resilience of a system allows critical analysis of linear categorisations and moves towards complex multi-linear problems. As such both aquaculture and capture fisheries are framed as linear responses that do not reflect the variability needed in a resilient living aquatic resource system. This can be prescriptive by identifying the need for variable systems and policy responses that attest to sustainable livelihoods, poverty alleviation and biological integrity.

These three concepts - complexity, diversity and resilience - form the basis for an ecologically enhanced approach to political ecology. They are also underwritten by key geographical concepts of scale, space and place. Ecology therefore emerges as an important heuristic for addressing complex social-ecological systems. In the case of Lao PDR this draws attention away from the aquaculture-capture fisheries dichotomy to an

aquaculture-capture fisheries continuum that represents an integrated system of living aquatic resources. As such ecology is not so much a missing link as a misunderstood link. The use and misuse of ecology in a variety of fields including social, biological, human and political ecology shows how synonymous the term has become with holism.

Social-ecological holism and the investigation of living aquatic resources

This thesis applies an ecological approach to political ecological and geographical research in order to analyse the disjuncture between global orthodoxies, development policy and the realities of rural Lao communities exploiting living aquatic resources. Central to this is ecological holism and the influence of multi-linear processes over the use, management and development of natural resources and environment. As shown above, the research reveals that aquaculture and capture fisheries are linear categorisations that do not reflect the complexity, diversity and resilience of human-environmental interaction. Taken together within a multi-linear ecological understanding social, political, economic and cultural processes emerge from household through to national and international scales.

Holistic systems are commonly referred to as being more than sum of their parts. That is, by understanding the complexity of the systems, as opposed to its constituent parts in isolation, properties emerge that otherwise would not (see Keller and Golley 2000). These 'emergent properties' are essential to an understanding of any social-ecological system and are evident in the analysis of living aquatic resources presented in this thesis. The historical context of living aquatic resources presented in Chapter 3 shows the contemporary cultural importance of fish and other aquatic animals to rural Lao society. The spatial analysis in Chapter 4 and the market analysis in Chapter 5 highlight the influence of scale over perceptions and representations of living aquatic resources. The common understanding is that fish ponds are dug in response to a shortage in natural aquatic resources and to provide a cheap source of protein to poor consumers. However, an ecological approach breaks down these perceptions by looking at the interaction of different fish and the decision making processes of fishers, farmers and traders. Instead the construction of fish ponds and the trade of fish are seen as decisions that are based on a range of emergent properties such as environmental, cultural and social connectivity.

The livelihood analysis in Chapter 6 shows the social and cultural importance of living aquatic resources to emergent properties of well being surrounding poverty and livelihoods. This draws directly on Sen's (1999) notions of capabilities, well-being and freedom as responses to the simplistic quantitative measures of poverty and also the sustainable rural livelihood approach as an integrative understanding of community subsistence (Scoones 1998; Ellis 2000). Finally, the policy analysis in Chapter 7 reveals the politics and power associated with decision making for living aquatic resources. Each of the chapters shows the importance of emergent properties in providing context and meaning to the decisions over the environment and livelihoods.

Emergent properties are therefore evident in a number of contexts and represent an integrated understanding of social and ecological systems analysis. They emerge from the *entorno*, a concept developed by Malpartida and Lavanderos (2000) and introduced in Chapter 2. *Entorno* is an heuristic tool that promotes a post-structural understanding of human-environment interrelations in opposition to rigid models such as ecosystems and energy transfer. Instead of focusing on the quantifiable links between human and non-human entities *entorno* focuses on a situated and contingent 'space of interaction' that lies at the nexus of ecological and social systems. These concepts of 'situatedness' and 'betweenness' are useful in the context of understanding the highly malleable and contingent nature of human-environment interaction. They also provide an opportunity to draw on an eclectic group of epistemologies and methods so as to understand the multiple perspectives involved in management and research of politicised environments and natural resources. The *entorno* therefore provides an heuristic space for explaining interactions that are not structured but instead represent the sum of the relationships and linkages that constitute the human-environment interface within complex social-ecological systems.

Figure 8-1 shows a graphic representation of the *entorno* as a space of interaction between social and ecological systems influenced by scaled forces and the emergent properties that emerge from the analysis of these interactions. There are four main components of this model (letters refer to Figure 8-1):

- A. Social systems – these include livelihood activities, social and cultural institutions, local knowledge and markets and trade. Each of these was

investigated in the preceding chapters of this thesis.

- B.** Ecological systems – these include hydrological system, fish ecology and migration, resource availability for feed and land use (forests, wetlands and agricultural land). Each was dealt with in this thesis.
- C.** Scaled forces – these include a range of political, social, economic and cultural influences stemming from global to household scales. The analysis in this thesis focused mainly on the influence of knowledge and power as mediated through the politics of government and non-government organisations.
- D.** Emergent properties – These include: integrated understanding of poverty and well being; cultural, social and environmental sustainability; power and equity over resource access; politics of resource access and use of technology; and finally, social and cultural cohesion.

Instead of seeing these linkages as linear cause and effect a more dialectical approach to social-ecological systems is developed that informs political ecological investigation of the broader influences over the knowledge, ideas and representation of human-environment interaction. The concept of *entorno* is central to this understanding. It can be represented at individual, household, national and regional scales. Understanding the interaction of humans with their environment has a long and contentious history of scholarship with a burgeoning literature (e.g. Worster 1994). The *entorno* circumvents this debate by stressing that the specifics of this interaction are not the main focus of analysis. The *entorno* provides a metaphysical space that focuses on the interaction of social and ecological processes. Backed up by grounded research this model provides a starting point for bringing in a wider understanding of social and ecological systems within a political ecology framework.

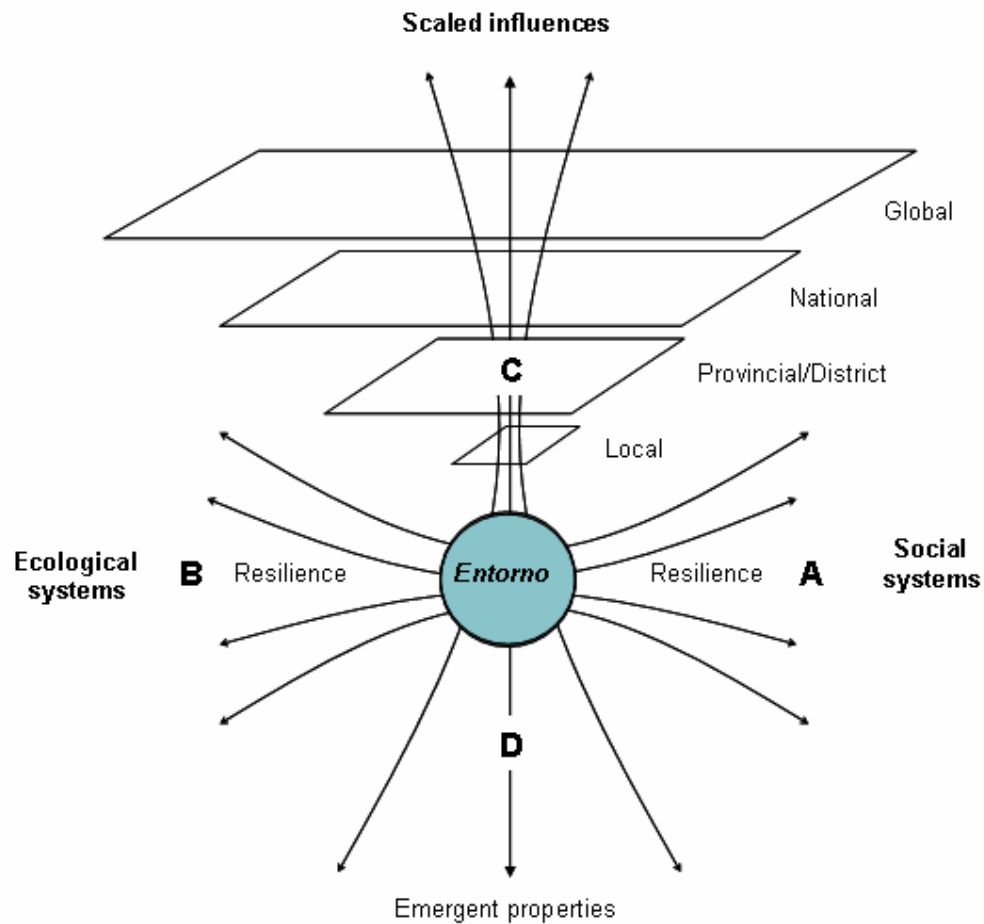


Figure 8-1 Social-ecological systems and emergent properties

Note: See text for description of A,B, C and D (Developed from the work of: Malpartida and Lavanderos 2000; Scoones 1998; Folke *et al.* 2003)

Example: The fisheries-aquaculture continuum

The aquaculture-fisheries continuum of Guttman provides a valuable model for applying an ecological approach to human-environment relations and a political ecology of living aquatic resources. The continuum highlights the range of locally contingent and flexible activities. Furthermore, the continuum provides an entry point for conceptualising how individuals, households and communities position themselves amongst different activities and how scaled influences affect the decisions over what activities are selected.

In an ecological approach to living aquatic resources the continuum is placed at the intersection of multiple processes and as such is represented by the *entorno* (see Figure 8-2). Again, multi-linear systems or multiple equilibriums are revealed that place

aquaculture and capture fisheries as situated and contingent responses. Assuming complexity and diversity of living aquatic resources within the context of wider scaled processes means that orthodoxies are critically examined and, moreover, that space is created for alternative knowledge and ideas to gain prominence. This model is especially important in, but not restricted to, a developing country context such as in Lao PDR where linear representations, drawing on simple cause and effect, gain prominence as a result of a chronic lack of information and the highly politicised agency of development organisations.

The results of this thesis can be framed within this modified framework for a geography of living aquatic resources. The thesis began with the recognition that living aquatic resources in Laos are instructed by global orthodoxies that promote aquaculture and are supported by both socialist and international development rhetoric. Social, cultural and political influences provide context to the conditions under which decisions are made about resource use at the village level. The outcome is a set of decisions over resource use that are the product of scaled, multiple, simultaneous processes. An integrated geography of living aquatic resources shifts analysis away from examining how to improve extension services of new activities to farmers to how and why existing activities support rural livelihoods. This includes a range of emergent properties such as cultural and social aspiration, sustainability, cultural interpretation and social cohesion. These are revealed on the axes of investigation between social, political, cultural and economic influences in Figure 8-2. An integrated approach creates space for alternative development and management initiatives that reflects both the perceived and instrumental needs of farmers relevant to the Lao context.

Problems with an ecological approach

The ongoing debate between reductionism and holism in ecology has not been widely addressed within political ecology research. It is argued that ecological thought proclaims an inherently holistic epistemology and ontology while the precepts of a systematic and scientific ecology remains reductionist. It therefore appears counterintuitive for ecological thought to proclaim holism while being largely based on reductionist methods and practice (Bergandi and Blandin 1998). This is an inherent limitation epistemologically, ontologically and methodologically. As political ecology

extends the epistemological basis of researching human-environmental relations the argument between holistic approaches and reductionist methodologies will persist.

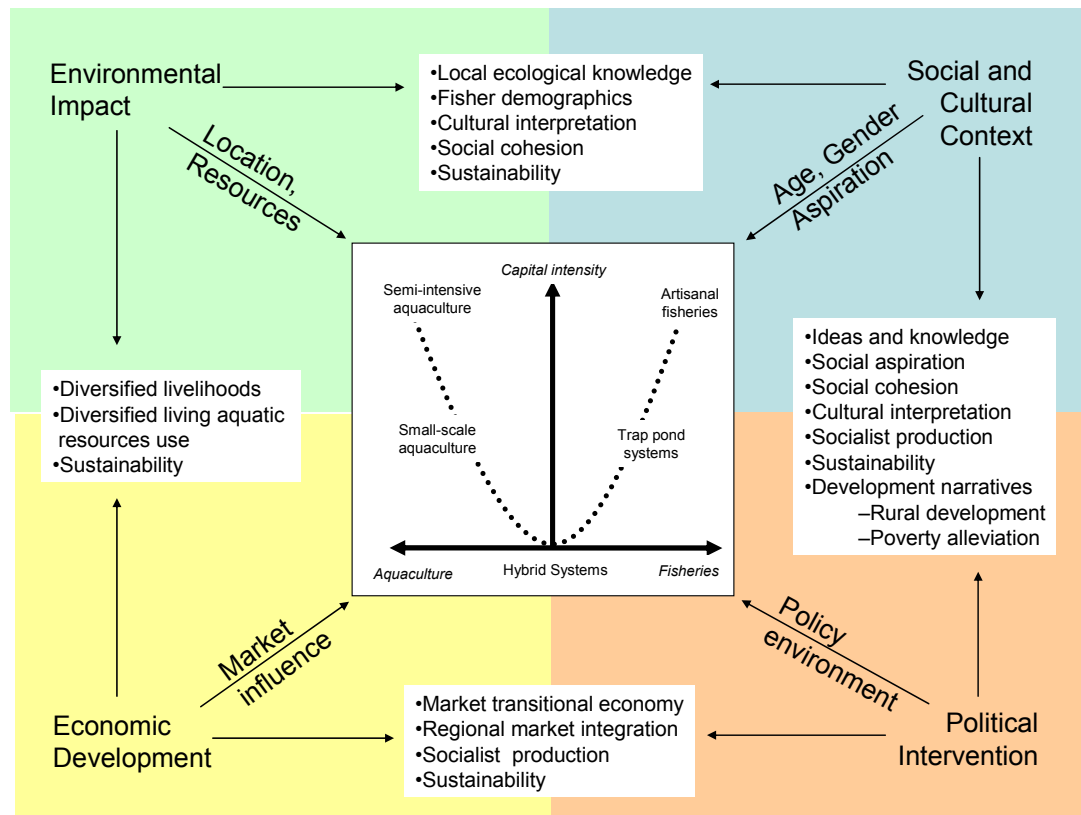


Figure 8-2 An ecologically based approach to living aquatic resources research, management and development

The ecological holism debate hinges on whether emergent features can be revealed through reductionist methodologies. Bergandi and Blandin (1998) argue that the inability of ecologists to adequately move beyond reductionist methods and epistemologies has meant that holism in ecology is a mere chimera. The danger lies in adhering to holistic ontologies while using reductionist methods (Bergandi 2000). An approach that focuses only on emergent properties runs the risk of metamorphosing into a hybrid form of “reductionist holism”. Such a change means that emergent properties are reduced to those that are measurable. The outcome is a return to simplified linear, reductionist models of explanation that reduce the complexity they seek to explain.

Political ecology, and indeed geography, has not sufficiently addressed the proposition that integrative research can be holistic. This may be a reason for the seeming lack of *ecology* within political ecology. Much of the recent attention given to integrative research in political ecology looks specifically at the complexity of human-environmental research in theory but provides little in the way of methodology. This thesis purports to reveal the integrative nature of political ecological research based upon reductionist methodologies and epistemologies. However, Bergandi's question persists: has ecological research, including social science based ecology, come to an ontological impasse?

8.2.2 Methodological insights - a geography of living aquatic resources

The advances made in promoting holistic approaches to human-environmental research have not been matched with advances in methodologies. Moreover, political ecology methods must focus on how emergent properties can be revealed without falling into the trap of "reductionist holism". These are long-standing debates and an answer is not provided here. However, some insights of how this impasse was negotiated through the central notion of an *entorno*, or aquaculture-fisheries continuum, are instructive.

This thesis applies multiple methods ranging from quantitative surveys, to participant observation, participation based livelihoods analysis and policy analysis. As such the research addresses multiple influences over human-environment interaction that influence the *entorno* based focus of the thesis – the aquaculture fisheries continuum. Each method is reductionist. However, these methods do not attempt to study the *entorno* itself, but rather the influences over this relationship through a geographically based political ecology. Focusing on these influences from outside the *entorno* reveals the emergent properties of the system.

A definitive strength of political ecology is the promotion of integrative research methods. This is a central feature of hybrid research promoted by Batterbury *et al.* (1997). They stress the need for combined research initiatives between physical and human sciences and so avoid reiteration of inaccurate orthodoxies. This is holistic in the sense of incorporating a diverse set of questions and enquiry, but the methods applied remain essentially reductionist. Robbins (2004) takes this argument further in his *hybridity* thesis. Influenced by the work on actor network theory he argues for an

examination of the products of human and non-human interaction focusing on the changes to social and environmental systems through their mutual interaction. By studying these changes a clearer picture of the power and agency of knowledge, people and institutions in environmental change emerges.

These studies argue for integrative methodologies but do not resolve the problems inherent in the holistic-reductionist divide. There remains a need to practically address complex social-ecological systems within a political ecology framework.

8.2.3 Implications for policy

An ecological approach to living aquatic resources should be reflected in the policy and planning of both government and non-government organisations. This is as much about process as it is about content. It is not only important to collect more informed and publicly debated (or democratised) information but also to ensure the ensuing knowledge is used to influence policy at practical management levels (Batterbury *et al.* 1997).

This thesis has argued that in policy and planning aquaculture and capture fisheries must be seen as parts of a wider system of living aquatic resources, the management and sustainability of which is an imperative of sustainable rural livelihoods. In doing so knowledge must move beyond a linear understanding that sees aquaculture as synonymous with fisheries. To achieve this the policy environment must critically assess the role of aquaculture within the imperatives of rural development and poverty alleviation and reframe capture fisheries as a central part of rural livelihoods, not only as relevant to conservation.

At the national level there is an over-emphasis on the development of aquaculture capacity. This is an issue of process. Development in Laos is driven by socialist rhetoric and the international development community. The uneven power relations between government and non government organisations means that prevailing international experience, such as those expounded by the global fisheries crisis, gain prominence in development rhetoric. An inclusive approach to living aquatic resources development is required that sees aquaculture as one small activity within a wider range of fishery activities.

Furthermore, the results show that communities, and individuals within those communities, have aspirations that are politically, socially and culturally embedded. As such their perceptions do not necessarily reflect the material importance of the resource. This is exacerbated when considering that those who promote an activity such as aquaculture will inevitably have the resources necessary to both adopt and practice that activity. Poor people are therefore not the main adopters of aquaculture. This is a controversial finding as it contrasts with the poverty focus of the government. However, it is one that has to be considered if policy is to address poverty alleviation and equitable rural development.

Living aquatic resources policy in Lao PDR must recognise and emphasise capture fisheries. This requires collection of not only data but timely and substantive information on which to base management and development decisions (see Coates 2002). This holds implications for the process of policy formulation. The lack of information available is compounded by the diverse interests and beliefs that frame living aquatic resources in policy and planning. Policy and project implementation must move beyond these programmatic, mechanistic approaches to a more negotiated process through which not only the needs of communities are identified, but also the aspirations of these communities and the wider influences that impinge on decision making in rural livelihoods.

An ecological approach is as much about the process, as it is about the content of policy and planning. As outlined above, understanding human-environment relations in terms of power and agency, coupled with an appreciation of the complexity and diversity of social-ecological systems, is a critical step towards better informed policy formulation.

8.3 Further research

Greater awareness of the importance of living aquatic resources to the livelihoods of rural communities in developing countries requires a concerted effort on the behalf of researchers, policy makers and international organisations alike. Data and information must be collected that contributes to a wider project of understanding social-ecological systems and the political ecology of living aquatic resources.

Further research should focus on the instrumental importance of these resources, such as the contribution of other aquatic animals in consumption, income in supporting rural livelihoods as well as their contribution to the national economy over different environments in both lowland and upland areas. However, such research should be coupled with a better understanding of the socio-cultural and socio-political influences over living aquatic resources. Building on this information base, research could investigate the potential for integrated management systems of living aquatic resources that are locally contingent whilst being supported by government aims and agendas. Research in Lao PDR could make huge gains in this area, building on the already growing interest in co-management systems.

The geographical scope of this thesis has been limited. There is great potential to replicate this study in other parts of the Mekong Basin as well as in other river basins around the world. The problems addressed here are not unique to Laos but reflect a common problem of inland fisheries the world over. How are living aquatic resources framed in different parts of the world? Under what conditions does aquaculture extension succeed and how does this relate to capture fisheries resources? The main focus should remain on the critical assessment of the power and agency of orthodoxies in governing the management and development of living aquatic resources.

The theoretical and practical application of an ecologically enhanced political ecology is also a pressing area of research. This should be promoted through a practically based political ecology stressing the complexity of human nature relations and also wider politicisation of the environment by taking into consideration the wider interactions between scales of management and the utilisation of the environment.

8.4 *Final comments*

Critical assessment of global orthodoxies is a positive contribution to realistic, equitable development. However, critique and refutation go hand in hand with the formulation of alternatives. This thesis has shown serious shortfalls in the use of aquaculture as a panacea for rural development and poverty alleviation, but it has not rejected aquaculture out of hand. Aquaculture has a role in the provision of nutrition and income to the population of Laos and, indeed, to the world as a whole. What is required is a recognition that aquaculture contributes to the livelihoods of a minority of farmers,

whereas capture fisheries resources contribute to the majority. Limiting the scope of living aquatic resources to aquaculture is potentially damaging to progressive attempts at halting or reversing fisheries degradation, as well as promoting poverty alleviation and rural development.

Critical examination of technology based solutions to natural resource degradation is not an anti-development stance. Instead it creates space for the emergence of alternative paths that are based on more realistic responses to the myriad of cultural, social, political, economic and environmental influences. Alternative models for living aquatic resources management and development are few and far between, but they do exist. The challenge is to reveal these alternatives from under the weight of hegemonic discourses by changing attitudes and promoting an ecological awareness, whereby the relationships between humans and the environment are seen, felt and understood more clearly.