Migration, Social Capital, and the Environment:

Considering Migrant Selectivity and Networks in Relation to Coastal Ecosystems[1]

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Abstract

This essay shows that there is a timely convergence of ideas and demand for empirical evidence for understanding the relationship between migration and coastal ecosystems. It explores a limited set of theoretical pathways from which hypotheses might be derived about the positive and negative impacts of migration upon the environment. These pathways are derived from a discussion about property relations in coastal ecosystems and current theory about migration processes. Social capital emerges as a key concept in both literatures enabling a productive, theoretical synthesis. In conclusion, some examples from recent research about coastal ecosystems are used to generate a future research agenda that systematically addresses measurement, methods, and modeling approaches for refining our understanding of the possible impact of migration upon coastal ecosystems.

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1. Introduction

The purpose of this essay is three-fold. First, to show that there is a timely convergence of ideas and demand for empirical evidence for understanding the relationship between migration and coastal ecosystems. Second, to explore a limited set of theoretical pathways from which hypotheses might be derived about the positive and negative impacts of migration upon the environment. This discussion will draw upon evidence about property relations in coastal ecosystems and current theory about migration processes. Social capital emerges as a key concept in both literatures enabling a productive, theoretical synthesis. Third, to outline a future research agenda, given the preceding discussion, that addresses measurement, methods, and modeling approaches for refining our understanding of the possible impact of migration upon coastal ecosystems.

Thus far, the migration and environment literature has not systematically or completely developed a theoretical or conceptual framework for considering new concepts in the migration literature, such as social networks and social capital in relation to the physical environment. This essay will draw evidence from cases in less developed nations, but the generalizations may not be limited to such contexts. My assumption is that the set of social relations defining natural resource use by people (consumption, exploitation, management, investment) is a critical intervening variable between migration and environmental outcomes. The set of social relations defining natural resource use are described in the environmental literature generally as property relations, which can vary from open access, to common property (with varying degrees of local and state participation), and to private or market-based relations (Ostrom 1996). Given the importance of this intervening context, two questions must be answered simultaneously to refine our understanding of the impact of migration upon the environment: *Which migrants with access to which resources? And, how are these migrants embedded in the set of social relations defining ecosystem use in a place of destination?* The purpose of this essay is not to answer these questions definitively, but to employ the theoretical concepts of social capital, social networks, and embeddedness in the migration literature to generate hypotheses that predict positive or negative environmental outcomes in a given context, or system of property relations.

Coastal ecosystems are of particular interest because a growing proportion of the world's population lives within 50 kilometers of a coast(Long 1990; Cohen and Small 1998; Hinrichsen 1998). Over the next century global warming threatens to impose dramatic constraints on land use as world sea levels rise(Cohen and Small 1998; Doos 1997). Coastal ecosystems are among the most rich and diverse in the world providing important global functions for marine ecosystems and atmospheric composition. Finally, coastal ecosystems have proved more difficult to manage through privatization or market

relations. Coastal waters, beaches and tideplains are likely to be organized as either open access systems or more likely some form of common property relations (Berkes and Folke 1998) with implications for perhaps greater vulnerability to disruption as a result of migration in or out of the ecosystem. Thus, they represent a particular challenge for understanding how migration has an impact upon ecosystem sustenance and consequently human well-being.

2. What Do We Know?

In this first part of the essay I show a timely convergence of ideas and demand for empirical evidence for refining our understanding of the impact of migration upon coastal ecosystems. This is done through a description of the rate of migration to coastal ecosystems worldwide, the resource valuation of coastal ecosystems, and the growing demand for particular coastal ecosystem products. This description is followed by a brief summary of the literature on migration and the environment to situate the present paper. Finally, the last two sections in this part of the essay describe theoretical innovations in the literature on common property resources and the literature on migration. In both cases, the theoretical developments have been to incorporate social capital into current models of human behavior. In the case of the ecosystem literature, this has meant greater recognition of the subtle and complex set of social relations governing common property resource. In the migration literature, this has meant greater recognition of the role of social networks and the interaction of migrant selectivity with social context for understanding migration processes. Each of these developments will be described briefly before continuing to the second part of the essay, which uses illustrative cases to sketch possible explanations for how human migration relates to the environment.

2. a. Convergence of Ideas and Need - Migration and the Coastal Environment

2.a.1. Migration and the Coastal Ecosystem

Coastal ecosystems provide numerous benefits to humans. They produce fish and other natural resources like wood for human consumption. Fish are vital elements of the world's food supply, accounting for 16.5% of human's animal protein and 90% of fish for consumption come from coastal areas, as opposed to the open ocean (Burke et al. 2001). Not only do they account for most of the fish consumed by people, but coastal ecosystems serve critical capacities in fish life cycles (e.g. breeding grounds or sources of food for marine fisheries). Besides fish, coastal ecosystems provide wood (many from mangrove forests) and building materials (lime stone) in many developing countries. As with tropical rainforests, there is widespread agreement that coastal ecosystems offer invaluable ecological necessities such as clean air, genetic diversity and nutrient cycling (Burke et al. 2001; Burke, Byrant, McManus, and Spalding 1998; Hinrichsen 1998). Additionally, coastal ecosystems are inherently beautiful making them a magnet for the world's population.

Population growth along coastlines grew about 10 percent between 1990 and 1995 (Burke et al. 2000) representing 39 percent of the world's population, if one

delimits a 100-kilometer inland range.[2] Within a still more narrow inland range, by 1995 twenty percent of the world's population lived within 25 kilometers of the coastline (Burke et al. 2000). Many argue that concentrated coastal populations have a profound impact on marine coastal ecosystems through shoreline development, subsistence activities, commerce, and recreation (Burke et al. 2000; Ruilai 1992; Burke et al. 1998; de Fontaubert, Downes, and Agardy 1996). Much of the growing concentration of population on coastlines can be attributed to in-migration and urbanization rather than natural population growth (Hinrichsen 1998). When coastal ecosystems coincide with urbanization they are often at risk of greater pollution because effluent dumping is easier to achieve along coastlines and access to shipping (which is less expansive than overland transport) increases the likelihood that industrial sites will locate along coastlines. Some have also argued that coastal ecosystems are an ecological destination of last resort in many less developed nations (Agardy 1997; Bernacsek 1986). In this case environmental refugees from land-based ecological systems move to the coasts to exploit resources. These migrants have few financial resources, know little about ecosystem functioning along the coast and do not have the cultural, historical, or social capital to effectively manage the coastal ecosystem (Bernacsek 1986).

Not surprisingly about half of the world's coastlines are threatened by development, according to the World Resources Institute (Burke et al. 1998; Burke et al. 2001). Mangroves provide a good example of a threatened coastal ecosystem, partially due to the considerable data that are available, but mostly due to the disconcerting loss of mangrove habitat in the last 50 years. Mangroves cover anywhere from 8 to 25 percent of the world's coastlines (Spalding and Grenfell 1997), and have declined by 50 percent in the last 50 years (Kelleher, Bleakley, and Wells 1995). Some countries have lost up to 85 percent of their original mangrove habitats. Coral reefs are another striking example of a resource prone to coastal ecosystem degradation. They have been referred to as the tropical rainforests of the ocean, and we are just beginning to understand their significance to coastal ecosystems and possible benefits to humans. Nonetheless, they are being degraded faster than ever from pollution and run-off from coastal development, unsustainable fishing practices such as cyanide or dynamite fishing, the development of shrimp farms (Parks and Bonifaz 1995) and coral reef bleaching due to the global increase in ocean temperatures (Burke et al. 1998; Sheppard 1999). Finally, farmed fish and shellfish activities have more than doubled in the past 15 years, primarily within coastal ecosystems. Although many believe this growth relieves pressures on ocean fisheries, there is growing evidence that pollution from intensive aquaculture and the harvesting of wild stock for carnivorous farm fish may lead to a diminishment of ocean fisheries(Naylor et al. 2000). In fact, Goldburg and Triplett (1997) find that aquaculture systems do not diminish demand for natural fisheries resources, instead they expand demand by creating new markets.

The human relationship to coastal and marine ecosystems has increasingly recognized some form of community property resource regimes predominating (Ostrom 1996; Ostrom 1987; Ostrom, Burger, Field, Norgaard, and Policansky 1999; McCay and Acheson 1987; Pretty and Ward 2001; Begossi 1998; Naylor et al. 2000; Palsson 1998;

[2] This is a relatively conservative estimate and the range of estimates varies dramatically. The UNEP estimated the figure to be 60% of the world's population living within 100 kilometers for the Rio convention.

Hanna 1998). Open access conditions used to be assumed to prevail in marine systems, although there is a growing chorus of dissidents on this point (McCay and Jentoft 1998; McCay and Acheson 1987; Begossi 1998; Naylor et al. 2000; Berkes and Folke 1998; Folke and Berkes 1995; Palsson 1998). In fact, fishing in many locales is often regulated to more or less success by, at the very least, norms (Palsson 1998; National Research Council 1997). And, Pretty and Ward demonstrate the predominance of common property institutions in a wide variety of ecological or environmentally important contexts, including marine and water systems (Pretty and Ward 2001). The growing recognition of the prevalence of common property regimes has generated concern about the institutions' resilience in the face of social change, their dynamics, and the varying role of local and national governance. One avenue of research concerns how population change affects common property regimes.

Some have argued that common property regimes are necessarily diminished by population growth (either through natural increase or migration) and thereby population growth contributes to environmental deterioration (Panayatou 2000). Others counter that common property resource institutions respond resiliently to the pressures of population, economy, and politics if the tools of management are in the hands of local communities with the support of national governments for enforcement (McCay and Acheson 1987; Ostrom et al. 1999). However, until now, there has been little empirical research or theoretical motivation to examine the ways in which migration patterns may differentially impact common property resource institutions across a wide array of ecosystems, including coastal ecosystems. Because human interaction within coastal and marine ecosystems are most likely to be organized around varying forms of common property resource regimes and because human migration to coastal ecosystems has continued at increasing rates over the last fifty years it becomes imperative to understand how migration and common property resource management interact to affect environmental outcomes in coastal ecosystems.

Humans depend on coastal ecosystems to sustain healthy lives, but the health of coastal ecosystems depends on sustainable human use and care. This dependence and sustainability is intricately related to migration processes, about which theorized pathways of relations have yet to be fully developed. There has been a growing literature examining the reciprocal and dynamic relationship between migration and the environment, but the focus has been upon land-based ecosystems and not upon coastal or marine ecosystems. The following section describes the findings from the primarily, land-based literature.

2.a.2. Migration and Environment (Population and Environment)

Much of the literature and research about migration and the environment began to emerge at the beginning of the 1990's as a result of growing concern that theory and research on population and environment was not taking into account the complexity of the relationship and the mixed empirical evidence relating population growth to environmental outcomes (and vice versa) (Zaba and Clarke 1994; Ness, Drake, and Brechin 1996; Davis and Bernstam 1991; Bilsborrow and Ogendo 1992). Consistent support for a Malthusian prediction could not be found in the empirical evidence and in some cases quite the reverse (Templeton and Scherr 1999; Leach 2000; Prabowo and McConnell 1993; Scherr, Bergeron, Pender, and Barbier 1997). The puzzle of

counterfactual findings generated a new level of theorizing and data collection, which turned the research focus towards studying more dynamic considerations of population factors (such as migration), intervening variables (social and economic organization), scale level variation in effects (with a tendency to expect findings at a more local or smaller scale). In this section I briefly describe the primary theoretical paradigm guiding most research in this field, i.e. population-environment multi-phasic response theory (Bilsborrow and Ogendo 1992; Davis 1963), and then summarize the findings from the literature on migration and the environment.

Migration has been described as "an extremely varied and complex manifestation and component of equally complex economic, social, cultural, demographic, and political processes operating at a the local, regional, national, and international levels…" (Castles and Miller 1993). As complex as migration is, the environment is equally so. And it is similarly problematic to remove environmental processes from the social, economic, political and institutional structures of which they are a part (Bilsborrow 2000). Therefore, drawing a linear, deterministic relationship between environmental degradation and migration is inappropriate and impossible(Zaba and Clarke 1994; Lonergan 1998). The current preference in the literature is to conceptualize the relationship as complex system meets complex system demanding longitudinal and multilevel approaches (Marquette and Bilsborrow 1999; Marquette and Bilsborrow 1997; Zaba and Clarke 1994). And several empirical case studies make evident support for this perspective (Sunderlin and Resosudarmo 1999; Burns, Kick, and Davis 1998; Silliman and King 1999).

The current theoretical paradigm dominating the migration and environment literature modifies a long-held demographic theory, multi-phasic response (Davis 1963), through specifying the intervening social relations and behavioral responses that would affect how population growth impacts environmental outcomes, specifically land-use practices (Bilsborrow and Ogendo 1992). The theory postulates that population growth affects land-use change through four stages, which can be consecutive, concurrent, or cumulative. I list them in the order they are presented in the original work(Bilsborrow and Ogendo 1992), which implies a consecutiveness: tenure regime change, appropriation of land (extensification), technological innovation, and demographic (out-migration) (Bilsborrow and Ogendo 1992).

This multi-phasic explanation for understanding the effect of population growth upon land-use change made important theoretical advances for many scholars in the field. However, it only considers two migration-environment relations – migration to places where there is "available" land (presumably organized under open-access or common property relations) and out-migration in response to limited environmental resources. Although more dynamic than previous theoretical models, it does not consider the varying forms of migration – return, repeat, circular, permanent, temporary – nor the selectivity of migration, nor how social networks and social capital may be important intervening variables for understanding migration impacts upon the environment. Despite these limitations, the empirical research that builds on this original theory begins to complicate the explanation through the recognition of four dimensions of the migration process: selectivity, origin/destination differences, remittances, and social institutions.

The following summary of the findings from the empirical literature shows that: (1) the selective nature of migration has an impact on environmental outcomes, including

variability in the type of migration; (2) environmental considerations at both places of origin and destination can serve as push or pull factors respectively (highlighting the reciprocal character of the relationship); (3) remittances back to places of origin may play an important role in redirecting consumption in either positive or negative ways for environmental outcomes; and, (4) migration affects the environment through social and economic institutions, such as land tenure and poverty.

One way in which the literature on migrant selectivity has attempted to show the variability of migrant impacts upon the environment is to compare spontaneous versus forced migration. The findings show varying results. In some cases, spontaneous migrants appeared to cause more destruction of the environment than forced migrants. In Indonesia, spontaneous migrants were associated with rates of deforestation twice those of the transmigrants (Bilsborrow and Ogendo 1992). In other cases, forced migration is generally worse for environmental outcomes in places of destination than is spontaneous migration. In Mexico, resettlement schemes of the 1960s and 1970s lead to extensive deforestation (Dwyer and Minnegal 1999; DeWalt and Rees 1994; Ewell and Poleman 1980). In the case of the Mexican tropical rainforest, in fact, spontaneous migrants adopted local management practices (Dwyer and Minnegal 1999). In Zimbabwe, migrants resettled through government programs were not interested in farming and did not invest in sustainable land use practices (McIntosh 1993).

Another way in which the literature on migrant selectivity has demonstrated differential impacts is to examine the impact of return migrants upon environmental consumption and valuation in places of origin. For example, return migrants to rural places in Ecuador have a lower impact on deforestation than do new migrants, although Bilsborrow (1992) does not specify a reason. In other instances, return migrants, especially if they are professionals or gained professional training while migrating, return to places of origin with a different valuation of ecosystem services and commitment to preserving the environment (Conway and Lorah 1995). In the case of the Caribbean islands, Conway and Lorah (1995) find that return migrants invest in the establishment of local NGOs for the protection of the environment. In another study of the Caribbean, return migrants invested in secure land holdings and proceeded to invest in long-term, sustainable agro-forestry projects (Thomas-Hope 1999).

However, most of the research on migration and the environment does not consider measurement of migrant selectivity in the traditional ways in which migrant selectivity is considered. Variation in age, life course stage, sex, or human capital of migrants has not been considered in regards to how variability in migrant stream composition might imply different environmental outcomes. Further, these selectivity issues can also be considered in relation to both origin and destination environmental outcomes, especially as these factors will differentially interact with the social institutions governing ecosystem management. An example from Kenya indicates that young male out migration from rural districts lead to a shift in agricultural production towards investment in more permanent agro-forestry crops through remittances (Gould 1994). Remittances were also used to invest in education rather than agricultural production (Gould 1994). Although the cumulative impact of these choices and their relationship to migrant selectivity were not completely explored in the Gould study, it would appear that selectivity has important impacts. Except for this example, migrant selectivity has not yet been completely explored in the literature. Later in this paper I will suggest some

possible ways to consider the relationship between migrant selectivity and environmental outcomes in future research.

A second way to summarize the migration-environment literature is to consider both origin and destination environmental outcomes as a function of push or pull factors. In the U.S., exploration of whether one is more important than the other reveals that environmental pull factors are more important than push factors (Hunter 1998). Similar findings are found in China (Ruilai 1992). However, one might consider that populations living in ecosystems of poor quality are less able to move, limiting the push factor in their decision to move (or not to move). On the other hand, those with the economic means to move to ecosystems of desirable quality will be more likely to move because of the destination-pull rather than origin-push characteristics, because they are less likely to be living in ecosystems of poor quality to begin with. The consideration of environmental push factors for motivating migration gains greater credence and evidentiary support in less developed country settings. Several case studies and general overviews of the literature show how environmental degradation leads to migration out of places of origin – resulting in the coining of the term "environmental refugee" (Bilsborrow and DeLargy 1990; Bilsborrow 1992; Bilsborrow and Ogendo 1992; Hugo 1996; Doos 1997; Kalipeni 1996; Lonergan 1998).

The push-pull paradigm holds considerable sway in the migration-environment literature – however, it begs the question of why and how people move to particular destinations and not others of equally high ecosystem quality, or why and how people move from particular places of origin and not others of equally poor environmental quality. Much of the explanation lies in understanding the intervening set of social relations organizing people's lives and their relationship to the environment. Some of the most important, new concepts in migration research, social networks and social capital, may provide some answers, but have yet to be deployed in analyses of migration and the environment. In fact, Lutz and Scherbov argue that where people move depends in large part upon social networks (Lutz and Scherbov 2000) and this factor may be equally as important for explaining migrant impacts upon the environment than sheer numbers of migrants, since social networks imply a degree of integration in both places of origin and destination affecting access to resources and resource valuation in both the short- and long-term.

Migrant remittances are a third way the literature has considered the impact of migration upon the environment. The pathways of influence appear relatively complex. Initial investigations sought to demonstrate how remittances were used to invest in land tenure security and consequently wiser land management or sustainability (Gould 1994; Dwyer and Minnegal 1999; Bilsborrow 1992; Lucas and Stark 1985). Generally results have shown positive effects upon limiting deforestation or promoting reforestation. Remittances have also been shown to shift consumption preferences away from local exploitation of the environment through increases in standards of living, sometimes through the investment in non-farm or non-natural resource based businesses (Bertram 1986; Connell 1994; Connell and Conway 2000; Gould 1994; Bernacsek 1986). Finally remittances have been shown to help maintain traditions in places of destination and origin through the investment in symbolic resources, including fishing – but not for commercial production (Felgentreff 1996) and to support village economies (Sofer 1993; Stanwix and Connell 1995). Remittances appear to be a critical element for

understanding the impact of migration upon places of origin, particularly. However, who remits, those migrants' investment intensions, characteristics of recipients of remittances, and the recipients' investment decisions as they relate to environmental outcomes are all descriptions that have not been made consistently in the migration and environment literature. Explanations for patterns may be linked to both migrant selectivity and migrant social networks. The flows of remittances and their investment in places of origin are intimately tied to the set of social relations in both destination and origin. It is to this aspect of the migration and environment literature that I now turn.

The variable impacts of migrant social networks and social capital upon the environment are the least theorized or conceptually evolved in the migration-environment literature. The general finding, especially in developing countries, implicates deteriorating social institutions in both place of origin or destination. In the case of migration impacting deforestation, most findings include important intervening characteristics of poverty, land tenure, export cropping systems and global demand, and agricultural mechanization (Bilsborrow and DeLargy 1990; Bilsborrow 2000; Bernacsek 1986).

Although return migration has not been systematically examined in the literature, it does suggest further evidence of the importance of stable social relations diminishing the negative impact of migration upon the environment. By implication return migrants' are embedded in a set of social relations which diminishes the impact of migration upon the environment in the destination (Bilsborrow and DeLargy 1990; Sawyer and Agrawal 2000). The way in which this might be so is not completely explicated in the preceding studies, but as will be show in the next two sections the literature on common property regimes and the literature on migrant social networks would have lead to such a prediction.

The human ecology literature on common property resource regimes, particularly the resilience of such institutions points to the importance of understanding social capital and social networks. Further, the general literature on migration suggests that social capital and social networks importantly explain choice of migrant destinations and the degree of assimilation. It is in the synthesis of the migration and human ecology literatures that I propose some theoretical tools for understanding how migration affects environmental outcomes in marine or coastal ecosystems where common property and open access regimes predominate. I turn first to the literature on property relations and the coastal ecosystem and then briefly discuss theoretical and conceptual developments in the migration literature.

b. Human Ecology and Common Property Relations

2.b.1. Common-Pool Resources and Common Property Relations

The human ecology literature finds that there is rarely a condition of open-access and therefore, by implication, Malthusian predictions of population size overwhelming environment resource quality unlikely (Berkes and Folke 1998; Folke and Berkes 1995). The findings in this literature also argue against a solution that involves privatization or socialization (Ostrom 1996; Ostrom 1987; Ostrom, Gardner, and Walker 1994; Ostrom 1990; Ostrom and Walker 1997; Ostrom et al. 1999; Ostrom 1998). The important lesson is that more solutions exist than Hardin's (1965) two extremes, but the presence of a local

community is probably insufficient to predict positive environmental management (Ostrom 1996). An inherent complexity is implicated with the realization of the preceding statements. To understand and model this complexity two terms have become de rigeur in the human ecology literature, *social capital* and *embeddedness* of individuals (or communities) within social networks of relations (McCay and Jentoft 1998; Pretty and Ward 2001). These two concepts will be strikingly familiar to migration scholars, especially those interested in migrant assimilation and patterns of transnational migration behavior (Portes, Guarnizo, and Landolt 1999; Portes and Sensenbrenner 1993; Portes 1996). Before exploring concepts of social capital and embeddedness in the human ecology literature I briefly discuss common pooled resources and common property resource regimes.

Scholars of common property resource management make explicit the distinction between the resource and the institution governing the social relations among people that affect the exploitation of the resource. For the former, common-pool resources (Berkes and Folke 1998; Ostrom et al. 1999) are defined by two problems: *exclusion* and *subtractibility*. Or, in other words, *exclusive* use of common-pool resources is very costly and individual exploitation *reduces* resource availability for other users. The latter characteristic is typically described as: people's short-term interests in using the resources may not be in theirs or others' long-term interests. Common-pool resources are found in both marine and terrestrial ecosystems, are both renewable and depletable, and can be either man-made or earth-made (Ostrom et al. 1999; Pretty and Ward 2001).

Common property resource institutions are the formal or informal set of social relations governing people's relationships within a particular ecosystem as they relate to resource exploitation (Ostrom et al. 1999; McCay and Jentoft 1998; Berkes and Folke 1998). This convoluted definition has emerged as a result of a decade of debate about what is a common-pool resource and to what extent and under what conditions local stakeholders manage resources for both current and future sustainable consumption (McCay and Jentoft 1998). Common property relations govern human interaction and resource exploitation through solving the exclusion and subtractibility problems – by restricting access and creating incentives for investment in the resource base. The past decade of research reveals a wide variety of institutions (formal and informal) with varying participation of local and national stakeholders, and varying success (Dwyer and Minnegal 1999; Begossi 1998; Joseph 1995; McCay and Jentoft 1998). Property rights are complex because they involve the management of a bundle of citizenship rights – the right to use a resource, the right to exclude others, the rights to manage resource, and the right to sell a resource.

Thus, the "tragedy of the commons" results, not from an inherent failure associated with a particular common pool resource, but from institutional failure to control access to the resource, and to make and enforce internal decisions for collective, long-term use (Berkes and Folke 1998; McCay and Jentoft 1998; Ostrom et al. 1999). Until recently, most policy approaches failed to recognize the formal and informal collective action of people within ecosystems, instead focusing upon individual behavior and attempting to modify individual motives (Pretty and Ward 2001). Despite recent recognition of this failing, policymakers are still faced with the dilemma of accomplishing a balance between individual, community, and national interests of cooperation and conflict (McCay and Jentoft 1998).

Four recent works in the human ecology literature point to the significance of social capital for explaining variable common property institution solutions to the social dilemma of Hardin's tragedy of the commons ((Ostrom et al. 1999; Ostrom 1999; Katz 2000; McCay and Jentoft 1998; Pretty and Ward 2001). These works have developed two approaches to social capital – one approach draws upon the concept of social capital as developed in some parts of the sociological literature (Coleman 1987; Coleman 1990; Putnam 1993) and the other approach focuses upon the "embeddedness" of human action (Giddens 1994; Granovetter and Swedberg 1992). I briefly review these two approaches as they relate to common property resource institutions.

The first approach emphasizes how the social bonds among people reinforce normative behavior and expectations(Ostrom et al. 1999; Katz 2000; Pretty and Ward 2001). These social bonds facilitate collective action, overcoming individual, self-interested behavior, for the benefit of the environment and other people. This seemingly altruistic behavior results from relations of trust and a history of experience with reciprocity and positive exchanges with others. In this model, "connectedness, networks, and group relations are vital characteristics of social capital" (Pretty and Ward 2001)p.211). From this perspective social capital grows through individual investments in social relations, but is fundamentally a characteristic of groups or communities and not a characteristic of an individual. Pretty and Ward demonstrate that social capital enhances collective capacity to manage watershed/catchment areas, agricultural irrigation, forests, integrated pest applications, and farmers' research. Katz demonstrates that communities where social bonds have been disrupted through migration into the community by "outsiders" are less likely to have the capacity to take collective action for long-term natural capital enhancement (Katz 2000). Ostrom draws a more general, but similar conclusion "When new users arrive through migration, they do not share a similar understanding of how a resource works and what rules and norms are shared by others. Members of the initial community feel threatened and may fail to enforce their own self-restraint, or they may join the race to use up the resource" (Ostrom et al. 1999)p.280). Implicit in both cases is that social capital is diminished through migration because migration disrupts the social bonds of reciprocity and trust which are required for collective action. The general assumption in this literature is that more social capital is better, although where social capital resides (which groups are most relevant) is also seen as equally relevant (Pretty and Ward 2001).

The other approach to social capital, which is not exclusive of the first, is to emphasize how human action is embedded within social relations. In contrast to the preceding approach, however, embeddedness emphasizes location within historically contingent social, cultural, economic, and political relations, as well as environmental conditions. Varying degrees of embeddedness (disembeddedness being the antithesis) can lead to either positive or negative outcomes for individuals, groups, or the environment. The key difference between the two approaches is not the existence of social bonds (which both approaches highlight as important), or that more social bonds are better (as in the first approach), but that each extractive action carried out by an individual or group has variable meaning to the individual or community. This meaning emerges because resource users are embedded in a variety of social institutions, which are themselves embedded, these institutions can include family, community, market or nation-state. McCay and Jentoft suggest a working hypothesis oriented toward

explaining individual behavior, as opposed to group behavior: "the social conditions required for tragedies of the commons may result from situations where resource users find themselves without the social bonds that connect them to each other and to their communities and where responsibilities and tools for resource management are absent" (McCay and Jentoft 1998)p.25. For example, a common fallacy is to assume that individualism causes tragedy of the commons scenarios. However, Davis and Jentoft (1993) show that by examining individual behavior, and questioning the term "individualism" among fishermen in Nova Scotia, they discern different fisher types. Utilitarian fishermen and rugged fishermen both look like individualists, but only the former type pursues actions with tragedy of the commons outcomes, because the former is more disembedded.

Although there are some examples in the common property resource literature that do imply an important role for migration, they do not systematically conceptualize social capital as an intervening variable. The two approaches outlined above, however, begin to suggest how migration may impact environmental outcomes through its impact upon social capital – either at a group or individual level.

2.b.2 Common Property Resource Relations in Coastal and Marine Environments

As mentioned earlier, many suggest there are extensive common property resource regimes within coastal and marine environments. This is primarily because of the common pool resource characteristics of the ecosystem components (inherent problems of exclusion and subtractibility) (Ostrom 1990; Berkes 1995; Berkes and Folke 1998). However, the success of management regimes are variable (Ostrom et al. 1999). But, evaluation of success or failure of management regimes in relation to ecosystem viability is particularly hampered by measurement dilemmas within the a coastal or marine ecosystem. Evaluating marine or coastal ecosystem viability or sustainability requires intensive longitudinal observation over wide ranging spatial areas on a scale much larger than that of terrestrially-based ecosystems (Agardy 1997). The required level of detail and intensity has not been systematically implemented for consistent observations in relation to varying management regimes. Thus, it is probably premature to draw conclusions about the impact of common property regimes upon environmental outcomes within marine or coastal ecosystems. This issue will be addressed in the conclusions to this essay with regards to methodological approaches for understanding the relationship of migration to coastal ecosystem viability.

2.b.3. Common Property Relations and Migration

Typically, migration into an area is presumed to weaken the social bonds in a place of destination. This appears to be the case in Guatemala (Katz 2000), Ecuador (Bilsborrow 1992), Mexico (Howard and Homer-Dixon 1996; Izazola, Martinez, and Marquette 1998), the Himilayas (Jodha 1998), and Brazil (Martine 1993; McIntosh 1993) where movement into a community not only puts added pressure on resource extraction, but diminishes trust, reciprocity, exchange and social bonds (Ostrom et al. 1999). But, this is not always the case. In Indonesia, transmigrants clear half as much forest as spontaneous migrants because, by implication, they have greater collective action capacities through greater embeddedness in political and social institutions at all levels (Bilsborrow 1992). In Ethiopia particular property systems are deployed to attract

migrants to communities (Bauer 1987). Further, migration out of a community may serve to embed an origin community more effectively, enhancing capacity for long term resource management (Begossi 1998; Bauer 1987).

To my knowledge, there has been no systematic analysis of how migration affects common property resource regimes (or vice versa) either through embedding processes or disruption of social capital. A key element for understanding social capital and migration is to understand the role of reciprocity in this process. In particular, who does the reciprocating and with whom reciprocation occurs or is expected to occur? Are there reciprocal exchanges of resources (either natural, financial or social) among migrants at a place of destination, between migrants and non-migrants in a place of destination, or between migrants and their origin communities? Does the variability in reciprocal systems of exchanges affect the embeddedness of migrants and non-migrants within their social and ecological community of origin or destination? Asking and answering these questions, which naturally emerge from migration studies, may yield important insights for why migration has both positive and negative outcomes for common property regimes and subsequently inconclusive impacts upon the environment. These two questions also imply an emphasis upon the second approach towards social capital, embeddedness. I turn now to briefly describe two dimensions of migration theory and research that are considered critical for understanding the social impacts of migration in both places of origin and destination.

2.c. Innovations in Migration Research

Broadly construed there are three lines of inquiry that yield important insights about the migration process. I begin with one of the earliest observations about migration, which is that migrants are highly selective representatives of a population. Not just anybody decides to move. This finding has since been importantly modified by two considerations, which are the second and third lines of inquiry. First, theorizing the importance of social networks has been the most important innovation in migration theory. This theorizing based on empirical research shows that social networks have a cumulatively caused impact upon flows and composition of migrant streams(Massey 1990), as well as the rates and character of immigrant assimilation in places of destination (Massey 1998; Portes and Sensenbrenner 1993). The more established the social networks the greater the flows and the lower the selectivity of the migrant members. Second, social networks and selectivity coincide to create important dynamics between places of origin and destination with unpredictable outcomes, especially regarding the stock, flow and investment consequences of remittances. In this section of the essay, I briefly outline the conceptual and empirical findings in each of these lines of inquiry. This review is not meant to be all encompassing, but to help set the conceptual stage for the following discussion on the theoretical pathways relating human migration to the environmental.

Before continuing much farther, a brief digression on defining migration is needed. In the developed countries literature migration is generally acknowledged to be a relatively permanent change of residence that crosses jurisdictional boundaries (e.g. for internal migration it would be counties in the United States, or for international migration it would nation-state boundaries), measured in terms of usual residence at a prior point in

time, typically 1-5 years earlier. Local moves within jurisdictions are referred to as residential mobility ((Greenwood 1997)p.651). This definition becomes fuzzier when migration is considered in a developing country context, where research in the last decade demonstrates the importance of understanding the contribution of temporary, circular and return migration to development processes, besides understanding permanent migration (Lucas 1997a). Growing recognition of these short-term moves has raised measurement concerns about standard measures used in national censuses and developed country contexts (Lucas 1997a). Defining the type of migration process affecting a particular origin or destination is critical for understanding its impact upon environmental outcomes. Each type, permanent, return, temporary, or circular implies different levels of human, financial, and social capital investment in destination and origin and by implication will have variable impacts on natural capital stocks and flows. Thus, it becomes imperative that research on migration and the environment take a more systematic approach to understanding the stochastic variability of human movement.

2.c.1 Migrant Selectivity - Human, Financial, and Social Capital Variability

The fact that only particular individuals are likely to move out of a place of residence may not be surprising. But it is surprising that there are consistent findings across most contexts (both developed and developing), specifically that age and education predicts migration. Typically migration reaches its peak probability when people are in their mid- to late twenties. And, within each age class the probability of migration tends to rise with education. These findings are more complexly defined in less developed countries, where out migration from rural areas is typically complicated by access to financial capital, related to both age and education. Access to financial capital typically follows a u-shaped pattern in relation to migration. People from very poor households and from rich households are more likely to move than are those from the middle-income range (Lucas 1997a). Less is known about whether these patterns relate to all types of migration (i.e. temporary, circular, return or permanent). In fact, there is some evidence that short-term migration is less related to current human capital (age and education) and more related to target saving strategies, such as investments for marriage, education, land, home, item capital or retirement (Lucas 1997a).

The preceding discussion implicates economic opportunity as a primary reason for migration and selectivity patterns. However, other reasons are more social. In many places marriage is an important explanation for migration. And, depending on whether marriage systems are matrilocal, patrilocal or neolocal may yield very different patterns of migration. Similarly, in some cases migration may be a result of an initial move by one member of the family followed by subsequent moves by the rest of the family, resulting in family reunification or family migration. Thus, much of our understanding of migrant selectivity depends on how we understand the motives for movement. Nevertheless, this discussion also demonstrates that the composition of most migrant streams can be usefully characterized in terms of its human and financial capital content.

These characterizations matter for understanding the impact of migrants upon the environment because knowledge, technology and finances facilitate exploitation or investment in natural capital in a destination. Thus, variation in the composition of migrant streams may explain variation in environmental outcomes in otherwise similar localities within an ecosystem. In section 3.a. of this essay a few ways in which

selectivity might variably impact ecosystem outcomes are noted in relation to fishing in Ecuador and India.

2.c.2 Migrant Networks - Defining Social Capital and Embeddedness

In an effort to explain variability in the composition of migrant streams over time and across locales, migration theory now conceptualizes the migration decision at a contextualized moment, where individual decisions are not atomistic but result because individuals are situated within social relations of families, households, communities, markets, and nation-states (Stark 1991). It is from this line of research inquiry that social networks emerged as a critical conceptual and measurement tool for understanding the decision to move (Massey 1990). Social networks in relation to migration are commonly understood as the links between residents in a community of origin and individuals living in another place, or with individuals who have migrated before regardless of their current residence (Massey 1990; Hugo 1998). Social networks increase the propensity of an individual to migrate to a specific destination through three mechanisms: (a) demonstrating feasibility (This includes informing the individual about the possibility of migrating to alternative destinations. The contact with former migrants makes individuals realize that they may be better off in a place other than their current residence (Hugo 1991)); (b) reducing the expected costs and risks **(**Among the mechanisms discussed here are the reduction of transportation and traveling costs by sharing information on routes and the safest and cheapest smugglers; the reduction of the risk of deportation through information about the safest places and times to cross the border; and the reduction of emotional costs. Social networks may reduce "assimilation shock" if immigrants arrive in an environment where others speak their language (Choldin 1973) and where living among other foreigners can easily prevent deportation (Massey 1990)); and, (c) increasing the expected benefits (This happens when contact with previous migrants helps in the job search process, by both reducing the "opportunity costs" of movement and increasing the long-term benefits (Massey 1987; Stark 1991; Taylor 1986). Social networks can also help to save and reduce living expenses and provide financial assistance upon arrival.)

One of the most important insights from this research has been that social networks are cumulatively caused. In other words, as migrant experiences multiply the marginal risks decrease and the marginal benefits increase thereby facilitating moves by individuals who would have been unlikely to take migration risks at earlier points in time. This means that older migrant streams will be composed of a greater diversity of individuals with much more variable human and financial capital at their disposal. Again, the variability in the history of migrant streams as it relates to the characteristics of migrants has not been systematically evaluated in relation to environmental impacts.

Within the migrant social network literature, the conceptualization of migrant social networks has not explicitly engaged with the social capital and development literature. However, it is easily linked because it uses terms such as trust, reciprocity, obligation, and information flows to describe how social networks facilitate migration (Curran and Saguy 2001).

Patterns of migrant assimilation are more directly engaged with the literature on social capital and they provide us with measureable concepts of social capital relevant to migrant assimilation – distinguishing among normative and instrumental types of social

capital formation processes. These concepts in the migrant assimilation literature dovetail more recent developments in the social capital and development literature that highlight the importance of distinguishing trust, norms, and networks as different, and not necessarily additive, components of social capital (Dasgupta 2000).

Specifically, Portes and Sensenbrenner (1993) identify how two forms of social capital can work to create opportunities and constraints for individual immigrants within immigrant communities. Immigrants who experience discrimination from the native born community, based on phenotypic or cultural differences, and/or whose options for exit out of an immigrant community are blocked (because of limited legal, political, or economic resources), and whose immigrant community in the place of destination has maintained an autonomous cultural repertoire, are likely to experience bounded solidarity. In this case, the social context of arrival in the place of destination enhances normative obligations towards the immigrant community and is expressed in a variety of behaviors (e.g. voluntarism, charity, and preference for co-ethnics in economic transactions). Social capital of this type is consummatory in nature, i.e. those making the claims on social capital rely on the normatively invoked generosity of others, whose generosity is unlikely to be repaid directly.

A second form of social capital, enforceable trust, relies on instrumental motives because the social antecedents of this form rely on economic resources and the sanctioning capacity of the community. Limited social and economic opportunities outside of the immigrant enclave, available in-group economic resources, and sanctioning capacity of communities to enforce reciprocity arrangements yields flexibility in economic transactions (fewer formal contracts), privileged access to economic resources (like employment or start-up funds), and reliable expectations that malfeasance will be addressed. In the short-run this can lead to the emergence of economically important ethnic enclaves of entrepreneurial vibrancy (Portes and Sensenbrenner 1993). This type of social capital is instrumental in nature, i.e. those making claims on social capital are expected to repay those claims to those who agree to the demands. The formation and accumulation of this type of social capital relies on transfers of assets among group members.

For both types of social capital, the longer an immigrant community experiences blockage and discrimination the greater the likelihood that cultural and linguistic resources are undermined, depriving the collectivity of the resources necessary to reward or punish members independently. Instead the collectivity has to rely on externally derived sanctions, primarily discrimination, which has the effect of downwardly leveling expectations and aspirations and limiting individual opportunity. Community ostracism by those left behind towards those who leave and abandonment of the community of origin by those who escape is a likely outcome (see examples in Portes and Sensenbrenner 1993). The result is a disembedding of the immigrant enclave from the larger social and economic community and subsequently limited access to opportunities for all members (Stepick 1992; Suarez-Orozco 1987; Portes and Sensenbrenner 1993).

Based on these accounts of migrant assimilation one can begin to describe variability in social networks not only in terms of the characteristic of the members (as was done in the earlier discussion of migrant selectivity), but in terms of the character of the relationships between a migrant and other members of the migrant community and in relation to external linkages to other social institutions and non-migrants in the place of

destination. The measurement of these phenomena occurs at the level of the individual, but can be usefully aggregated to characterize groups or communities.

This treatment of social capital as an asset of migrants distinguishes between those making claims on social capital, those agreeing to the demands of claimants, and the resource in question. But, this literature falls short of explaining which migrants are more or less compelled by bounded solidarity or enforceable trust. Recent theoretical work on social capital and development adds additional conceptual clarity. Not only is it important to distinguish between social capital forms built on normative behavior and reciprocity, but social capital must consider group members' relative positions within a community or social network (or relative power in relation to other members) as a key to understanding the successful functioning of collectivities and consequent development outcomes (Dasgupta 2000). Dasgupta suggests that social capital is greatest and will increase when successful claimants are not the elite members in a network but the poorest members (Dasgupta 2000, p.362) and the obverse occurs when social capital's distributive mechanism (either internally or externally) yields greater inequality (as Portes demonstrates in his examples of negative social capital outcomes (Portes 1998)). Both Dasgupta and Portes find that temporal conditions are the final, important element when considering social capital formation, its growth and its effects. For Dasgupta, it is the conditions that affect long-term versus short-term discount rates of all forms of capital. For Portes, it is similar, although embedding processes are the critical components for understanding discount rates.

How does this discussion contribute towards a more complete understanding of the relationship of migration, social capital and the environment? This discussion of migration and social capital relates directly to the human ecology and common property resource management literature, but provides greater conceptual clarity about embedding processes (McCay and Jentoft 1998). Firstly, it emphasizes understanding the social ties and resources (social and economic) available to immigrants in places of destination, depending on their relative position within a community – through their normative obligations and normatively induced behaviors within communities in places of destination and through the structure of their instrumental relationships. Secondly, it emphasizes the importance of understanding the type, flow and distribution of resources (social and economic) within and between social groups and social institutions. Thirdly, it emphasizes the importance of the length of temporal vision for affecting social capital formation, growth and its impacts, given the way migration occurs, who migrates, and the context of reception in the place of destination. These three aspects suggest a way for understanding the differential impact of migration upon the environment as mediated by the migrants' relationship to common property resource relations in places of destination. A few possible pathways for understanding this complex relationship are offered in section 3.b of this paper.

2.c.3. Connections between Origin And Destination: The Role of Remittances

The emphasis in the preceding discussion of migration is upon migrant relations in a place of destination. The role of remittances in the migration process mostly addresses migrant relations to places of origin. The literature on the impact of migrant remittances upon development outcomes in places of destination has focused on investment flows. First, remittances are found to increase income and wealth inequality

in places of origin (Massey 1988; Massey, Alarcon, Durand, and Gonzalez 1987; Stark, Taylor, and Shlomo Yitzhaki 1986; Stark, Taylor, and Yitzhaki 1986). Second, remittances are found to increase consumption, but not greater investments in productivity (Taylor et al. 1996a; Taylor 1999; Taylor et al. 1996b). Third, who remits and their relationship to places of origin affects the character of the investment (Lucas and Stark 1985; Portes et al. 1999; Curran and Saguy 2001). Finally, varying degrees of embeddedness in places of destination and relative to ties to place of origin affects the level and flow of remittances (Curran and Saguy 2001; Lauby and Stark 1988; Lucas 1997b; Durand, Parrado, and Massey 1996).

All of these aspects can be systematically studied in relation to migration impacts upon the environment. Some studies were already noted in the earlier discussion about the impact of migration upon the environment (see section 2.a.2), but few have systematically considered what is known about migration, remittances, and development in relation to environmental outcomes in places of origin and destination. In the next section of the essay (3.c), evidence from recent studies in the Asia-Pacific region, suggest the importance of migrant remittances for altering the social relations governing coastal environmental resource use and management in places of origin.

3. Migration, Property Relations, and Coastal Ecosystems

In this part of the essay I draw upon several cases to illustrate the importance of selectivity, social networks and remittances for affecting environmental outcomes. The case studies are drawn from research funded by the MacArthur Foundation under the auspices of their Population Consumption and Environment Initiative administered by their programs in Population and Health and Global Security and Sustainability. The purpose is to begin to sketch out possible answers to two questions that might be applied to understanding the relationship of migration to coastal ecosystems: *Which migrants with access to which resources (selectivity)? And, how are these migrants embedded in the set of social relations defining ecosystem use in a place of origin/destination (social networks)?*

By doing so I bring to bear what we have learned from a productive decade of research on migration processes to refine models of migration and the environment. In the conclusion of this essay (Section 4) I discuss the type of data and research designs, from a social scientist's perspective, required for a research agenda that tackles the relationship between migration and the environment.

a. Migrant Selectivity and Marine and Coastal Resources

Recent research in the Galapagos Islands in Ecuador highlights the importance of understanding selectivity issues in relation to environmental resource exploitation. In this case, the selectivity must be inferred, but the description of the case reveals questions about who migrates and what type of migration they employ. A second case reveals how the combination of selective out migration and selective in migration changed the social relations of ecosystem valuation and management in Goa, India.

Although the Galapagos Islands are world renowned for their unique flora, fauna and world heritage status, they also represent economic opportunity to many Ecuadorians, particularly poor fishers living along the South American coast (Bremner,

Perez, and Borja forthcoming). The most recent marine resource to come under extraction pressure is the sea cucumber (Isosthichopus fuscus). Demographic evidence in the Galapagos indicates disproportionate numbers of men age 15-24 relative to similarly aged women and relative to other age groups at two different points in time (1982 and 1990). However by 1998 the ratios begin to resemble a more classic population pyramid with a declining fertility rate. This empirical evidence is confirmed by anecdotal accounts of migration to the islands for harvesting sea cucumbers, whereby origin communities describe male relatives leaving for the islands and destination community members describe the inundation of male migrants from the mainland. But the age and sex distribution of migrants appears to have changed over time, such that young males initially predominated now both men and women are equally represented by 1998 and they are bearing children. Thus, it appears that individual migration has lead to family migration and more permanent residence.

The young men migrating to harvest sea cucumbers came from particular communities along the Ecuadorian mainland coast. They already had had experience harvesting sea cucumber in their origin communities. Through their connection to Asian trading networks (the market for sea cucumbers is primarily in Japan and China), which gave them access to financing, technology, and knowledge, they were able to completely diminish the sea cucumber population along the mainland coast. Following their Asian beneficiaries they were then able to locate a new population of sea cucumbers on the Galapagos Islands. These new fishers to the Galapagos Islands had important demonstration effects upon the local fishers. Soon most fishers (part time or full time) were participating in the extraction of sea cucumbers until harvesting was closed by the Ecuadorian government between 1992-1994. Since then the harvesting season has only periodically opened for very limited time periods (Bremner et al. forthcoming), but each time more and more fishers participate in the harvest and the catch per unit effort has declined dramatically from the beginning to the end of the season and across years.

This example shows how migrant selectivity is important for the way the resource base is exploited in a destination. But this case also reveals how the causality of the relationship works in both directions. The particular environmental resource draws a particular type of person to a locale. In the case of the Galapagos Islands, the sea cucumbers attracted young male migrants. More specifically, it is young male migrants with particular human (fishing skills), financial (Asian financial backing), and physical (boats and technologies) capital resources from one location on the mainland coast. Migrant selectivity is also associated with the type of migration and the age of the migrant network. During the initial stages of the establishment of the migrant stream, selectivity is strongest and migration is temporary. The longer the migration origin-destination path is established the less selective the composition of the stream and the more permanent the migration.

Based on the evidence from this case, it is unclear how the change in migrant composition and type of migration might affect resource exploitation and overall ecosystem health. Exploitation of sea cucumbers initially drew migrants to the destination, however given their limited residence in the destination the effects on the overall ecosystem well-being may have been relatively limited. Also, even though diminishment of the species is associated with migration and changing composition of the migrant population, it is not clear in which direction to draw the causal arrow. Or, as

migration becomes more permanent and the migrant population more diverse then the negative impact on overall ecosystem health may be greater, even though the exploitation pressure on a particular species may be reduced. Although the case raises more questions than it answers, the questions from a migration scholar's perspective are about the character of migration and the composition of the migrant stream, and both kinds of questions are derived from ideas about migrant selectivity.

In an example from Goa, India, selective out migration and selective in migration changed social relations concerning ecosystem management in the coastal tidal plain (Noronha et al. 2002). Goa is known to the world as a place of beautiful beaches and wonderful sunsets, but this characterization is relatively recent. Prior to the 1970s (before Goa was "discovered") the Goan coastal tidal plain was comprised of a relatively complex set of land use relations making the most of land resources, fresh water and brackish tidal water to grow rice and coconuts, farm fish, and pan salt. Goa is also known for significant historical variability of migration patterns. In the early 20th century Goa was characterized by out migration to British India and Portuguese colonies in Africa. After colonial independence from Portugal in 1961, Goa experienced a surge of return migration from other Portuguese colonies and British India. Then, in the 1970's Goa experienced selective out migration of young men (both single and married) to the gulf state nations. Simultaneously, Goa's beaches and low cost of living were "discovered" by low-budget tourists. The combination of both selective out migration and selective in migration redefined land use along the coastal tidal plains. Limited male labor for maintaining the complex irrigation system, as well as remittance income from male migrants supplemented livelihoods and shifted production and consumption priorities. Incoming tourists and associated migration of tourist industry service sector labor and capital also shifted relative use values of land. The result has been a decline in paddy land, fish ponds, and salt flats and an increase in housing construction. What this means for ecosystem health, particularly pollution and effluent management is not evaluated. Nevertheless, selective patterns of migration are critical for our understanding of the relationship between migration and land use change.

The two examples illustrated above highlight the importance of migrant selectivity for understanding ecological impacts. Specifically, from these two examples we can see that who migrates (age, sex, independent or family) and what form the migration takes (permanent, temporary, return) are critical pieces of evidence for understanding the population-environment relationship. Further, the examples offer perspectives from both an origin and destination, reminding us that selectivity has impacts in both places. Finally, it is clear that there is a reciprocally caused relationship between migration and the environment. Environmental characteristics can selectively pull migrants, but subsequent resource exploitation may change the form and composition of future migrant streams, which can further affect environmental outcomes in both origin and destination.

b. Migrant Networks, Common Property Resource Systems and Environmental Outcomes

The changing characteristics of migrants within a particular migrant stream are important components of the explanation in the preceding examples. Implicated, but not

explicitly, in this explanation is the importance of migrant networks. As mentioned earlier in the essay (2.c.), migrant networks can serve to increase the heterogeneity of migrant stream composition – through the provision of information and resources. Migrant networks can also affect social relations in places of destination through the embedding processes mentioned in section 2.c.2. Two examples are used to illustrate these processes. One shows how social relations of communal property management are maintained among migrant fishers (Ghana) and one shows how variability in embeddedness results in variability in resource exploitation (Guatemala).

Ghanaian canoe fishers are among the most mobile along the West African coast. Documentation shows they have migrated as far north as Mauritania and as far south as the Congo throughout the 20th century (Overaa 2000). Historical accounts point to both push and pull factors contributing to Ghanaian fishers' high degree of mobility. Push factors include population pressure and land shortages. Pull factors have also been compelling explanations and include relatively better fishing grounds, lower input prices, and currency differentials. But in recent decades political conflict and turmoil have limited Ghanaian's access to other nations' fishing grounds. Nevertheless, the striking feature of Ghanaian migrant fishers is the replication of social institutions in places of destination - replete with recognized tribal authority (recognized in places of origin and destination). Migrant fishers must register with local tribal authorities in places of destination before fishing and conform to the same fishing regulations as those in their place of origin. The social networks linking places of origin and destination insure strong normative and instrumental embedding relations (Overaa 2000). Working through these already established social networks, some interventions, such as co-management of fisheries along the West African coast appear to have been successfully established and may forbode sustainable fisheries in the future.

Quite different embedding processes are evident on the Guatemalan coast (Ross and Mendez 2001). A study of the growing commercialization of fishing in Livingston, Guatemala shows how varying degrees of embeddedness in larger economic and social institutions has marginalized some groups and benefited others, resulting in disparate impacts upon the marine and coastal ecosystem. Q'eqchi, Garifuna, and Ladino migrants moved into the coastal region during the last half of the twentieth century, but their insertion in the local economy is very different with different consequences for resource extraction. Nevertheless they are all involved in fishing activities to greater or lesser extent, an activity that has grown in economic significance for the region in the last five years. Ladinos' greater degree of embeddedness within regional and national socio-economic institutions and networks affords them access to financial and legal resources for investment in large scale fishing or employment opportunities in such operations as wage laborers. The Garifuna have much lower access to these networks of social support and consequently exploit fisheries resources of lower commercial value, but high nutritional value, supplementing their diets. The Q'echi exploit commercial species as well, but in much smaller quantities and only to supplement their income through sales in local markets or to commercial buyers. The impact of these diversified approaches to livelihood strategies is not fully analyzed in the preceding study, but the implication is that diversification results in overexploitation of the fisheries resources to the detriment of the ecosystem (Ross and Mendez 2001).

In both of the preceding cases social networks and their relationship to embedding processes are implicated in the way migration impacts coastal ecosystems. However, the two cases present differing outcomes. In the first, the embedding processes link origin and destination communities and integrate both normative and instrumental social motives to affect individual behavior. There is some indication that these embedding processes will ensure better management and greater resilience for both humans and the ecosystem. In the second, instrumental constraints are most at work and to the benefit of some more than others. More importantly, the lack of normative embedding processes results in significant over exploitation of the fisheries resource. Again, neither of these studies offers definitive results, rather they are suggestive of the importance of concepts already well developed in the migration and human ecology literatures, but which have not been systematically applied within the field of migration and the environment.

c. Considering Natural, Financial, and Human Resource Flows in Relation to Coastal Ecosystems

An important, but rarely discussed aspect, is the impact of migration upon the environment in places of origin. One possibility is the alleviation of population pressure upon the environmental resource base through out migration. To my knowledge there is no empirical research addressing this possibility. Beyond noting the limited theoretical and nonexistent empirical attention to this possibility, this section of the essay will turn instead to the impact of migrant remittances upon environmental outcomes in the place of origin.

Measuring resource flows within migrant networks is a critical component for an improved understanding about the impact of migration upon the environment. These are implied within the preceding section, but not explicit. In the next two examples, these resource flows are especially implicated in regard migrant origin communities. Specifically, these two examples highlight the importance of understanding the stock, flow, and meaning of remittances exchanged between migrants and their origin communities. Asking questions about the level and frequency of remittances, as well as who remits and who receives the remittances, adds a layer of complexity to the previous discussions about migrant selectivity and social networks. An example from Vietnam illustrates the combination of both selectivity and remittances has an important impact upon ecosystem management. An example from Micronesia illustrates how both selectivity and social networks combined with remittance patterns have a detrimental effect upon crab populations and mangrove forest stands.

In a small-scale, longitudinal study of Vietnamese households located in the Red River Delta on the northern coast, Adger et al. (2001) analyze the role of migration and remittance income for affecting livelihood outcomes between 1995 and 2000. With regards to environmental outcomes, they examine household investments in aquaculture. Aquaculture has been shown to have significant negative impacts upon mangrove forests and other fisheries (Naylor et al. 2000; Goldburg and Triplett 1997). Deforestation of mangroves also increases risks of floods and undermines the availability of marine and fish resources for the entire community. They find that over the five-period of study the households in the study site have significantly increased their reliance on remittance income, expanded aquaculture production, and reduced agricultural production. They conclude that it is the combination of the loss of labor through migration and the

remittance income which has shifted local production activities away from labor intensive paddy cultivation to less, labor intensive aquaculture investment, especially for wealthier households (Adger, Kelly, and Locke 2001). They note that the combination of out migration, remittances and shifts in agricultural production have increased income inequality in their study site. Implicit in this explanation is the importance of migrant selectivity particularly how it affects remittances and consequent investments.

In another study of mangrove resources, Naylor et al. (2001), examine migration and remittance patterns in Micronesia. Micronesia is characterized by extensive, but temporary, out migration of the working age population (25-34 years old) to the United States through the terms of agreement of the compact association which gives Micronesians open access to living and working in the U.S. (mostly in Guam and Hawaii) (Naylor, Bonine, Ewel, and Waguk 2001). Several processes seem to be at work in relation to migration, embeddedness, and ecological resources use. Households with migrants in the U.S. are more likely to have a household economy based on subsistence. These households, in turn, were more likely to use mangrove wood for fuel (twice as much fuel as households linked to the formal economy).

Besides mangrove fuelwood extraction, crab harvesting also takes place. Crabs occupy an important ecological niche within mangrove forest systems, as well as an important economic niche for Micronesians. Crab consumption also appears linked to migration in two ways, yet to be completely explored by Naylor et al. First, until recently the most important reason for crab harvesting was gift export to Micronesians abroad. Importantly they find that households with greater levels of migration and remittance income are more likely engaged in crab harvesting. One way to consider the gift exports is to see them as a way of increasing ties to migrants in order to ensure steady, remittance flows. Secondly, commercial exports of crab has increased eight-fold between 1996 and 2000, matching gift exports. Crabs are being sent to seafood restaurants in Guam, presumably because of prior migration networks. Despite the increases in crab harvest, Naylor et al. also show that crab abundance is declining as the per unit effort has dramatically increased with time. Thus, in two ways migration and remittances may be driving particular types of resource exploitation behaviors on the part of Micronesians. First social networks have increased origin village contacts and opportunities to trade and market ecological resources to places like Guam and, in the future Hawaii. Second, remittance income is so important to the maintenance of Micronesian households, that crab gift exports are used to ensure a steady resource flow. These last statements are conjectures and not tested directly by Naylor et al. However, given the literature on migration, social networks and remittances these are not unlikely suppositions.

The preceding two examples demonstrate the importance of considering the role of migrant remittances in relation to ecological outcomes in places of origin. Admittedly, the two examples are relatively sketchy in their detail, but from a migration scholar's perspective they point to further, more systematic inquiries. In the first example the combination of migrant selectivity and the flow of remittances back to a place of origin appears to have had a significant impact on reorganizing agricultural production or resource exploitation – from paddy rice farming to aquaculture. In the second example, migration, social networks and remittances appear to have increased mangrove deforestation and crab harvests, significantly affecting the abundance of crab.

4. Conclusions: Considerations of Measurement, Method, and Modeling

This essay shows that there is a timely convergence of ideas and demand for empirical evidence for understanding the relationship between migration and coastal ecosystems. Coastal ecosystems are under increasing pressure from population growth as a result of migration, industrial development and ecological resource exploitation. Through a review of the migration and environment literature several themes are identified as being extremely important explanations for particular environmental outcomes. These themes include migrant selectivity, social networks, and remittances. However, the review highlights how these three themes have not been as systematically studied as one might expect from a migration scholar's perspective. Migrant selectivity has not been systematically explored (especially regarding sex, age, and human and financial capital). Neither have migrant social networks been systematically linked to resource use or property relations in either place of origin or destination. Further, very little research has focused upon the relationship between migration and coastal ecosystems.

A review of the human ecology literature with regard to coastal and marine ecosystems reveals the prevailing attention to common property resource management. Several important theoretical concepts emerge from this review, dovetailing nicely with recent concepts in migration theory. Particularly important to understanding the success of common property resource management institutions is describing variability in social capital – which is measured as a function of social ties and embedding processes. A similarly focused review of recent developments in the migration literature also highlights the importance social capital, both social networks and embeddedness. The preceding reviews of the literature generate two questions in relation to migration and the environment: *Which migrants with access to which resources (selectivity)? And, how are these migrants embedded in the set of social relations defining ecosystem use in a place of destination/origin (social networks)?*

Based on these two more theoretical reviews of two very different literatures, I explore six examples from very recent research examining migration and coastal ecosystems. The examples highlight the importance of migrant selectivity, social networks, and remittances for understanding environmental outcomes in places of origin and destination.

These examples highlight the importance and variable impact of migrant selectivity upon environmental outcomes (Ecuador and India). The interaction of migrant social networks through instrumental and normative embedding processes with environmental resource valuation and use (Ghana and Guatemala). And, finally, the role of remittances is shown to affect resource extraction in places of origin through differences in social networks and migrant selectivity (Vietnam and Micronesia).

Rather than review the findings from the analysis of illustrative examples, let me instead propose an approach to studying migration and coastal ecosystems that systematically includes methodologies and measures from the field of migration. The preceding review of illustrative cases and varied literatures provide the basis for this proposed approach. There is nothing in this approach that might not be applied to other ecological systems.

The measurement of migration is a difficult and complex task, but rigorous attention to it is extremely important. Unlike other demographic events which have

distinct beginnings or endings (pregnancy, birth, marriage, death), migration is a fuzzier concept and consequently more difficult to measure. This is particularly true in developing country contexts. Rather than give a particular prescription for measuring migration (which can be found in any number of demographic textbooks (Bilsborrow, Oberai, and Standing 1984; Shryock and Siegel 1976; Smith 1992)), I suggest particular dimensions of migration that should be considered essential measurement elements. Timing and duration of migration are critical aspects of the experience. A second element is the motive for migration, whether employment, unemployment, marriage, ecological adversity or ecological opportunity, etc. A third element is information about the origin and destination of the migrant. A fourth element is the pattern of migration (in some cases this can be intuited from questions about timing, duration, origin and destination). These patterns can be temporary, seasonal, circular or permanent. A fifth element is the character of social ties that facilitate a move, that exist in places of destination, and that remain with places of origin. One way to measure these ties is to ask about the flows of information and resources (e.g. housing and employment assistance, material goods, and money) that travel through the ties bringing migrants to places of destination and binding them to places of origin.

The measurement of migration, particularly, understanding motives, patterns, and ties between origin and destination, suggest a methodological approach to understanding the impact of migration which demands analyses of selectivity. Who are the migrants within a migrant stream? Standard demographic concerns include the age and sex composition of migrants, but other concerns might include levels of human and financial capital. These concerns reflect an understanding that the social context of migration and the subsequent consequences vary depending on whether the migrant is an individual, a member of a migrating family, a person with high levels of education or with very little financial assets. These variations, especially if they consistently explain the composition of a particular migrant stream, imply varying impacts upon a destination community – socially and ecologically.

Finally, more recent research suggests that social networks are important for understanding migrant impacts in both destination and origin and over time. First migrant social networks effectively diminish the selectivity of migration over time changing the impact of migration upon destination and origin communities. This insight requires a methodological approach that includes a temporal dimension, preferably of more than two time points, since migration between origin and destination has a cumulative impact that two time points cannot effectively capture.

Second, social networks can measure two aspects of social capital that are consistently described in the human ecology literature and the migrant assimilation literature. The first of these aspects is stock and flows of varying resources within social networks in places of destination, in places of origin, and between origin and destination. This is an instrumentalist understanding of social capital. The second aspect is the way social networks embed individuals within communities and individuals through communities to larger social institutions (e.g. governments, markets, civic society, other communities, and in particular common property institutions). This second aspect includes both instrumental and normative understandings of social capital.

The first aspect is easier to measure as it involves asking relatively straightforward questions about instrumental relationships. What is exchanged

(information, assistance, finances)? Who does the reciprocating and with whom reciprocation occurs or is expected to occur? Are there reciprocal exchanges of resources (either natural, financial or social) among migrants at a place of destination, between migrants and non-migrants in a place of destination, or between migrants and their origin communities? Does the variability in reciprocal systems of exchanges affect the embeddedness of migrants and non-migrants within their social and ecological community of origin or destination.

The second aspect of social capital is more difficult to measure, and requires more demanding collection of data about communities, implying measurement at the level of the group rather than the individual. Studying this aspect of migrant social networks and social capital would involve a case comparison approach, including ethnographic information.

The preceding description of a methodological approach could be fruitfully applied in relation to migration into or out of any ecosystem. Regardless of the ecosystem, to understand the impact of migration, measurement of behavior in relation to an ecological system must include those who are non-migrants, those who receive or send remittances, and those who are migrants. All types of ecological measures must also include some temporal depth to begin to understand the extent of the migration impact and the causality of the migration-environment relationship. Even so, coastal ecosystems present particular challenges. One of these is the common pool resource nature of many of the elements within a coastal ecosystem. Therefore privatization is difficult to achieve and full government control unlikely, especially where legal and enforcement institutions are weak. Another aspect is the difficulty of assessing environmental resource damage. Unlike deforestation, where the impact of logging is measurable and visible, fish stock (like people) are mobile. Thus, intensive measurement of catch per unit effort is one of the most essential features of valuable data collection in marine and coastal ecosystems.

Finally, measurement of property relations across many elements within an ecosystem is necessary. Understanding the variable roles, responsibilities, and rights of individuals, local communities and nation-states is paramount for understanding the impact of migration upon these very institutions and subsequent environmental outcomes.

In conclusion, this essay demonstrates tantalizing insights from numerous studies around the world that point to the need for a reformulation and reapplication of effort in collecting data and conducting research on the relationship between migration and the environment. Based on the evidence from the literature I argue that there is a convergence around particularly important concepts, especially social capital (as a combination of both migrant selectivity and social networks), to explain the relationship between migration and the environment. However, to date, there have not been systematic attempts to incorporate these concepts into studying human impacts upon the environment. To that end, this essay reviews the literature, clarifies concepts in both the human ecology and migration literature, and proposes a research agenda that systematically includes migration measures and methodological approaches. This approach emphasizes temporal and spatial depth, attention to more complex measures of migration, comparisons of migrant and non-migrant behavior, the instrumental and normative social ties binding migrants and non-migrants between origin and destination and within destinations.

The limited scientific attention among migration and environment scholars towards coastal ecosystems, the significance of coastal ecosystems to human livelihoods of all forms, and the growing population along the world's coasts, necessitates an approach that incorporates the most recent conceptual and methodological approaches in the fields of migration, common property resource management, and coastal ecology. The approach proposed here is from a migrant scholar's perspective and emphasizes understanding the social ties and resources (social and economic) available to immigrants in places of destination, depending on their relative position within a community – through their normative obligations and normatively induced behaviors within communities in places of destination and through the structure of their instrumental relationships. Secondly, it emphasizes the importance of understanding the type, flow and distribution of resources (social and economic) within and between social groups and social institutions in both place of origin and destination. Thirdly, it emphasizes the importance of the length of temporal vision for affecting social capital formation, growth and its impacts, given the way migration occurs, who migrates, and the context of reception in the place of destination. These three aspects suggest a way for understanding the differential impact of migration upon the environment as mediated by the migrants' relationship to common property resource relations in places of destination and origin.

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