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Population Change in and around Protected Areas



LUCAS JOPPA

ABSTRACT

Two global analyses of human population growth near protected areas seek to go beyond case studies to generalize the impact human populations have on nearby protected areas and rural development. Answering these questions is important for both human welfare and biodiversity conservation. However, as author of one of those studies, I would argue that human migrations operate at multiple spatial and temporal scales, ensuring that any hope for a globally coherent signal is premature at best or misdirected at worst.

INTRODUCTION

Species extinctions are occurring well above natural rates, and the creation of protected areas (PAs) has long been the primary response to slow the decline in global biodiversity. During the past 100 years or so, the global network of protected areas has grown to cover more than 12 percent of the terrestrial earth surface (Jenkins and Joppa 2009). With a few regional exceptions, human populations around the world have also grown exponentially, with increased numbers of people living closer to protected areas. This has surely produced greater anthropogenic pressure on protected areas, but it is less clear how the existence or delimitation of areas with protected status themselves have influenced human activity near their borders. This is an important question; human-protected area interactions are not only a likely determinant of how effectively protected areas

can conserve biodiversity, but can also potentially shape patterns of rural development.

The relationship between people and protected areas has long been an area of active research in ecological anthropology, as well as in conservation ecology. Certain segments of the conservation community are concerned that protected areas may create a sort of “Conservation Catch-22” by encouraging human in-migration near their borders and thereby accelerating their isolation from natural landscapes (Terborgh and Peres 2002). Here, the underlying concern is that the net impact of protected areas on conserving biodiversity becomes negligible. Elsewhere, there is apprehension that protected areas might work to the detriment of neighbouring human communities by disrupting traditional modes of rural development

(West et al. 2006). Given the significant resources and funding that are funnelled towards the creation of protected areas, these are non-trivial concerns.

Most prior work on these issues used case-study data and focused on one or several protected areas at a time. There is growing interest, however, in scaling these questions up beyond individual protected areas. For example, a global-scale analysis by Wittemyer et al. (2008) presented evidence for increases in migration and population growth near protected areas. This is a contentious point, and my colleagues and I have argued in response that analyses at such large scales are inherently incapable of providing a realistic picture of human population trends around protected areas (Joppa et al. 2009; Hoffman et al. 2011). I believe that the limitations of the available datasets and the innate complexities of migration make global trends difficult to discern, in the event that they exist.

The purpose of this manuscript is to discuss the limitations of these global analyses of human populations surrounding protected areas. This is an important issue, and one that, if ignored, has the potential to lead conservation biologists, anthropologists, and protected area managers down the wrong path in their understanding of how complex the relationship between people and protected areas can be.

I first present a simplified discussion of some potential migration motivators, and how those motivations might play out on the ground. From there, I consider potential constraints on migrants who may wish to move towards or away from a protected area boundary. Although greatly simplified, presentation of these migration motivation and limitation sections provide context for a summary of two competing global analyses of human population changes around protected areas. To conclude, I use a combination of the theoretical constructs from the first two sections, and the empirical results from the third, to argue for a return to individual protected area case-studies.

In all of this, I only consider population change through migration mechanisms, leaving aside the additional population changes ensuing from natural birth-death dynamics. Doing so leaves an overly

simplified description of human demography near protected areas, but one necessarily so. The complexity of interactions between birth-death dynamics, the biotic factors influencing them, and, in turn, the influence of protected areas on those factors is immense. For example, protected areas may increase economic prospects, thereby increasing people's financial access to life-saving medication or clean water and positively skew the birth-death ratio. Negative alternative scenarios are just as easy to imagine. I ignore these issues for two reasons. First, I argue that many of these factors are wrapped up within people's decisions to migrate, and are thus covered by proxy through the arguments below. Second, the main purpose of this paper is to argue the limitations of any search for global trends in human demographics around protected areas, and addressing the additional complexities added by considering birth-death dynamics would only further confirm this point.

WOULD PEOPLE MIGRATE TO PROTECTED AREA BOUNDARIES?

Biodiversity conservation and human welfare are often both at stake when establishing and maintaining protected areas. Those dual concerns can frequently cause disagreement about the best way to enact conservation measures intended to serve multiple purposes. From a human perspective, protected areas can be thought to exert both attractive (pull) and repelling (push) forces on the landscape (Ogelthorpe et al. 2007). A simplification of the "pull" argument is that protected areas provide benefits for rural residents, causing people to preferentially move towards their borders. Under this argument, one accepts that protected areas often require infrastructure, such as roads leading to their entrance, and people to work in them. Natural areas also provide many ecosystem services, and protected areas may contain the last remaining natural resources available to rural communities. In theory, the combination of infrastructure, employment, and necessary goods and services might cause protected areas to serve as the only available rural economy. Just as urban centers do, protected areas might then retain or attract

human settlement and population growth. If true, this would be a powerful way to assess the value of ecosystem services, ecotourism, and natural resources for rural economies.

Protected areas in Malawi, where I have previously worked, exemplify many of these issues. Satellite imagery clearly shows that Malawian protected areas contain a large fraction of the remaining natural vegetation in the country. On a landscape largely denuded of native forests, drawing legal boundaries of many protected areas on maps is often not necessary, with the boundary starkly delimited with vegetation. This is not to imply that protection is solely responsible for remaining natural resources. Many protected areas around the world are not randomly located on the landscape. In fact protected areas are often preferentially located in places where resource extraction is inherently difficult. However, in a country heavily dependent upon firewood and charcoal for cooking, the benefits of living near these resources, even if it might be illegal to harvest them, can often be significant. Several protected areas in Malawi are a source of clean drinking water, which is another resource in short supply. More direct economic benefits are also seen. Park staff is often hired from the communities surrounding protected areas, and artists sell their crafts along the main entrance roads. It would be difficult to deny that protected areas can influence local economies.

Alternatively, protected areas may serve as a push force, driving people away. Protected areas may be detrimental to rural development by excluding people from traditional lands and may marginalize rural residents by denying them access to natural resources. Other negatives can be political, such as accepting displacement or exclusion from ancestral grounds, or administrative, such as having a protected area bureaucracy to deal with on a regular basis. Further, protected areas may serve as an effective economic barrier. In Malawi, few public roads cross protected areas, and a village located on the “wrong side” of a protected area may be isolated from any beneficial economic activity. Living in direct proximity to a protected area can also have more immediate negative

consequences; in Malawi, and many other countries, protected areas are often sources of danger to human lives and livelihoods. For instance, escaped elephants trampling people to death in villages near protected areas is a sad, but not uncommon, occurrence in certain parts of the world. More common are the crop-raiding issues of baboons, elephants, hippos, and other animals that often wander from within nearby protected areas to feed upon crops tended by a local farmer. The consequences can be devastating for the farmer who loses a year’s harvest to animal raids. These adverse outcomes are just as real as any positive economic benefit. Rural residents who suffer negative or burdensome effects of living near a protected area may eventually be convinced to seek their economic futures elsewhere, becoming part of the massive rural-urban migration happening around the world.

COULD PEOPLE MIGRATE TO PROTECTED AREA BOUNDARIES?

The previous section dealt with a few factors that might determine whether people would actually *desire* to live around or migrate to or from protected area boundaries. But what are the factors that determine whether opportunities to migrate are available for those who actually wish to do so? These are often highly context-specific, and land tenure situations offer a particularly relevant example. There are, of course, many other constraints on movement and I focus on land tenure as an example only. Issues surrounding tenure are well positioned to illustrate the many context-specific pieces of information that dictate movement, the possibilities for movement, and even awareness of potential opportunities to move.

If protected areas do create a local economy, then this economy will likely influence any functioning market in rural property. Markets may increase the value of land surrounding protected areas, making migration financially unrealistic for many extraction or cultivation dependent migrants. This is a process commonly seen in many tourism-dependent locations. As tourism takes hold the property market

becomes increasingly valued, forcing those who work in the tourism industry to move further away. This is perhaps more often the case in developed countries, but the purchase of land by private interests near protected areas in developing countries also occurs. One must remember that lands surrounding protected areas, particularly in sub-Saharan Africa, are rarely unclaimed. The accessibility of land to migrants—to or from a protected area—in a locally controlled system of land tenure, as is the case in Malawi, may simply not be possible or logistically feasible.

The opposite land tenure scenario is one of a frontier situation, where local systems are ineffective or do not exist. Here migrants can move in relatively freely, perhaps even with the expectation of later obtaining legal titles to the land. Many European colonies in prior centuries were settled this way and, while it is rare in sub-Saharan Africa, it remains relevant in the tropical forest regions of Latin America.

Further complicating whether migrants *could* relocate are the costs and benefits of actually moving. Migrants from rural to urban areas are often poor. Urban migration is possible for these individuals as a result of pre-existing infrastructure and other amenities of urban settings. Areas around rural protected areas, on the other hand, rarely afford these features. Another factor to consider is that rural parks are often located far from main roads and other transportation options, making access difficult. Thus, even if individuals wish to migrate to protected area borders, the logistical constraints on such a move are often prohibitive. Potential migrants in Malawi wishing to relocate to a protected area boundary will face different perceived benefits and costs of such a move, and will experience different constraints on their ability to obtain transportation to a site, than potential migrants in Brazil wishing to relocate to a protected area in the a remote section of the Amazon forest. The point here is that the pros and cons for migrating to a protected area boundary, along with the types of logistical constraints, vary across geographic regions.

Even within a country, issues surrounding one protected area do not necessarily predict issues around

any other. Intra-national differences in the pros and cons of living near a protected area can often be greater than differences across national boundaries. One can easily imagine the difference between two protected areas within a single country. In the first protected area one can imagine a significant tourism base for wildlife viewing, robust infrastructure, and strong integration of the surrounding community with the welfare of the protected area. The other protected area might be difficult to access (decreasing tourism), poorly managed (decreasing surrounding community relations), and contain significant numbers of crop-raiding animals. This simple example speaks to the inherent site-specific nature of any human population trends near protected area boundaries. It is clear that perceived benefits and costs of living near a protected area can vary widely both within and between countries. This observation alone makes finding a globally coherent signal of protected area migration trends highly unlikely.

GLOBAL MODELS OF MIGRATION TO PROTECTED AREA BOUNDARIES

Nonetheless, we do need to remember that protected areas are the single most dominant conservation strategy around the world. This situation is complicated by conservation funding that is often doled out at scales larger than individual protected areas. Given this, it has remained an outstanding question whether there are any globally generalized population trends around protected areas.

In a paper in the journal *Conservation Biology*, Sholte and de Groot (2009)) lay out three basic global models for human immigration to protected area boundaries. These three models are characterized as Attraction, Frontier Engulfment, and Incidental. The attraction model is what I am primarily concerned with in this paper as it is the one that posits that the existence of the protected area itself—along with perceived benefits—preferentially draws people to its borders. I will briefly deal with the issue of frontier engulfment, but do not consider their incidental model, which exists

as a catch-all for events that do not fit into a push-pull categorization (such as when protected areas become areas of conflict or areas of refuge).

The attraction model is especially interesting because a recent study claimed to have found globally coherent evidence for it (Wittemeyer et al. 2008). To test whether protected areas draw people towards their boundaries, Wittemeyer et al. analyzed 306 protected areas across 45 countries. Protected areas near urban areas were excluded from the analysis. For each of these protected areas the authors then compared population growth within 10 km around their boundary with a country-wide rural growth rate estimate. This calculation was meant to detect any positive flow of migrants to protected area boundaries. The purpose of comparing growth rates near protected areas to rural growth rates, instead of, for example, with urban migration patterns, was apparently an attempt to hold certain landscape perceptions constant.

The results of this comparison were overwhelming. Of 306 parks analyzed, population growth in the 10 km boundary around 245 of them was higher than the country's rural growth rate. When these data were aggregated to the country level, 38 of 45 countries had disproportionately high growth rates around their parks. After establishing this trend of disproportionate growth around protected areas, Wittemeyer et al. proposed a mechanism for this result—international conservation funding—by finding a positive correlation between the strength of results in each country with a measure of that country's total international biodiversity funding.

This was an intriguing result, but to have such an overwhelming majority of protected areas experience increased nearby population growth seemed at odds with the issues highlighted in the preceding sections, as well as with what one might expect in a world where more and more rural people are moving to urban centres in search of economic opportunities.

In an effort to see what was driving the patterns Wittemeyer et al. (2008) reported, several colleagues and I re-analyzed their results, finding them to be artifacts of comparing incompatible datasets (Joppa

et al. 2009). Wittemeyer et al. used data on human population from two different sources; one to calculate population change near protected areas and another for population change in rural areas. In our subsequent analysis, we found that the dataset used to calculate populations near protected areas provided consistently higher growth estimates than the dataset used to calculate population growth in rural areas. This discrepancy was true for all but one of the 45 countries Wittemeyer et al. considered. The incompatibility of the two datasets assured the result reported by Wittemeyer et al., but did little to shed light on whether or not protected areas were actually experiencing disproportionate population growth near their boundaries.

In our follow-up analysis, my colleagues and I removed any concern about discrepancies between the two population datasets by using only one of them. In doing so we failed to find any significant evidence for disproportionate population growth around protected area boundaries. In that analysis, for each protected area we simply subtracted population growth 10-20 kms away from the boundary from growth 0-10 km away. If protected areas were experiencing disproportionate growth, that number should be greater than zero. Across all protected areas studied, that number was normally distributed around zero. This was a direct refutation of Wittemeyer et al. (2008), and fit nicely with some earlier results showing deforestation near protected area boundaries to be no higher than further away—the opposite of what one might expect if human populations were increasing near protected areas (Joppa et al. 2008).

Frontier engulfment is Sholte and De Groot's third model of population growth near protected areas. In it, a protected area might be created in a remote region, far from human populations. Over time this protected area is engulfed by an extraction frontier such as logging, a process that then opens up the region to further human settlement. In our re-analysis of Wittemeyer et al.'s (2008) findings, we used Kafue National Park in Zambia as an example of a protected area that is simply in the way of nearby expanding population centres, a type of frontier engulfment.

Kafue National Park is experiencing population growth around its border, but this did not seem to be driven by the existence of Kafue National Park itself, but rather by other human driven forces already at work on the landscape.

CONCLUSION

In their article, Sholte and de Groot (2009) conclude, "A re-analysis of the Wittemyer et al. (2008) and Joppa et al. (2009) data that use the three immigration models will contribute to the development of management approaches to cope with immigration to PAs." This re-analysis might be ideal, but is unfortunately impossible due to the inadequate nature of the global data available. Census data are notoriously difficult to obtain even in countries with significant government resources. Rural populations can be the most difficult to census, compounding the problems of gathering accurate counts of people around protected areas. Just as the other issues addressed in this paper, census detail varies considerably between nations. For example, across southern Africa, the number of census units within countries varies from less than three to more than one thousand (South Africa). For global population datasets, numbers reported within each census unit are then interpolated over the landscape using varying datasets on infrastructure (e.g., roads). These infrastructure datasets also vary in quality and extent, both within and between countries. Thus, any global analysis will inevitably be comparing data that differs significantly in quality from one country to the next.

However, even given perfect data, I have shown there are theoretical, methodological and empirical reasons why coherent global trends for human population change around protected areas are unlikely. This expectation is predicated on the complexities of the simplified causes, consequences, and constraints of migrating to protected area boundaries outlined in this paper. All factors relevant to migration questions differ greatly at the international, national, and regional scales. The overwhelming numbers of push and pull factors, migration constraints, and

local perceptions of economy make it likely that the dynamics of individual protected areas are too numerous and locally specific to justify currently searching for overall global trends. On top of these complexities we can add the equally important, but potentially even more complex, relationship between protected areas and any potential impacts on birth and death rates of individuals living nearby. Economies, ecosystem services, and infrastructure are just a sample of the factors influencing these natural human processes. Again, we know these factors vary strongly across geo-political space, leading one to not anticipate a single or even major globally coherent inflow/outflow trend nearby protected areas.

This is not to say that all hope is lost, or that human demography near protected areas is not relevant to conservation outcomes. Even without detailed population data we can be sure that given the concomitant growth in the protected area network and human population, collisions between these areas, and people struggling to find land on which to survive will continue. However, studying the influence of protected areas on human populations is best served by conscientious case-studies with careful household level data collection. It is there that the most useful insights will be found. Protected areas are managed on a site-specific basis, and their complex interactions with nearby human populations should be analyzed no differently.

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