A Reserve Full of Rooftops: Technology, Scale, and Meaning in Remote Monitoring of Human Populations in Guatemala's Maya Biosphere Reserve.

By: Micha Rahder
PhD Candidate, Cultural Anthropology
University of California Santa Cruz

"That house just isn't there anymore, that's where Carlos used to live!" Josue exclaimed excitedly, pointing to a purple dot marked on an aerial photograph. I sat with him and another man in the hot afternoon shade in the small forest village of Uaxactún, inside the Multiple Use Zone of Guatemala's Maya Biosphere Reserve. Together we were examining the photograph of the village used by the state's protected area monitoring agency as part of its estimation of population levels inside the vast reserve. Poring over the details of the photograph, with "houses" coded as red, blue, or purple dots depending on how long they had been present, the two men excitedly filled in the human stories behind the appearance or disappearance of particular rooftops in the photograph — who had moved in or out, when, and why; and they eagerly placed themselves on the image in terms of their own houses, as well as where their extended families and friends lived. They emphasized that parts of the image were simply *wrong*, saying, "What CONAP [the protected area council] is missing is coming to get information from here in the community, to get *more complete* information."

Three weeks earlier, far away in the National Palace of Culture in the capital, Guatemala City, I had watched as a PowerPoint slide with another aerial photograph, this time of the village Paso Caballos, flashed on screen with animation to show the growth of population in this Q'eqchi' Mayan migrant community located inside the reserve's Laguna del Tigre National Park. This slide, quickly followed by one showing projected population growth in the whole reserve over the next decade, served to illustrate that "population" was one of the key threats to the reserve, alongside climate change and "powerful interests," a careful way of referring to drug traffickers, land-grabbing cattle ranchers, and other organized crime that has flourished in the jungles along Guatemala's northern border with Mexico. These slides were part of a formal presentation to the president of Guatemala, who although he had less than two months left in office in his four-year term, was on the verge of deciding his last national budget, including how much to give to protected areas like the Maya Biosphere Reserve.

These two moments, and the two villages featured as photographs within them, will frame my argument about politics, scale, and meaning in constructing and interpreting evidence for decision making in the Maya Biosphere Reserve. Remote monitoring of populations is only meaningful at particular scales: a reserve-wide view of population, such as that enabled by flyover counting of rooftops, helps create and maintain a coherent narrative around landscape change and sustainable development needs across the reserve, useful at higher political levels such as the scene in the National Palace. On the other hand, in terms of regional- or village-level decision-making and priority setting, this information is less useful, often inaccurate, and at times even counter-productive. These official estimates are often given greater weight than local understandings of village settlement and population dynamics, however, because of the perceived objectivity and neutrality of photographic methodology — hard adjectives to come by in a landscape beset by violence, social and political conflict, and rapid change. But in fact, this trust in technological truthfulness is itself a political, not a technical, determination, and one with political consequences.

Throughout this paper, I follow an approach outlined in the works of John Law and Annemarie Mol (Law and Mol 2008; Mol 2002), using the idea of *enactment* to indicate the way that multiple ontologies of an object — for example, human population or the Maya Biosphere Reserve — arise through particular practices, such as aerial monitoring or on-the-ground census. By emphasizing enactment, my analysis of population monitoring practices contrasts with those that might frame the question as that of multiple perspectives or approaches to a single, 'real' object. This approach shifts the focus from questions of agency or intentionality, and insists that enacted objects are always also *actors*. The question then becomes not, who made this population estimate? But rather, what do population numbers *do?*

Population Monitoring in CEMEC

Memories of Guatemala's violent 36-year long civil war and continued economic, social, and ethnic inequalities form the troubled context for conservation and development in the Petén, Guatemala's northernmost department. Since the late 1960s, the Petén's population has exploded from fewer than 30,000 to over 750,000 people. Over the same period more than half of the region's forest has been lost, leading in 1990 to the establishment of the Maya Biosphere Reserve, the largest protected area in Central America. The reserve, a patchwork of human-

exclusive ‘nuclear zones' and `multiple use zones’ dotted with small communities, is intended to balance biodiversity conservation with local livelihoods; but chronic mistrust, corruption, and the continuing legacy of state violence and inequality have thrown up barriers to this lofty goal. While some regions of the reserve have been successfully protected, many core areas, particularly in the western parts of the reserve, are now overrun by agricultural migrants and cattle ranchers, fueled by rapid population growth and deep poverty (Meyerson 1998; Schwartz 1990; Nations 2006; Primack 1998; Sundberg 1998).

Remote monitoring of the reserve's population is conducted by CEMEC – the Center for Monitoring and Evaluation of CONAP, the National Protected Areas Council. CEMEC conducts this monitoring each year – barring budgetary, logistical, or climatic problems – sending CEMEC technicians on low-altitude flights to snap photos and carefully georeference them against the flight’s GPS tracker. Each rooftop in the photographs is then manually marked in GIS by a technician working in a computer lab in Flores, and the new photos are carefully compared side by side with previous years' images, in order to code newly constructed as well as lost buildings. The total number of rooftops is then multiplied by 5.5 — an average population per family determined from a 2001 census of the reserve — in order to estimate the population of each village, and of the reserve as a whole.

The assumptions of this methodology are: 1) that each rooftop is a “household;” 2) that all households hold to the 2001 reserve-wide average of 5.5 people per family; and 3) that the number of rooftops in a particular place has a linear relationship with population growth that follows this average. I will return to our two villages to show how these assumptions don't hold well in particular places, but there are also several issues at a general level: 1) the original census measured people per “family,” which does not necessarily map onto number of rooftops seen from above; 2) different communities had different per-family averages in 2001 — Paso Caballos was slightly over 5.5, while Uaxactún was under 4.8; and 3) new rooftops do not appear according to the logic of population growth, but according to more complex social and cultural norms — for example, it makes little sense to imagine a household splitting in two when it reaches a critical mass of 11 people, but a new house would likely be constructed by a young couple moving out of their parents' houses and starting a family.

Still, when averaged over the vast expanse of reserve as a whole, annual counting of rooftops gives a good general indication of whether settlements are growing, shrinking, or

staying stable, and at what pace, as well as a broad view of how human populations are distributed across the reserve. It also provides a relatively quick, cheap, and easy estimation of population, something which would be extraordinarily difficult to do otherwise with such scattered, remote villages, and with the complex dynamics of immigration and reproductive rates that vary highly between villages. This broad view of population enacts a single, coherent "reserve" object, rather than a highly varied patchwork of management zones, institutional responsibilities, ecosystems, and human dynamics. This object then sits easily with broad narratives about environmental change and sustainable development that work well at state and international political levels, particularly for attracting funding to conservation and development initiatives – there is excellent reason to present this information to the President of the Republic.

Zooming in: Population in Paso Caballos and Uaxactún

Growing population as a key threat to natural landscapes is one of the world's most powerful "environmental orthodoxies," taken for granted narratives that at best give partial explanations for environmental change and have more to do with political than ecological landscapes (Forsyth 2002). I propose that there are two closely related problems with the way that this evidence is used and interpreted in practice in the Maya Biosphere Reserve. First, the enactment of a "population problem" in the reserve flattens differences in history, ethnicity, land tenure status, demography, and poverty – both between and within villages – that play much greater roles in human environmental impact than sheer number of humans. Second, when this data is used in village-scale decision-making, the information often contradicts local understandings of human-environmental dynamics, leaving the interpretation of conflicting kinds of knowledge up to individual conservation & development practitioners.[1]

Turning to our two examples[2], Uaxactún is composed largely of *Peteneros*, families that can trace several generations of local history living and working in the region's forests and extractive industries. The village is also mostly *Ladino*, the Spanish-speaking dominant ethnic group in

[1] For more on contrasts between official-scientific and local or traditional knowledge, see Atran et al. 1999; Becker and Ghimire 2003; Dove 2008; Fairhead and Leach 2003; Robbins 2000; Agrawal 1995; Lowe 2006.

[2] I use Uaxactún and Paso Caballos to illustrate my arguments, but emphasize that these two are not examples of two (or more) *types* of village in the reserve, but representative of the broader incommensurability of local village life formations.

Guatemala, and Spanish is spoken by all village residents. According to the aerial count, the population is currently estimated between 1,600 and 1,700 people, and has grown very slowly since counting began in 2006. However, other estimates from those who live and work in the community claim a much smaller population, less than 1000 people, and also claim that the population has actually been slowly shrinking for the past few years.

The residents of Paso Caballos, on the other hand, are Q'eqchi' Mayan, an indigenous group native to a neighboring region of Guatemala who migrated in large numbers to the Petén in the late 20th century, in search of land for cultivation and in retreat from the horrific violence of the 36-year civil war. In Paso Caballos many residents — especially women and older men — do not speak any Spanish, isolating them from direct communication with the many state and NGO representatives constantly passing through their village. Here, the population estimate is over 2000 people, a number that has almost doubled since 2006. In Paso Caballos, others who lived and worked in the community were unable or unwilling to provide alternative estimates; questions of who lived in the community were extremely sensitive due to conflict over strict Park rules about immigration.

These two communities both have long histories of state and NGO intervention in their lives and livelihoods, but they are, in many ways, at opposite extremes of conservation and development practice in the Maya Biosphere Reserve. Uaxactún has been granted a community-run forestry concession inside the reserve's Multiple Use Zone, land that technically belongs to the state but is managed by the community for sustainable forestry, harvest of non-timber forest products, and small-scale swidden agriculture in defined areas. Paso Caballos, on the other hand, is located within a National Park, part of the human-exclusive “nuclear zone” of the reserve. The Q'eqchi' who settled at Paso Caballos arrived after the official declaration of the Park in law and on maps, but years before the reserve was practically established on the ground. As such, they fought to sign an agreement with CONAP in 1997 that granted the village semi-legal status, with a small communal forest reserve and strictly bounded and regulated agricultural areas. This agreement, though it has more or less held together for 15 years, exists in a tentative, uncertain legal limbo, leaving residents and conservationists alike in very delicate positions.

And, of course, a rooftop does not mean the same thing to each village. In Uaxactún, many “households” have two or three rooftops, reflecting traditional separation of the kitchen into another outbuilding and legal access to forest materials for community use, such that even poorer

families within the village may be able to construct multiple single-room buildings over the course of several years. Local claims that the population is shrinking are based largely on the results of a recently-constructed *telesecundario*, or remotely-taught high school, following which many young adults have started to leave for the central urban area for further schooling or to find jobs. At the same time, the community's forestry concession has slowly increased local incomes and financial security, and Uaxactún, as one of the more legally secure communities in the reserve, also has a much higher proportion of non-household buildings, among them school buildings and churches, a carpentry workshop, offices for the forestry concession, and a compound of buildings belonging to NGOs and archaeological institutes. Although anyone who knows the village can easily identify these rooftops, CEMEC cannot take the time to get to know each monitored village, so each of these buildings is counted as holding an estimated 5.5 people. But in a quick count I was able to identify about 25 non-housing rooftops in the 2011 photograph, accounting for nearly 10% of the current population estimate.

On the other hand, in Paso Caballos the 5.5 people per rooftop estimate, rather than being too high, is more likely to be on the low side. Families commonly have 8 or 10 children, all crowded together in single houses — greater poverty, more limited land, and lower access to forest building materials means that many households fit all their sleeping, cooking and other activities under one large roof. A few households do build multiple small buildings, but these are often quickly filled by extended families living in close residence. Here, in contrast to Uaxactún, there are only a very few buildings that are not used for housing: a scattering of over-crowded schoolhouses, churches, and a single communal meeting hall. As birth rates boom and villagers' family members continue to immigrate in from outside the reserve, the strictly delimited boundaries of the village have led to greater density of residences, creating increasing pressure on the thin, nutrient-poor soils allotted to their agricultural area, and severe pollution of the slow-moving headwaters of the San Pedro River along which the village is built.

So while it is true that, as indicated by rooftops, the population of Paso Caballos is growing much more quickly than that of Uaxactún, focusing on the number of people in each village will not provide very much information about what kinds of sustainable development or conservation interventions are needed or will work in each place. The proliferation of rooftops in Paso Caballos is frequently used as an illustration of the population “threat” to the reserve's forests, as seen in the presentation to the president. But in fact, the people in the village are scared of being

evicted from the park and losing their tentative land rights, so have densified the small village without infrastructural support rather than expanding into neighboring parkland, resulting in major environmental, health, and social problems that are unrecognized by a population-leads-to-deforestation framing. Using this reserve-scale data in local decision-making processes leads to conflict, problematic assumptions, and contradictory understandings of human-environment dynamics.

In practice, it is usually left up to individual state or NGO field practitioners to work out the appropriate response according to their own political beliefs and understandings of the evidence. One NGO worker who has worked and lived part time in Uaxactún for seven years spoke with me about the population monitoring compared to local understandings of village dynamics. He had recently sat down with a small group of community leaders and performed a "mental census" of the village, imagining themselves walking through the houses and counting who lived in each one. This exercise – which resulted in the less-than-1000-and-shrinking estimate – closely echoed my own experience discussing the aerial village photograph with Josue and Marvin, whose knowledge of village residents' comings and goings was rich and detailed. In this case, the NGO representative drew on his social ties to village residents and long experience in the community to decide that population was in fact stable or shrinking, and much smaller than reported, and used that information to make decisions about what kinds of support the community most needed from his organization, rather than the official state estimate.

On the other hand, in Paso Caballos, the image of growing population has caused conflict and disagreement between community members and state and NGO representatives. Villagers insist that the population growth does not include letting in "outsiders," which is strictly against the rules of their agreement with CONAP. They report that the growth is due to the high birth rates in the community, and to close family members who move to join them — a definition of insider/outsider that differs from state understandings that limit "insiders" to only those who were present at the 1997 signing of the agreement and their offspring. Villagers repeatedly emphasize the need for better schools for their children, and for local health services (more than one health project has failed in the village in recent memory) and access to clean water, while CONAP insists on the priority of intensifying boundary-maintenance around the community's territorial limits and on agricultural fire management practices. These two perspectives are both closely tied to questions of the village's population dynamics, but respond to extremely different

enactments of the population-environment question. As a result, one NGO worker who has worked in Paso Caballos for five years found herself constantly torn between the competing visions and priorities of local villagers and the state protected area council. Her job required close coordination between the two perspectives, and the incommensurability between them led not only to conflict between villagers and state representatives, but also manifested in a frequent sense of uncertainty and anxious changes of plans in her own strategies and decision making. In this case, decentralizing responsibility for making sense of competing narratives and forms of evidence led to more conflict and distrust, as people may be blamed for "changing their story" when in fact they are reacting to differing knowledges from different social contexts.

Conclusion: Politics and Scale

Despite these challenges, remote population monitoring is widely preferred and taken for granted as a superior method for many reasons. Clearly, it is much cheaper, quicker, and easier to fly over many villages in one or two days, than to conduct yearly on the ground census surveys. But in addition, the counts from this monitoring are rarely if ever questioned outside of the villages being monitored — monitoring by way of aerial photography is widely recognized as "objective" information, more trustworthy than on-the-ground census counts, notorious in Guatemala for having poor coverage of remote areas and being riddled with social and political barriers to accuracy.[3] In addition, the Maya Biosphere Reserve is beset by social and political conflict, often erupting into violence, which makes census counts of illegal settlements particularly difficult. Remote monitoring appears to stand above the fray of all these problems. Despite its construction within particular political and institutional networks, this appearance of neutrality is a powerful ally in decision making. But, as I have shown, aerial monitoring is not, in fact, more accurate or helpful information than on-the-ground studies of population dynamics in many contexts, so what seems like a technical preference for objectivity or clarity is in fact a political preference for broad-scale technologically-mediated information.

This preference has important political implications. At some scales and in some contexts, reserve-wide technological monitoring is a very useful and powerful tool. While there

[3] The 2001 census of the reserve was carried out by malaria public health workers, who were able to enter and gain the basic trust of small communities that would usually turn away people easily recognized as state representatives.

are many problems with the population/deforestation framing, it is still one of the most familiar and convincing environmental narratives, one that can be essential in garnering support for protected areas and sustainable development initiatives from national governments and donors to international programs. In the presidential palace, telling a complex story about ethnic identity, poverty, and violence in an illegal migrant community inside a National Park would not lead to greater budgetary allotments for protected areas. But that same discourse is extremely problematic when carried down into smaller scales: using the troubled and marginalized Paso Caballos as the emblem of a "population problem" while Uaxactún is congratulated for its stability and good conservation practices ignores the incredible social and economic differences between the two communities, further solidifying the gulf between them.

Most importantly, it is essential for conservation and development practitioners to recognize that just because evidence is technologically mediated, it is by no means neutral. It is constructed at particular scales and in response to particular framings of landscape change, and in moving the information to other scales it can become distorted and counter-productive. While people working in the reserve come to closely know the different local dynamics of the places they work, it becomes their individual responsibility to negotiate between conflicting knowledge and information, creating a rough patchwork of decision making processes that reflect individual practitioners' political preferences and social ties. A greater attention to the scales and political framings of evidence at all levels of conservation and development practice is essential.

References:

Agrawal, A.
1995. Dismantling the Divide Between Indigenous and Scientific Knowledge. Development and Change 26: 413–413.

Atran, Scott, Douglas Medin, Norbert Ross, et al.
1999. Folkecology and Commons Management in the Maya Lowlands. Proceedings of the National Academy of Sciences of the United States of America 96(13): 7598 – 7603.

Becker, C.D., and K. Ghimire
2003. Synergy Between Traditional Ecological Knowledge and Conservation Science Supports Forest Preservation in Ecuador. Ecology and Society 8(1): 1.

Cowen, M., and R. Shenton
1995. The Invention of Development. *In* The Power of Development. J. Crush, ed. Pp. 27–43. London: Routledge.

Donovan, DG, and RK Puri
2004. Learning from Traditional Knowledge of Non-timber Forest Products: Penan Benalui and the Autecology of Aquilaria in Indonesian Borneo. Ecology and Society 9(3): 3.

Dove, Michael R.
2008. Beyond the Sacred Forest (I).

Fairhead, James, and Melissa Leach
2003. Science, Society and Power: Environmental Knowledge and Policy in West Africa and the Caribbean. Cambridge, UK: Cambridge University Press.

Forsyth, Tim
2002. Critical Political Ecology: The Politics of Environmental Science. New York: Routledge.

Harvey, David
1974. Population, Resources and the Ideology of Science. Economic Geography 50(3): 256–277.

Law, John, and Annemarie Mol
2008. The Actor-Enacted: Cumbrian Sheep in 2001. *In* Material Agency. C. Knappett and L. Malafouris, eds. New York: Springer.

Lowe, C.
2006. Wild Profusion: Biodiversity Conservation in an Indonesian Archipelago. Princeton: Princeton University Press.

Meyerson, Fred
1998. Guatemala Burning. The Amicus Journal 20(1): 28–31.

Mol, Annemarie
2002. The Body Multiple: Ontology in Medical Practice. Durham: Duke University Press.

Nations, James D.
2001. Indigenous Peoples and Conservation: Misguided Myths in the Maya Tropical Forest. *In* On Biocultural Diversity: Linking Language, Knowledge, and the Environment. Luisa Maffi, ed. Pp. 462–471. Smithsonian Institution Press.

2006. The Maya Tropical Forest: People, Parks, & Ancient Cities. Austin: University of Texas Press.

Primack, R.B.
1998. Timber, Tourists, and Temples: Conservation and Development in the Maya Forest of Belize, Guatemala, and Mexico. Island Press.

Robbins, Paul
2000. The Practical Politics of Knowing: State Environmental Knowledge and Local Political Economy. Economic Geography 76(2): 126–144.

Schwartz, Norman B.
1990. Forest Society: A Social History of Peten, Guatemala. Philadephia: University of Pennsylvania Press.

Sundberg, Juanita
1998. NGO Landscapes in the Maya Biosphere Reserve, Guatemala. Geographical Review 88(3): 388–412.