The political ecology of a highway through Belize’s forested borderlands

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Abstract. This paper examines how a new highway in Belize will change a tropical forest landscape. Since the end of British colonialism (1981), the Maya communities in Belize’s Toledo District have struggled with the state for control of the lands they have customarily used to produce a livelihood. We were approached by some Maya leaders, who recognize that the paving of a new highway through their villages could transform Maya agricultural practices and thus land use and cover change (LUCC), and asked to produce an analysis that could assist them in managing their lands. We braid together historical, social, political, economic, and satellite data to answer two questions: (1) How has land cover changed since 1975 in areas with Maya customary versus noncustomary land-use practices? (2) What will be the consequences of paving the new highway through this region for the landscape and the Maya communities? Using a multifaceted LUCC/political ecology analysis we found that forest clearing is greatest where noncustomary farming practices are employed. Noncustomary practices are spatially concentrated along the Belize–Guatemala border; the shift to noncustomary practices resulted from in-migration by war refugees who maintained close ties to Guatemalan markets. The paving of the highway promises to reduce the functional distance to Guatemala’s markets, which could change land use in other villages to the detriment of the forests because of the likely diffusion of noncustomary farm practices. Forest change will be shaped by the region’s complex political geography.

Keywords: Belize, forest, highway, Maya, political ecology

1 Introduction

It is widely recognized that road building in tropical forests typically has negative environmental consequences, both directly (e.g., through physical disturbance and edge effects) and indirectly, by facilitating expanding human settlement (e.g., Laurance et al., 2009). This paper analyses a case from the west-central area of the Toledo District of Belize, where the ‘mile 14 to Guatemala border’ highway is presently being upgraded. At the time of writing (January 2014), bulldozers are clearing vegetation and leveling the rolling hills in broadleaf forests near the village of Jalacte, a Q’eqchi’ Maya community adjacent to the border of Guatemala (see figure 1). Much of the roadwork is labor intensive
and the local Maya men, who produce a livelihood in their milpa farms by growing maize, beans, and rice, appreciate the opportunity for steady wage labor. Other Maya communities also look forward to the highway’s completion, which will link these previously remote villages with markets for their agricultural goods as well as the public services offered in Punta Gorda Town. But there is another side. Villagers know the new highway will bring more car accidents.(1) Moreover, the Maya Leaders Alliance (MLA), an umbrella group of indigenous-rights organizations, contends that the paving of the highway could change agricultural practices; thus, upgrading the highway may hasten forest degradation and contribute to breaking up commonly managed lands. They asked us to produce an analysis that could assist them in addressing these threats.

The literature on roadway expansion, agricultural development, and forest change is particularly rich in tropical Latin America (Carr, 2006; Southworth et al, 2011; van Vliet et al, 2012; Viña et al, 2004). Our analysis contributes to this literature by clarifying the relations between roadway effects on land-use practices and the complex political character of space. While numerous studies have examined forest change in places with customary and noncustomary practice [see Ostrom and Nagendra (2006) for a review], or differences in the effects of roads on forests across international boundaries (Southworth et al, 2011), our study addresses these sets of dynamics in tandem. Our principal methodological contribution lies in combining historical and political research with the interpretation of remote sensing. Moreover, our research reflects an attempt to improve local forest governance. Such interdisciplinary, practical research has been identified as particularly valuable for the project of building effective forest commons management (Hayes, 2010; Ostrom and Nagendra, 2006).

The ‘mile 14 to Guatemala border upgrade’ (hereafter the ‘new highway’: a more apposite term and the one used locally) cuts an east-to-west route through the center of the upland Maya communities, beginning at a junction called ‘Dump’ and concluding at a new international border crossing with Guatemala:

(1) Road accidents are not often discussed in the development literature but account for more deaths in the developing world than either malaria or tuberculosis (The Economist 2014). Data on road accidents in the Toledo District are unavailable, but anecdotal evidence suggests that they are a leading cause of death. Road accidents are also a threat to animals (Laurance et al, 2009).
“A contract … was signed between the Government of Belize and the Contractor Cisco Construction Ltd at a cost of [US$ ~25 million\(^2\)] for the upgrading of the road from Big Falls Village (Dump) to the Belize/Guatemala Border. … The works consist of upgrading approximately 34KM (23 Miles) to paved standards, the existing road embankment from Big Falls Village mile 14 (Dump) to a point 1.5km south of Jalacte Village, following the current alignment, which passes through the villages of Mafredi, San Antonio, Santa Cruz, Santa Elena and Pueblo Viejo” (Government of Belize, 2011, no page).

Apart from Mafredi, these are indigenous Maya villages. So too is Jalacte, the village adjacent to the road terminus at the border.

The road bisects a complex political geography. Three distinct political spaces coincide through the roadway. The first is territorial: the road is interlaced with a long-standing claim to the region by Guatemala. At the time of Spanish arrival, southern Belize was inhabited by indigenous Maya people. The Spanish claimed the area but, unlike in neighboring Guatemala, never established a colonial state or urban base, and later English loggers claimed the territory for the British Crown (although the trees were cut by African slaves). In 1763 the Treaty of Paris, signed between England and Spain, gave the settlement its first recognized status by allowing the “Occupation of Cutting, Loading, and Carrying away [of] Logwood”. The treaty maintained the Spanish claim until 1798, when a naval skirmish near an island known as St. George’s Caye formalized British authority. But, after winning its independence from Spain, Guatemala revived the claim in the 19th century. The present boundaries of Belize were established through the Anglo-Guatemalan Treaty of 1859 (Shoman, 2010, pages 29–35). That treaty, however, included Article 7, “requiring Guatemala and Britain ‘conjointly to use their best efforts’ to establish a means of communication from Guatemala City to the Atlantic.” In effect, Guatemala bargained for a road through Belize. The two countries collaborated on a survey for the proposed roadway in November 1861, but the British subsequently withdrew their involvement.\(^3\) Article 7 having thus gone unfulfilled, the Guatemalan state claimed the 1859 Treaty void, even after Belize won its formal independence in 1981. The paving of the highway comes during another period of tension with Guatemala over the territorial status of southern Belize.

The second political aspect of this space is regional. Recently Mexico and Central America have undergone a push for regional integration.\(^4\) Once completed, the road will tie Belize’s transportation network (including a deep-water port) to the Pan-American highway via the Santa Cruz–Chacte road network in Alta Verapaz, Guatemala. For supporters, these developments signal regional economic integration. Belize’s exports to Guatemala are significant—estimated at US $74 million annually (2005–11)—but could be much greater.

\(^2\)The highway is funded by a loan to the Government of Belize from the Kuwait Fund for the Arab Economic Development through the Central American Bank for Economic Integration (Government of Belize, 2011, no page). We have been unable to access original loan documents. Another source indicates that the loan is for BZE$47 million, or US $~23.5 million, with an interest rate of 5.9% to be repaid over twenty years (Anon, 2011). Credit was provided by the Kuwait Fund for Arab Economic Development, the OPEC Fund for International Development, and the Central American Bank for Economic Integration.

\(^3\)Perhaps due to the considerable costs involved—the Colonial Office called the scheme ‘impracticable’—or concerns about potential harm to the British settlement (Shoman, 2010, page 31), the road was never constructed and the transportation network connecting Guatemala with Belize remains meagre.

\(^4\)This integration is associated with the Plan Puebla-Panama (PPP), initiated in 2001 and subsequently renamed the Mesoamerican Project (MP) in 2009. Belize is an active member in PPP/MP. While it is difficult to specify PPP/MP projects, the map of the Corredor Atlantico del Caribe (see ‘Mapa de Corredores Viales de la RICAM’ at [http://www.proyectomesoamerica.org/](http://www.proyectomesoamerica.org/)) features the Dump–Jalacte highway. Officials and activists in Belize treat this highway as Belize’s contribution to PPP/MP.
with infrastructural improvements (Bulmer-Thomas, 2013). This figure excludes most commerce along the present roadway, since the flow of goods through Jalacte is unmonitored and unrecorded.

The third political dimension of this space could be characterized as *colonial* and concerns the ownership of the lands through which the route passes. Through political struggles and legal work, the Maya communities of southern Belize recently won rights to their lands. On 18 October 2007 the Supreme Court of Belize found that “Maya customary land tenure exist[s] in *all* the Maya villages in the Toledo Districts [sic] and where it exists, gives rise to collective and individual property rights within the meaning of … the Belize Constitution” (Conteh, 2007, ¶126i, original emphasis). This judgment was reaffirmed by Belize’s Court of Appeal in July 2013 (Morrison, 2013). One of the judges on the Court of Appeal reiterated:

“[T]he Maya people have rights to land and resources in Southern Belize based on their long-standing use and occupancy, and that the respondents have succeeded in establishing their claim to customary land tenure in Belize. The … Maya communities of the Toledo district of Belize have a historical and cultural relationship with the lands on which they currently live and work, and with the populations which have historically inhabited them, and that the patterns they describe in their villages are consistent with the traditional patterns of customary land tenure” (Alleyne, 2013, ¶335).

Notwithstanding these legal victories, the Maya communities presently face a concerted push by foreign firms for the extraction of oil, rosewood, and other valuable natural resources. The highway is braiding these strands of sociospatial change together. Its dimensions unite in our study area, where the highway bisects the largest contiguous area that has been historically and continuously occupied by Maya people since prior to British colonization.

### 1.1 The changing forest

This region is comprised of tropical broadleaf forest managed on a communal, usufructory basis and used to produce agricultural and forest products. The forests of southern Belize have drawn the attention of numerous geographers (Binford, 2007; Cherrington et al, 2010, 2012; Emch et al, 2005). While these studies have illuminated certain dynamics of forest change in southern Belize, few have attended to the region’s complex political qualities, and none has compared areas under Maya customary and noncustomary land use.

Our previous research examined an area where customary forest use and land tenure practices have been in place since the 19th century (what we call 'study area B'). We found that the forests in study area B “persist as secondary forests, used periodically by Maya farmers. The area cleared annually by Maya farmers is not increasing. The fallow period is stable. So too is the farming population” (Wainwright et al, 2013, page 183). This stability, we hypothesized, was likely due to the persistence of customary Maya land use and tenure. But not all the forests of the Toledo District are managed by customary Maya practices. Previous studies noted that forested areas close to major roads and near the Guatemalan border have seen the greatest reductions in forest cover in southern Belize (Cherrington et al, 2012; Emch et al, 2005). Yet this insight has not led to any systematic comparison.

This paper stems from two decades of collaboration by one of us (Wainwright) with these communities—work which has included, among other things, testimony as an expert witness in the aforementioned Supreme Court case (Wainwright, 2007). We initiated our research after a request from the elected leaders of Santa Cruz to examine the forest which they have long used and, with the 2007 judgment, legally own. This led to an earlier publication (Wainwright et al, 2013). The impetus for the present paper came when we presented our findings to the MLA in December 2012. They requested that we expand our research to include the broader area so that we could clarify the history, extent, and drivers of forest change in adjacent

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(5) On the Maya legal strategy, see Anaya (1998) and Wainwright and Bryan (2009).
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forest lands under customary and noncustomary agricultural practices. The government often attributes the loss of forests across southern Belize to Maya farmers (e.g., Government of Belize, 2001), without distinguishing between customary and noncustomary practices. The MLA sought material with which to respond. To provide this, we employed a multimethod political ecology approach integrating historical, political, agricultural, and LUCC analyses.

While it is beyond the scope of this paper to review the vast literature on LUCC, forest change, and roads in Latin America (cf. Carr, 2006; Chomitz and Gray, 1996; Southworth et al., 2011; van Vliet et al., 2012; Viña et al., 2004), we locate this project at the point where this literature meets political geography: hence, a political ecology of road effects on forest change. [The intersection of political ecology and LUCC is examined in Brannstrom and Vadjunec (2013).] By bringing a multimethod political ecology approach to bear on this particular landscape, we emphasize the political dimensions of the space and the historical dynamics driving land-use and forest change. While we are not the first geographers to use this mix of methods, combining historical, political, and LUCC analyses remains rare.

This approach allows us to make two novel contributions. First, by comparing multitemporal Landsat images since the 1970s of our previously studied (customary land use) forest and adjacent (noncustomary use) forest, we are able to quantitatively contrast patterns of landscape change and to explain these changes in historical–political terms. These results are presented in section 2, where we describe land cover variations in light of recent history and politics of land use. Second, in section 3, we evaluate the likely consequences for this region of the upgrading of the highway. This is the first scholarly study of this new highway and the first to discuss the emergence of the new farm system in southern Belize.

2 How is land cover changing?

2.1 Customary and noncustomary use

Our two study areas share the same climate and physical environment. Landscapes are dominated by karst topography with calcareous, weathered, low-nutrient soils that receive ~4000 mm of rain per year. The native vegetation is tropical broadleaf forest; there is a pronounced dry season (January–April). What principally distinguish our study areas are the social relations governing agriculture. In study area B, Maya customary land-use practices predominate. These practices have generated a considerable literature, including numerous anthropological descriptions of customary Maya agriculture land use in southern Belize (Downey, 2010; Grandia, 2012; Wilk, 1991; Wright et al., 1959; Zarger, 2009). (6)

To summarize, Maya customary agriculture in upland Toledo is a swidden approach that minimizes risk in an environment poorly suited to intensive practices. It involves clearing forested areas (typically with a machete), allowing plant materials to dry, burning the dried biomass, and planting seeds in the ash-laden soil with a dibble stick. Maize and beans are consumed in the household; other crops, like rice and cacao, though consumed in household, are often also sold as cash crops. (7) Milpa farming requires few capital inputs. Use of agrochemicals is uneven but generally limited. Farm fields are used intensively for one or two years after initial clearing, then fallowed to allow secondary forest regrowth and subsequent recutting. (8) The shifting of farms is coordinated at the community level through negotiations supervised by the alcalde, a state-sanctioned traditional leader. Labor is typically pooled in collaborative work groups. Land is customarily managed at the village scale as a commons,

(6) This list is not exhaustive. The following summary draws on these sources.

(7) Surpluses are modest. Customary Maya households in rural Toledo are generally cash poor, earning less than US $1/day/capita. Household reproduction is enabled by direct consumption of farm products.

(8) The term ‘secondary’ is standard yet problematic. The forests of southern Belize have been influenced by anthropogenic modification for thousands of years (our study area was densely settled by Maya people about 1500 years ago). Moreover, there is no single climax stage of forest growth.
where individual farmers hold usufructory rights to their parcels. Farmers in each community
monitor the forest-clearing actions of their neighbors and form workable boundaries using
landscape markers. Conflicts are worked out through negotiations under the aegis of the
village alcalde.

By contrast, the land-use and farming practices in study area A are not customary. Land
is fully parceled and intensively managed. Labor power is purchased, with Maya Belizians
paying Maya Guatemalans to work in their fields. Because of the proximity and porosity
of the border and Guatemala’s relatively large domestic market, farmers in Jalacte carry
their crops westward, crossing the border with horses laden with sacks of corn and beans.
Crops are sold like any other commodity, typically via middlemen in Guatemala; payment
is received in cash which is used to purchase farm inputs (among other things). Thus Jalacte
has become a distinctive, unusual village. Instead of a well-situated church, at the center of
the village is a muddy track along which commercial traffic bustles through the passage to
Guatemala. The local (unofficial) unit of currency is Guatemala’s quetzal.

Unfortunately, no published research has addressed the emergence of these new,
noncustomary farming practices. Unpublished research by Schulman (2002), who interviewed
farmers in Jalacte regarding their noncustomary farm practices, provides insights.⑨ All of
the farmers Schulman spoke with grew corn (household mean, 4890 lb/year) and black beans
(2825 lb/year) for sale in Guatemala through middlemen. Cultivation is labor intensive and
chemical intensive. All informants reported the purchase of labor power in the village—an
average of 1.8 hired workers/household/year, all from Guatemala—a rare practice in other
Maya communities. Additionally, some villagers rent land to Guatemalan farmers, either as
tenants or sharecroppers. While hiring labor is now considered normal in Jalacte, renting
land is not generally accepted since, as one of Schulman’s informants explained, “problems
with Guatemalan tenants could develop if their landlord decided to stop renting land to them”

The landscape transition between these two farming systems is easily discerned
with the naked eye [figures 2(a) and 2(b)]. Roughly halfway between Pueblo Viejo and
Jalacte, the landscape becomes dominated by tall grasses, particularly the ubiquitous
and fast-growing elephant grass (Pennisetum purpureum). The grasses roughly mark the
point where customary Maya production practices have ceased. Agroecosystems differ
substantially. In customary practice (area B), farmers carve their milpa fields out of the
broadleaf forest and burn the biomass to create a forest patch in which to cultivate. Before
weeds become problematic, farmers fallow the land, opening a new patch elsewhere in the
forest. This strategy produces a quilted landscape of forest vegetation at multiple stages of
regrowth [figure 2(b)]. The relatively small crop-field size within the forest matrix reduces
opportunities for weed-seed bank development, reduces grass invasion, protects against
plant disease outbreak, and reduces insect pest pressure. Hence production requires only
modest quantities of agrochemicals, if any at all.

By contrast, in Jalacte crops are planted on semipermanent fields, not routinely
rested in fallow. To control weeds, farmers apply herbicides intensively before planting;
Schulman (2002) found average applications of 0.61 of Gramoxone and 0.71 of 2,4-D per
acre. These agrochemicals are purchased in Guatemala, imported illegally, and applied via

⑨Quantitative data in this paragraph are from Schulman’s unpublished report of undergraduate
research inspired and supervised by Wainwright. Apart from informal conversations, Schulman
interviewed 14 farmers (selected from an alphabetized list to reduce likelihood of a family cluster
in his sample) from 106 households. He found a low standard deviation in responses. These results
conform with our understanding of local practices based on intermittent fieldwork (1996–2013).
⑩During fieldwork in 2013 we found that land leasing and a form of sharecropping called la
mitad—dividing the product between landowner and laborer—are still practiced.
backpack spray—with minimal safety equipment. After spraying, farmers will typically burn
the mat of dead grass to clear a space in which to plant crops. Crop diversity is minimal, with
only two main commercial crops—corn and black beans—and few varieties are planted.
The resulting landscape is open and homogenous, apart from occasional cohune palms
(*Attalea cohune*) and living fences as boundary markers. In short, the adoption of new farm
practices near the border has resulted in a more uniform agroecological environment, one
where intensive grass-weed pressure makes customary land-use practices ineffective and
prevents the growth of secondary forest. These biophysical changes on the landscape have been captured by Landsat.

2.2 LUCC analysis
We obtained remote sensing images at three years (1975, 1993, and 2011) from the online Landsat archive of the United States Geological Survey (USGS, 2012). To avoid issues due to vegetation phenology, all images were taken from a 10-week window during the height of the dry season, a time when Maya farmers cut and dry their forest patches in preparation for burning and planting. Figure 3 compares our two study areas during the dry seasons of 1975, 1993, and 2011. The 1975 Landsat image reveals a spatial pattern associated with customary swidden farming: numerous small clearings (magenta) represent forest cleared during the dry season surrounded by green vegetation of varying age and density. In 1975 only about 25 farms were cut into the forest in the Belize portion of study area A. These farms form the western extent of the customary land-use area of the village of Pueblo Viejo. By 1993 the intensive farm system visible in Guatemala (the western portion of study area A) appears to have spread eastward in Belize; hence the area near the border no longer displays the customary land-use pattern. Land use in study area B, by contrast, changed little. By 2011 the differences between A and B are even more pronounced. The portion of area A under continuous cultivation, pasture, or choked by grass weeds has expanded considerably. By the 2000s the number of discrete ‘patches’ cut into the forest cannot be calculated for area A, because we cannot easily distinguish between cultivated land, pasture, and weeds on the Landsat images. Between 1993 and 2011 the amount of forest fallow in much of area A seems to have fallen to zero, a finding consistent with Schulman’s (2002) study of Jalacte.

To further clarify the spatiotemporal patterns of land use during this period, we assembled a collection of dry-season images that cover both study areas for each year between 1993 and 2001 (except 1997 and 1998 due to the lack of usable Landsat images for study area A). Each image was classified into vegetation and nonvegetation (also noncultivated or cultivated). Both training and test data contain 400 pixels randomly selected for each class. Class labels for the training and test samples were identified by interpreting the Landsat images aided with in situ data from field visits and interviews. Images were classified using maximum likelihood classification (MLC) and support vector machine (SVM), then validated using the randomly selected test data. SVM provides slightly more accurate results than MLC. Overall accuracies for the classification of all the images ranged from 95% to 99%. Postclassification processing was performed to separate burned farm fields from roads and village nucleus lands, and to remove salt-and-pepper noise in the classified maps. Roads were identified based on GIS road layers coupled with Landsat images. Village nucleus lands were edited based on classified maps from multiple years. The village nucleus and roads were then removed from the class map to create maps of farm fields: that is, routine cultivation. Finally, a majority filter was applied to remove areas smaller than 9 pixels, which are considered as false patches. This allows us to compare the frequency of cultivation (figure 4). For the seven years examined, in study area B only about 0.4 % of the land was cleared more than twice. By contrast, in area A, approximately 14% of the land was cultivated more than twice.

2.3 The new farm system
Why did this new, noncustomary way of farming suddenly appear here? The literatures on Maya land use and LUCC in Belize have not addressed this question. This is not only an analytical lacuna: the question also has political dimensions, not least because the new highway is being laid through this region. Consider again the three political dynamics that

(11) For a fuller discussion of methodology for image selection and processing, see Wainwright et al (2013).
(12) On the changes in study area B see Wainwright et al (2013).
Figure 3. [In color online.] Landsat images (band combination: 7, 4, 2) in study areas A and B: (a) 1975, (b) 1993, (c) 2011.
overlap in this space. First, because of the territorial conflict with Guatemala, Belizean discussions of forest clearing near the border are typically framed in a harsh light—as ‘invasion’. In popular view, the loss of forest in Jalacte is essentially a criminal act carried out by Guatemalans against Belize.\(^{13}\) Second, with respect to the dynamics of regional integration: a study for the Inter-American Development Bank found that two of the four largest imports to Belize from Guatemala in 2002–11 (comprising 16% of total imports by value) were agrochemicals (Bulmer-Thomas, 2013, page 33). As we have seen, Jalacte’s noncustomary farm system reflects its proximity to Guatemalan markets both for demand (corn and beans) and for supply (agrochemicals). Third, a persistent discourse in Belize treats Maya farmers as irresponsible, itinerant people who ‘slash and burn’ their way through the rainforest (on this discourse, see Wainwright, 2008; Wilk, 1991). Without recognizing its noncustomary character, Jalacte’s farm practices seem to lend credence to the view that the Maya are destroying Belize’s rainforests, thus contributing to anti-indigenous sentiments.

A stronger explanation of events requires that we consider the history of Jalacte. Fortunately, rich historical material is available because of a distinctive research project conducted in 1995–97 when a team of researchers, selected from each Maya community in southern Belize, conducted research on their own villages.\(^{14}\) These data were used to compile the *Maya Atlas* (TMCC and TAA, 1997). The main data source for the *Maya Atlas* was a household survey conducted in each community by trained local residents, using indigenous languages. While the quality of the resulting data should be examined critically, for those communities where the original household data sheets are accessible and legible, it is possible to assess data quality and draw out useful material.\(^{15}\)

We reviewed the June 1997 *Maya Atlas* household data survey forms from Jalacte, where the original field research was conducted by Ricardo Cucul and supervised by project leader Diego Bol, both Maya men from southern Belize. In 1997 there were eighty-eight households in Jalacte; Cucul interviewed the heads of each. In November 2013 we reviewed half (48%) of the original data sheets. The quality of the data is uneven. For certain questions, practically

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\(^{13}\) See, for example, the many online responses to Anon (2011).

\(^{14}\) This project was co-led by geographer Barney Nietschmann. Wainwright participated in the *Maya Atlas* research (see Wainwright, 2008, chapter 6).

\(^{15}\) The original *Maya Atlas* household survey forms are held by the MLA. We thank the MLA for allowing us access. Unfortunately, some data sheets have been badly damaged in storage.
all responses were identical, which requires some interpretation. In some instances the uniformity of answers reflects social homogeneity: for example, the first language of every household is said to be Q’eqchi’ Maya—an accurate result. In other instances, uniform data imply that the question was probably misunderstood by the village researcher. For instance, only two answers are recorded for question 12: “when did your ancestors come to these lands?”—“no” and “100 years ago”. Neither reply squares with local history, and the two contradict each other. Fortunately, better data were provided in response to question 6: “how many years have you lived in this village?” Responses reveal that the mean length of residence in Jalacte was 12.5 years (median 12; mode 12). The Maya Atlas survey was conducted in June 1997, implying average arrival in early 1985. Replies to question 6 show that two thirds of the households in Jalacte had arrived between 1980 and 1987, the period when the new land-cover pattern emerges.

What caused this abrupt growth of a Maya community that broke with long-standing customary land-use practices? The answer is the brutal civil war in Guatemala, cause of more than half a million dead. During the worst period of the war (1981–84), a series of violent attacks swept through the Alta Verapaz as part of a nationwide campaign of state/military terror against the left and indigenous communities (Grandia 2012; Grandin, 2004; Wilson, 1995). Grandin writes:

“In June 1982 after completing its first sweeps through Chimaltenango and Quiché [in the western highlands], the military arrived in Alta Verapaz [ancestral home of the Q’eqchi’]. Following their pacification of the EGP communities [ie, those allied with the guerrilla army, *Ejército Guerrillero de los Pobres*] in western Alta Verapaz, troops moved east to Cahabón, committing massacres in Seáris, Setzacpec, Chíax, Balame, Salac, and Chiacach. In July, soldiers decapitated seven party members in Setzacpec. A month later in Seguamó, the military and civil patrollers carried out Cahabón’s worst slaughter, murdering 106 people” (2004, page 128).

Q’eqchi’ community life was shattered, and entire villages erased from the map. By 1982 a steady flow of Q’eqchi’ migrants were fleeing their communities. Particularly after 1983, when the rebel EGP army retreated from Alta Verapaz and the Guatemalan army hunted refugees through the forest, Q’eqchi’ people migrated into relatively marginal lands: northward into the lowlands of the Petén, and eastward to remote corners of Izabal Department (bordering southern Belize). A relatively small fraction of these migrants trickled across the border into Belize and a few—perhaps twenty households—into Jalacte. Question 10 from the Atlas research asked respondents to name their home village. Most of the households established in Jalacte had immigrated from Maya communities in eastern Guatemala. Several of these communities, including Cobán, Chiacté, and Cuzpeméch, were sites of massacres or were destroyed during the height of the war (1981–84). (16)

Thus the clearing along the border in the 1980s is not the result of customary farming practices by Maya farmers from Belize. Rather, it is the result of opportunistic strategies enacted by Q’eqchi’ Maya refugees of Guatemala’s civil war. Through migration, these households successfully protected themselves. They produced a novel, indigenous community that straddles an international border. These pioneers’ grandchildren speak Q’eqchi’ at home, English in school, and Spanish in Guatemalan markets.

(16) On military repression of the Q’eqchi’ communities in the early 1980s, see Wilson (1995, chapter 7) and Grandin (2004, chapter 4). Both discuss massacres near Cobán. Among those who settled in Jalacte in the 1980s, “Cobán” is the most common answer given to Atlas question 10 (“What village are you from?”). We read “Chiacté” from ‘Chicate’ (as recorded by Cucul on data sheets 14 and 15) and “Cuzpeméch” from ‘Cruz Pamak’ (sheets 13 and 16). It is worth emphasizing that no part of the Q’eqchi’ ancestral region was spared the extraordinary violence of 1981–84.
3 The highway

What will be the consequences for the landscape and the Maya communities of paving the new highway through this region? This question should have been fundamental to the impact assessments for the highway upgrading; unfortunately, it received little attention. The environmental impact assessment (EIA) (BEC, 2010) for the highway upgrading includes only one cursory passage on agriculture and land use:

“The upgrading of the road may have an impact on the use of the agricultural lands. … Attempts have been made by different development projects to increase the production of the milpa system and/or to diversify the production. One of the limiting factors of these attempts is in restricted access to markets. The market in Guatemala is there but prices are low and the shipment of crops is burdensome. For long the internal market in Belize was inaccessible in two ways; the bad condition of the road to major population centers and the lack of a marketing network to enable the sale of the products. With the constructure [sic] of the road to Jalacte, one of the restraints will be lifted. … Usually the farmers of the project area will ascertain you [sic] that yes; they easily can produce more and different crops. But increased production does not guarantee increased income for the farmers. Increased yields which in most cases cannot be stored for a long period will over flood the market and prices will plunge. If the Toledo farmers gain access to a better paying market or they are able to store their harvest until prices on the market are higher, intensification of agriculture can happen. … [Consider] the more intensive agriculture practices of Jalacte which is already resulting in environmental degradation” (BEC, 2010, section B2.1).

This statement is the only substantial comment on the potential intensification of forest use—undoubtedly the most serious environmental consequence of the highway upgrading. Its analysis is thin. Let us reconsider the question in light of our research results.

Paving the Dump–Jalacte highway will reduce the functional distance and travel time in two directions: eastward (people and goods moving from Guatemala and the border area to Belize’s markets and deep-water port in Big Creek) and westward (people and goods from Belize entering Guatemala). The Maya communities near the highway will be influenced in both respects: the travel costs of bringing their goods to markets in Belize and Guatemala will decline (Chomitz and Gray, 1996).(18) The market in Guatemala is much larger and typically provides higher prices for staple agricultural commodities. Thus, if travel cost declines equally in both directions, we can expect that more Maya farmers will seek to sell their goods in Guatemala. On this reasoning, the EIA is correct in positing that “if the Toledo farmers gain access to a better paying market [ie, Guatemala] … intensification of agriculture can happen.” This hypothesis is consistent with Chomitz and Gray’s model (1996) and Wilk’s (1984) empirical study of the effects of roads on agricultural practices in Belize. Intensification of agriculture practices would mean that the noncustomary farm system we find in Jalacte—which is “already resulting in environmental degradation” (BEC, 2010, section B2.1)—will spread eastward.

To formulate a stronger hypothesis regarding how the new highway could exacerbate deforestation, we analyze forest-cover change since the 1970s in the subregion where customary practices are not practiced (study area A) and in the neighboring area where customary practices still predominate (study area B). We use the west–east axis of our study areas (along which the highway runs) to assess how distance from the border

(17) We have been unable to obtain a copy of a first EIA, written by Boomsma (2002). In any event, it was superseded by BEC (2010).

(18) Chomitz and Gray’s (1996) study—an exemplary analysis of the economic-geographical consequences of roads on land use and deforestation in Belize—unfortunately falls victim to the territorial trap. They ignore all markets outside of Belize (page 498).
has influenced cultivation patterns. The maps of routine cultivation generated are binned to create profiles of percent routine cultivation from the western edge of study area A to the eastern edge of B. Recall that each study area consists of pixels in 400 rows by 400 columns; therefore, the two study areas have 800 columns. The percent of routine cultivation \( (y_i) \) by column can be calculated by dividing the total number of cultivated pixels in each column by 400 [equation (1)]. Then, we average the \( y_i \) for each five columns to create a smoother profile \( (Y_j) \):

\[
y_i = \frac{c_i}{400}, \quad i = 1, 2, \ldots, 800,
\]

\[
Y_j = \frac{1}{5} \sum_{k=1}^{5} y_{5(j-1)+k}, \quad j = 1, 2, \ldots, 160,
\]

where \( c_i \) is the number of pixels classified as routine cultivation in each column of figure 5, \( y_i \) is the percentage of routine cultivation in column \( i \), \( Y_j \) is the average of \( y_i \) per five steps (columns).

![Figure 5](image_url) [In color online.] Percentage of the area under routine cultivation in study areas A and B over time. Land-use change images from figure 3 reproduced here for reference.

Near the border, the portion of area A under routine cultivation increased considerably from 1993 to 2011. By contrast, in study area B the percentage of land under regular cultivation remained consistent. In 2011 cultivation was as high as approximately 40% along the border, declining to about 7% in study area B.

4 Conclusions

Our analysis reveals that divergence of forest-landscape change along the highway corridor results from the emergence of noncustomary Maya farming practices near the Belize–Guatemala border since the 1980s. The clearing along the border is not the result of customary farming practices by Maya-Belizean farmers. Rather, deforestation resulted after
Maya war refugees migrated into Belize from Guatemala and adopted intensive agricultural practices, while maintaining close ties to the Guatemalan market. The paving of the highway through this region promises to reduce the functional distance to Guatemalan’s markets. Thus, the new highway could change land use to the detriment of the forests in area B if customary farm practices adapt to the presence of the road by becoming more like those near the border. In this event, the deforestation frontier will shift eastward. While this may seem the most likely prospect, there are other possibilities. Three variables will shape these changes; each brings considerable uncertainty. These uncertainties—not addressed in the EIA for the highway—derive from the three political–spatial dynamics noted earlier. Let us reconsider each.

The first source of uncertainty concerns the border. The new highway bisects a region where the binational, territorial division of space is a fundamental social and economic fact. The key uncertainty here is the future political regulation of the border. At present, the border is ‘soft’: Maya farmers pay no import or export taxes and cross with relative ease. This may change. According to government statements (Cuellar, 2011; Government of Belize, 2011), an international transit station and customs house will be constructed to regulate cross-border traffic. Assuming this occurs, it is unclear whether Belizean state officials would allow Maya farmers to cross the border without paying taxes on goods. Collecting these taxes—or enforcing labor law—would change the economics of farming, to the detriment of the noncustomary practices. This could trigger reforestation near the border. By contrast, if the border does not ‘harden’ in economic terms, but a transit station increases the sense of stability and safety along the border zone, we should expect the opposite effect: stimulation of cross-border traffic, greater exports of unprocessed agricultural commodities from area B (and other Maya customary-practice regions), and greater deforestation.

The second source of uncertainty is regional. Project documents and government statements about the highway emphasize its role in regional market integration (eg, Government of Belize, 2011). If the highway ties Maya farmers more fully into regional economic networks, economic theory and the history of agrarian change in Latin America strongly suggest that some farmers will successfully adapt, profit, and scale up, while others will be squeezed out. But such transformation—the creation of more fully capitalist agrarian communities (eg, in study area B)—presupposes the erosion of local barriers to capitalist practices, especially the common ownership of the land and social friction around hiring wage labor. It is too soon to know how the road will tie this space into regional economic networks. It is possible that the paving of the highway will cause the state to look more critically at its regional-integration policies, so that the improved infrastructural linkages are not accompanied by more open trade policy. Alternatively, the new highway could attract narcotics traffickers to the region. The highway may have been funded under neoliberal auspices, but other outcomes are possible.

The third crucial dynamic that will shape the effects of the road concerns the state–Maya negotiations over land rights. The highway bisects a space that has been continuously occupied by Maya people since before British colonization, and generations of struggle by the Maya communities have led to the successful defense of their rights in political and legal terms. Yet at present the state does not recognize our description of this space as ‘Maya’ and rejects the Supreme Court’s judgment in favor of Maya land rights. The state’s stance

\[19\] Farming practices in both study areas are bound up with exploitative capitalist social relations (Wainwright, 2008). That said, in area B Maya farmers produce a livelihood through practices which exhibit precolonial qualities and facilitate community-based land management. These qualities and practices persist amidst capitalist social relations: the result is a complex, layered landscape marked by previous rounds of extraction and regeneration. Even places that look “like primeval forest” may be “fallowed area within a larger system of exploitation” (Wilk, 1991, page 66).
The political ecology of a highway will shape the new highway’s effects. The highway will stimulate commercial trade and movement through the region; the environmental effects of these changes will largely depend on changes in Maya livelihoods. These changes will be mediated by local political–economic capacities, which are in turn rooted in control of resources. As Chomitz and Gray (1996) note in their study of roads and deforestation in Belize: “market distance, land quality, and tenure have strong interactive effects on the likelihood and type of cultivation” (page 501). If the Maya communities win control of land tenure, they are likely to greatly benefit from the reduction in market distance, which will create new incentives and opportunities to export their products—beginning with corn and beans but potentially shifting to higher value goods. Without such tenure, they will be increasingly tied into international markets as marginal, small-scale, resource-poor producers. In this scenario, we may anticipate that parcelization and sale of land to non-Maya people will follow as poor households, cognizant of their position and government policy, sell what little they can claim as the highway brings investors.

The conclusion of our analysis therefore is that, while the economic–geographical effects of the new highway are fairly straightforward and predictable, the complex political–geographical character of the region makes it difficult to predict the changes to come.

* * *

In a strictly scientific sense, our paper should end there. But this research was initiated as a political intervention and, as a matter of record, we feel a responsibility to make a statement about what we believe and what we hope will occur.

The most likely scenario is that the new border will be ‘soft’, Belize’s agricultural economy will be tied more strongly into regional and global markets, and the government will not respect Maya rights to land. Under these conditions, the new highway will encourage Maya farmers to adopt the more fully capitalist and chemical-intensive agricultural practices which we find near the border: forest fallow will decline; deforestation will increase. In this scenario, by 2030 we may expect to add a line to figure 5 with high rates of routine cultivation stretching through area B. By then, many small farmers would have left the villages near the highway through urban migration and the land will have passed into private hands.

The best-case scenario, in our view, is radically different. The new border would remain ‘soft’ for the indigenous inhabitants (acknowledging ancestral passageways), but the state would adopt a selective, developmental approach to trade policy, while also respecting the Supreme Court’s decision on Maya land rights. Under this scenario, Maya communities would gain much long-term confidence in their capacity to adapt their customary land-use practices to facilitate patterns of economic growth that benefit them directly. Rather than sell individually—or sell land—Maya farmers could form producers’ cooperatives to purchase and store their crops at the border. This could further reduce transport costs and increase prices received, thus increasing the share of value returning to the communities. This is only an illustration of one mechanism by which Maya communities near the highway could benefit economically from the highway, under changed political circumstances. This scenario is not ‘ours’: it emerges from conversations in the Maya communities and is reflected in the work of the Maya Leaders Alliance, such as their “statement to the people of Belize” of 12 June 2014:

“As Maya people our struggle is the same as many Belizeans. We simply want a dignified life. Central to the dignified life is the right to remain on our lands which we have inherited from our great grandparents, something we will never give up. We want to maintain ownership of our culture and our resources. .... We want to be respected, consulted, and asked for permission to come onto our lands. We want our traditional leaders—our Alcaldes—to be respected and consulted on issues that affect us as a people. ....
And, whosoever is interested in a relationship with us needs to treat us as equals” (MLA, 2014, page 2).

This vision, like the scenario we described, could only be achieved through political struggle. Whether this will occur is impossible to forecast. The only certainty is that the new highway will braid the political character of this space in ways that will shape the evolving forest landscape.

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