Digital Pedagogy, Asian Pathways: Interrogating Geospatial Approaches to Conflict in the Philippines

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Project Overview

The Richard Charles Lee Asian Pathways Research Lab (RCL-APRL) Virtual Internship Program at the Asian Institute is a structured experiential learning opportunity. As part of our ongoing commitment to thinking through creative methodologies for understanding Asian pathways, this year's project offered professional development in a learning-focused environment, introducing and training students in a suite of practical digital tools and qualitative research methods, during the fall-winter 2020-21. Interns participated in workshops and readings designed to enhance their qualitative research skills and to consider the colonial genealogies and ethical implications of cartographic digital research. Our final project offered interns the opportunity to examine the ways that data visualizations can help researchers think into their projects from new perspectives.

Led by the Asian Institute's RCL Postdoctoral Fellow, Dr. Joseph McQuade, the program trained research interns to use digitized archival sources and geospatial tools to research, track, and visualize data related to conflict and environmental insecurity. Through workshops, readings, and group discussions RCL-APRL interns learned to think critically about their relationship to digital technologies, as well as the benefits, challenges, and ethical questions that these technologies pose for researchers. Responding to the unprecedented challenges students and recent graduates currently face in seeking employment opportunities, this year's lab programming was structured as an unpaid internship, open to all undergraduate and graduate-level students at U of T as well as recent graduates. As a non-credited program, the RCL-APRL delivers a flexible program to interns located around the globe.

This year's research focused on Mindanao, the second largest island in the Philippines. Through a series of collective workshops and individual assignments, interns used digitized sources to better understand the spatial dimensions of conflict and

environmental vulnerability in the region. In collaboration with GIS (Geographic Information Systems) specialists from the Appraising Risk Project at McGill University's Indian Ocean World Centre, interns contributed to a collective data set and received technical training in how to visualize and analyze this data in a free and open-source GIS platform. This interinstitutional collaboration provided a major learning opportunity for interns that will continue to enhance lab activities going forward.

Methods and Outcomes

Our project drew on armed conflict data produced by the Uppsala Conflict Data Program (UCDP), which we merged with our team's research on other conflict incidents not included in the UCDP dataset. As such, we have tried to compile as complete as possible a database of conflict incidents for the period in question, though we do not claim our set to be fully exhaustive. Our dataset includes information regarding the most proximate GPS coordinates for each incident, as well as the date of the incident, the identities of the main actors involved, and the number of casualties incurred (including civilians). These conflict points, which we have represented geospatially as dots, form the core of our data visualization.

Members of the RCL-APRL internship were asked to engage in independent research on conflict events that have occurred on Mindanao during the period of 1986 to the present. They were encouraged to explore journalistic and investigative sources and then enter information regarding each event into a collaborative dataset hosted online. This dataset used pre-established variables designed to be interoperable with UCDP's Georeferenced Event Dataset (GED). The exercise provided interns with hands-on experience collecting raw data from archived digital sources. Interns compared findings and shared advice on how best to locate accurate information, especially in the case of incidents that occurred during the first decade under investigation (1986 to 1996), where information tended to be less readily available.

Like the GED, our dataset used the concept of the conflict dyad, referred to as Side A and Side B. This dyad represents the known participants in a conflict event, whether they are two combatants, or the victims of violence and their attackers. Conflict dyads generally identify groups rather than individuals. In addition to the dyad, students entered a descriptive summary of the event, its date, and its outcome, including recorded fatalities of each side. The number of civilian deaths and of displaced persons were also recorded. Location data was entered in the form of a location name and its coordinates, generated from online maps or dedicated geo-coding tools.
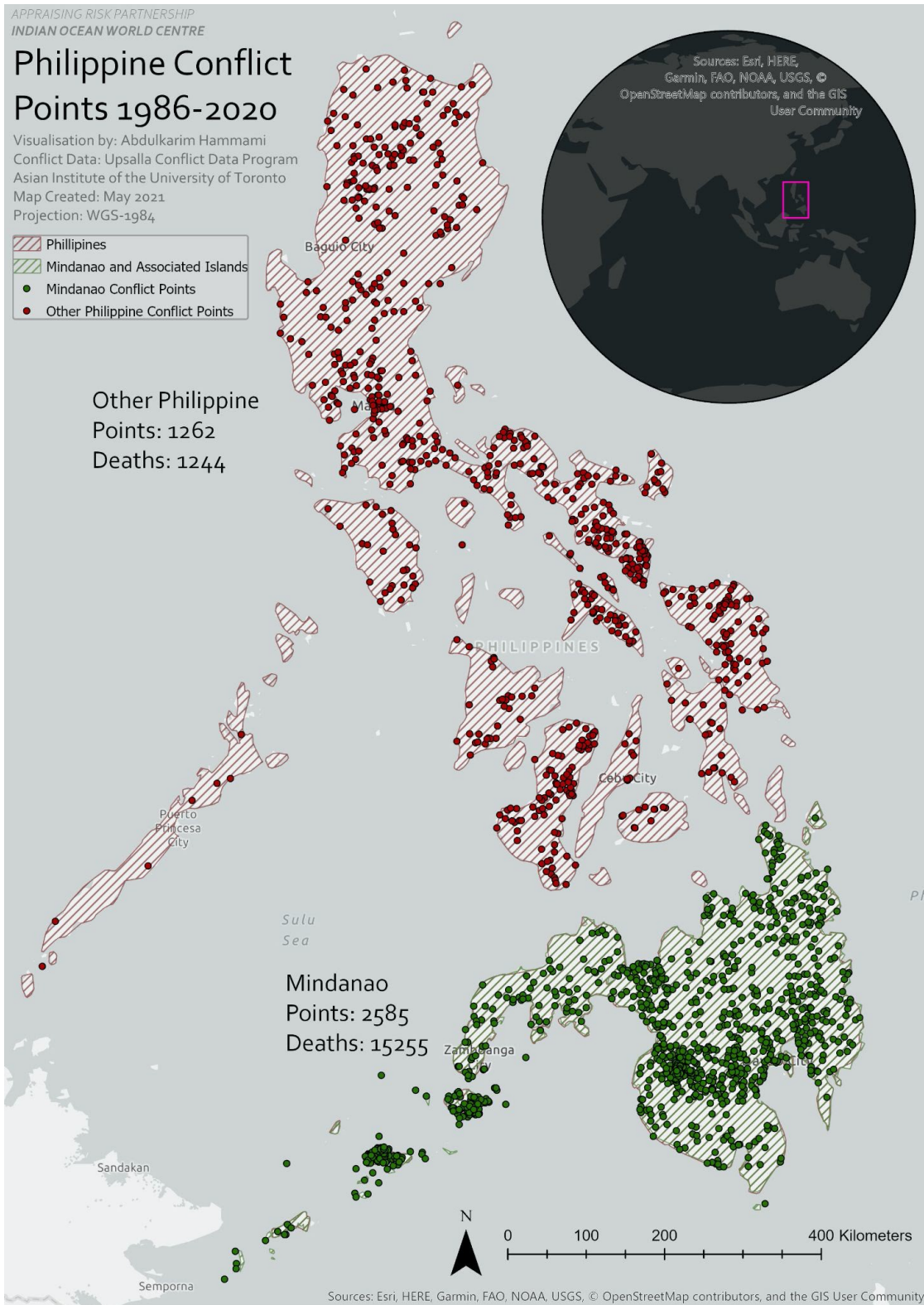
Figure 1: Conflict in the Philippines, 1986-2020 (map produced by the Appraising Risk partnership).

Over the course of three weeks, students contributed 113 unique conflict events. This event data was then used as the basis for workshop sessions dedicated to introductory GIS skills. During these sessions, GIS Analysts from Appraising Risk worked collaboratively with our Research Interns to show how data, in this case conflict events, can be mapped geospatially using QGIS, an open-access GIS platform.

As such, the collaborative RCL-APRL dataset proved to be both a useful pedagogic tool and a beneficial addition to existing conflict datasets such as the GED. After excluding duplicate events, we combined student data with a sub-section of the GED, representing conflict events on Mindanao within the relevant timeframe. The result was a more robust dataset that could better account for the range of conflict incidents that have taken place on Mindanao during our chosen timeframe.

For the next phase of the project, Research Interns worked in three teams to collect a secondary dataset of mines, ports, and military bases. By plotting these additional data points based on GPS coordinates, we rounded out our picture of how conflict densities on Mindanao may or may not correspond to these locations. The results of this phase of research can be seen in Figure 7.

Through assigned readings and online resources (especially Sen 2017; and Blight et al. 2021), interns were also asked to reflect on some of the limitations or dangers inherent in approaching issues of conflict and environmental security from a geospatial perspective. While GIS mapping can be a valuable tool for ensuring access to disaster relief and humanitarian services, the imperial origins of modern cartography necessitate an approach that is attentive to the layers of power embedded in the production of cartographical knowledge. Grounding our approach in critical cartography, we aimed to show that mapping need not remain the preserve of technocratic experts, but can be a participatory venture that challenges or destabilizes 'traditional positivist' spatial representations shaped by the interests of resource exploitation and the accumulation of capital (Crampton and Krygier 2005).

Issues of access and data-ownership are especially important, and it was for this reason that we used the free and open-source QGIS platform instead of the more commonly used (but proprietary) ArcGIS suite owned by ESRI. With a few hours of training and access to high-speed internet, this technology can be learned and deployed by a wide range of individuals, organizations, and communities. We hope that our project highlights some of the possibilities enabled by this free and open-source software, with the ultimate goal of providing greater opportunities for future potential collaborations or partnerships with local and Indigenous-led counter-mapping initiatives (for example, the Ogimaa Mikana artist collective).

As such, this year's APRL project did not provide a traditional academic analysis of the causal pathways of armed conflict on Mindanao, but instead aimed to create visualizations that could be freely accessed and used by local organizations attempting to better understand how these technologies can inform their own research or activism. Based on our collected datasets and on others accessed through the Appraising Risk partnership, our team produced open-source visualizations that can be freely used (with acknowledgement) by researchers, local partners, or international organizations to better understand the spatial distribution and chronological progression of conflict in the southern Philippines. Although we have provided some preliminary analysis, the main purpose of our resource is to provide a starting point for future work aimed at determining the mechanisms by which climate and geography may shape conflict on Mindanao. For example, armed conflict incidents on Mindanao tend to cluster around roads and cities, challenging positivist assumptions that greater connectivity and market integration lead inevitably to a reduction of violence.

Timeline

Our maps in this section are designed to show how, if at all, key ceasefires and peace negotiations between the Government of the Philippines and various armed non-state groups have shaped the phases of the conflict. In other words, has there been a consistent relationship between the implementation of ceasefire agreements and a real decline in violent incidents on Mindanao at each stage in the unfolding of the peace process? As the locus of insurgency has shifted from one group to another, has this had any detectable impact on the spatial distribution of attacks either by the insurgents or by government forces?

Chronologically, we focused our research on the period from the end of the Marcos regime in 1986 to the present. While data from the preceding Marcos regime and earlier colonial and postcolonial governments would provide useful grounds for comparison, incorporating these longer histories was beyond the scope of the current project. Instead, the project focuses on the most recent period of unbroken democratic governance in the Philippines, with only a brief discussion of the earlier periods in the section that follows.

It is important to note that a high density of conflict points corresponds to the intensity of a conflict within a given area but does not provide an accurate measure of the

strength of an armed group within that same area. Often, areas in which armed groups (whether government or non-state) are strongest can correspond to a lower density of conflict points, as the armed group in question can successfully exercise a monopoly of violence within that area. As Shivaji Mukherjee has shown, the longest-running civil conflicts are most often those that are low-intensity, with more evenly-matched opponents producing a more intractable conflict over time as neither can gain the upper-hand and establish control of the contested region (Mukherjee 2014). As such, we regard the conflict points on our maps as measures of conflict intensity but not necessarily as measures of insurgent or government strength.

Background

Mindanao has been the site of several long-running conflicts since the earliest days of Spanish colonial encroachment. From the sixteenth century onwards, various predominantly Muslim groups fought a series of wars and skirmishes against the Spanish, though the extent to which this constituted a unified Muslim resistance movement has been exaggerated. Originally using the term 'Moro' to describe all the inhabitants of the Philippines, the Spanish soon came to apply the label only to the Muslim populations of the southern islands, in contrast to the Christian converts called 'indios'. After the victory of the United States in the Spanish-American War of 1898, US forces took control of the Philippines and undertook a campaign of 'pacification' against the Muslims of the southern islands, who had begun to embrace a more coherent Moro identity. American atrocities against the Moro population included the massacre of hundreds of Moro rebels and civilians at Bud Dajo, a volcanic crater on the island of Julu, in 1906. Over the following decades, the American administration implemented policies that favoured the Christian population and encouraged Christian migration from Luzon to Mindanao, altering the demographic composition of the southern island (McKenna 1998).

When the Philippines gained independence in 1946, the Moro population remained marginalized within a constitutional framework that favoured the Christian majority. This trend was exacerbated during the authoritarian presidency of Ferdinand Marcos. Following the election of Marcos in 1965, young, educated Moros in 1969 formed the Moro National Liberation Front (MNLF), a secular-oriented political movement demanding greater autonomy for the Muslims of the southern islands. In 1972, the MNLF turned to armed rebellion, providing Marcos with the rationale for implementing Martial Law and solidifying his grip on power. As Jacques Bertrand has shown, an intensification of the conflict through the 1970s forced Marcos to negotiate with the

MNLF and to promise some concessions out of a desire to not jeopardize relations with Middle Eastern and North African oil-producing countries, especially Libya (Betrand 2021, p. 146). Conflict resumed when it became clear that Marcos had no intention of honouring the agreement and in 1984, a new resistance group emerged that embraced a more explicitly Islamic identity, called the Moro Islamic Liberation Front (MILF). Two years later, widespread resistance to the authoritarian Marcos regime from across the Philippines toppled the government and ushered in a fresh period of admittedly imperfect democracy that has continued to the present day (Bertrand 2013, pp. 82-91).

We now turn to the three phases of conflict for which our team collected data. For each phase, we have produced a map that plots the spatial distribution of conflict points. Our hope is that these maps can provide useful resources to help students and researchers better understand how conflict on Mindanao has unfolded geographically over time.

First phase, 1986-1996

The first phase begins with the fall of the Marcos regime in 1986 and continues until signing of the 1996 Final Peace Agreement, also known as the Jakarta Agreement, by the government and the MNLF (for an early assessment of the agreement, see Bertrand 2000). During this period, most conflict incidents resulted from clashes between government troops, especially the Armed Forces of the Philippines (AFP), and two primary sub-state groups – the New People's Army (NPA) and the MNLF. A small number of conflict incidents also occurred between government forces and the MILF, which broke off from MNLF in 1984.
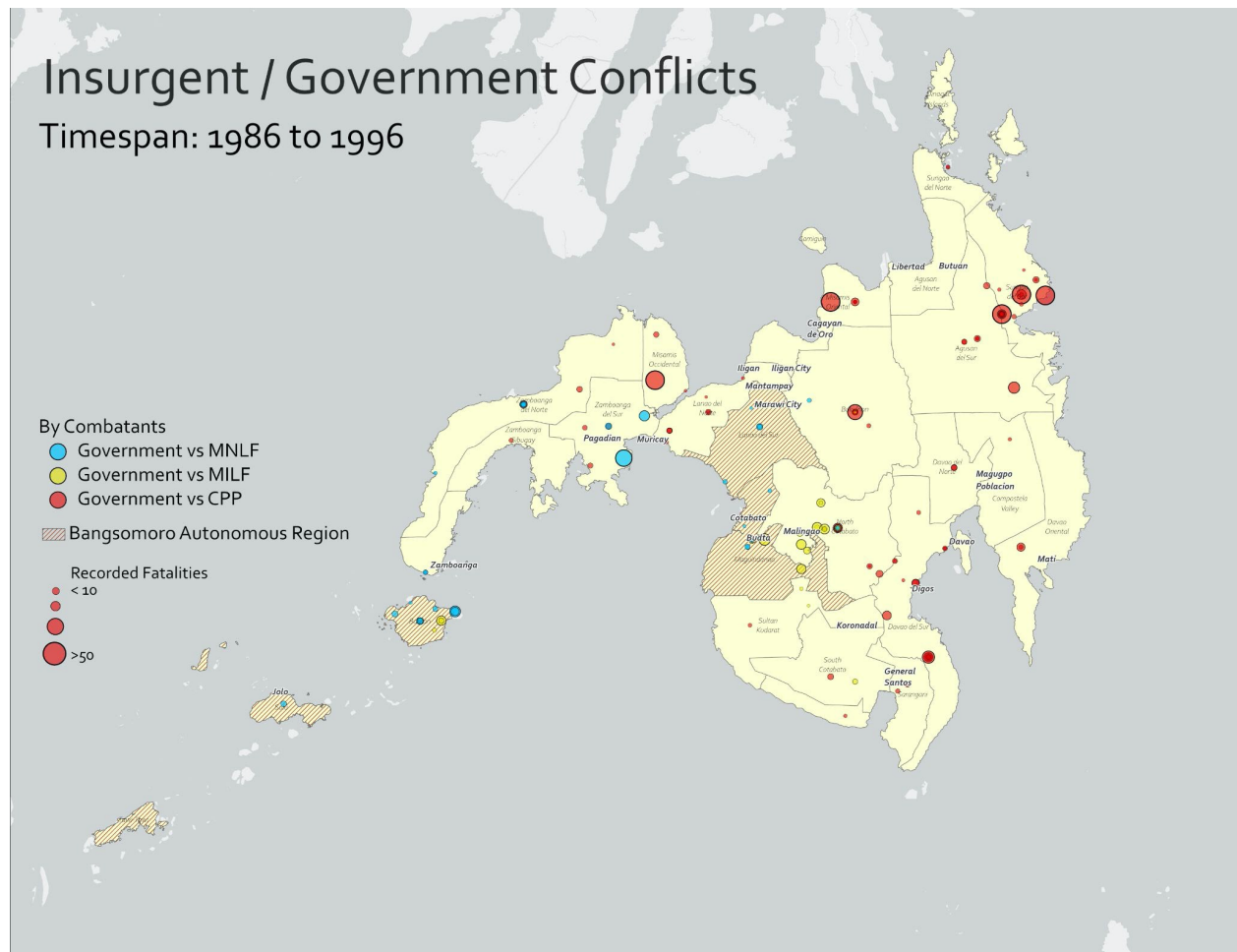
Figure 2: Conflict incidents on Mindanao, 1986 to 1996 (map produced by the Appraising Risk partnership).

Most conflict incidents during this period were the result of clashes between government forces and the NPA. The NPA is the armed wing of the Communist Party of the Philippines (CPP), and has been using Maoist-inspired guerilla tactics for decades as part of what its adherents view as a 'people's war' against the Philippines government. Unlike the other two groups discussed in this section, the NPA is highly active throughout the Philippines and has operated for decades as the main armed opposition to the government. As our map shows, during this period the NPA fought government forces in most provinces on Mindanao, the main exception being the Autonomous Region in Muslim Mindanao (ARMM), which would later become the Bangsomoro Autonomous Region. As we will see, this rough division of Mindanao along an east-west axis between Moro separatist groups and the NPA will become even more apparent in the periods that follow.

The bulk of MNLF conflict incidents form a rough arc that extends from the islands of Sulu and Basilan up into Mindanao's northwestern promontory and then down into the Autonomous Region in Muslim Mindanao. A nationalist group based on specific territorial claims and ethno-religious identity, the MNLF can be seen to operate within a circumscribed geographical range.

Conflict incidents involving the MILF were even more localized, forming a dense cluster just south of the island's centre, in the provinces of Maguindanao and North Cotabato, with only a handful of outliers further south and on the island of Basilan.

Second phase, 1997-2012

The signing of the 1996 Final Peace Agreement did not end the conflict on Mindanao. In the decade and a half that followed, deadly clashes between the government and sub-state armed groups continued, despite a decline in armed hostilities between the MNLF and government forces. Our second phase of research begins in the immediate wake of the 1996 Final Peace Agreement and concludes with a preliminary peace agreement between the government and the MILF, signed in 2012. The agreement laid the groundwork for the establishment of the Bangsomoro Autonomous Region, a new political unit to replace the failed ARMM.
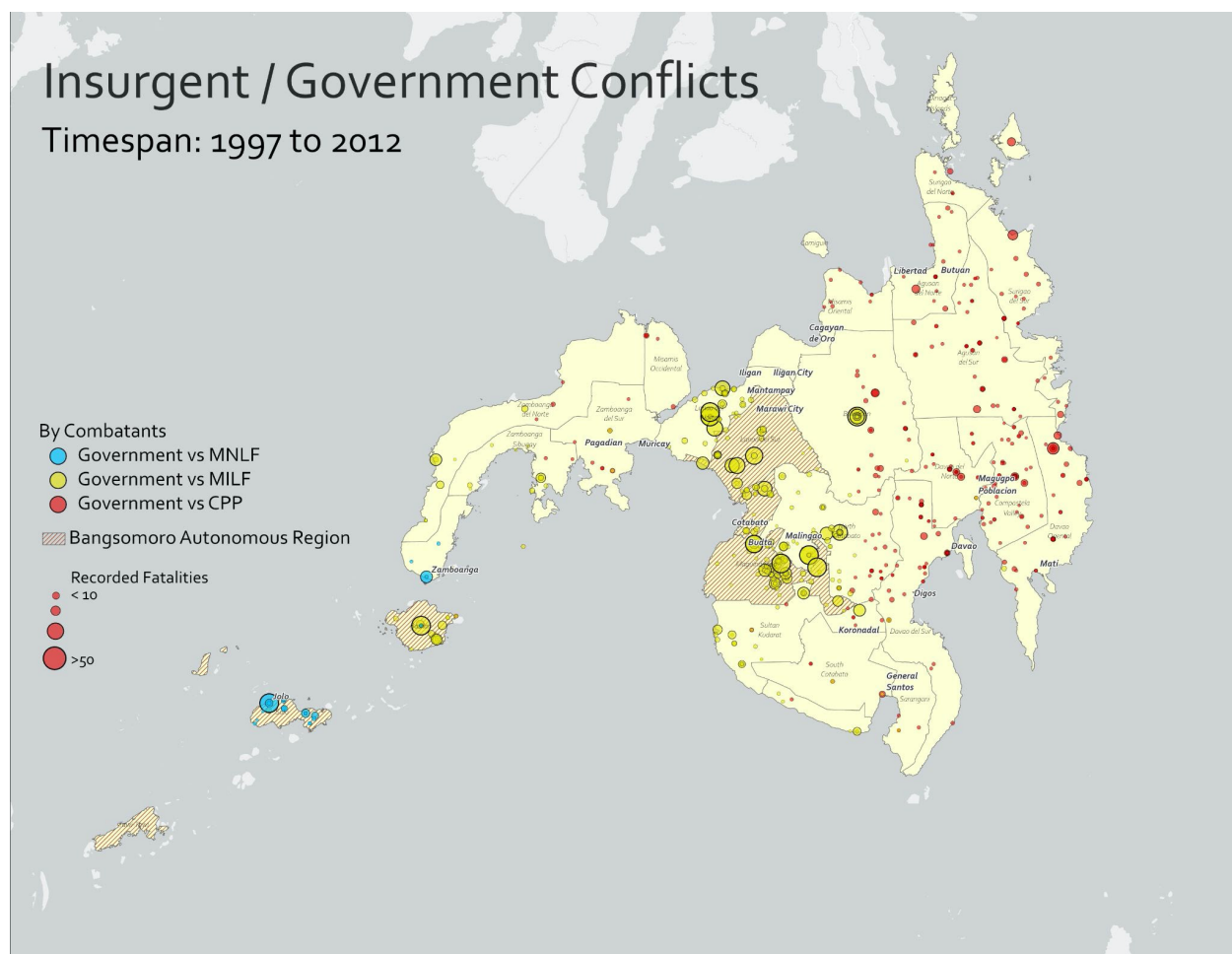
Figure 3: Conflict incidents on Mindanao, 1997 to 2012 (map produced by the Appraising Risk partnership).

During this period the MILF replaced the MNLF as the primary locus for the armed wing of the Moro separatist movement. When violence did break out between the MNLF and government forces, incidents were relegated to the island's periphery and to smaller islands like Sulu. By contrast, the range of the MILF expanded significantly, with conflict points across much of the western half of Mindanao and a high density of conflict incidents within the Bangsomoro area and adjacent provinces.

Conflict incidents involving the NPA decreased in lethality but increased in frequency and in spatial distribution. As mentioned in the previous section, the dividing line that bisects Mindanao into western and eastern halves, dominated by the Moro separatist movement and the NPA respectively, becomes more clearly defined in this period. Some NPA conflict incidents do spill over into the western half of the island and, for the

first time, we see MILF activity as far northeast as the province of Bukidnon. Nonetheless, the overall trend in conflict incidents reveals a clear geographical division of the island into MILF and NPA spheres of operations.

Third phase, 2013-2019

For the third and final phase researched for this project, we opted for a different visualization style, zooming in on the western half of the island to highlight the highly concentrated nature of armed conflict in the period. Ongoing discussions surrounding the Basic Law for Bangsomoro between the Government of the Philippines and the MNLF corresponded with an overall decline in armed clashes among these parties. A notable exception was the siege of Zamboanga city by a breakaway faction from the MNLF in 2013 that lasted three weeks and left dozens dead and thousands displaced (Country Reports on Terrorism 2013). Clashes between the Armed Forces of the Philippines and the NPA dwindled significantly during this period, forming a roughly even distribution of small-scale incidents across the eastern half of Mindanao. Meanwhile, the MILF abandoned their demand for complete independence in favour of subnational autonomy, leading to an overall decline in violence under the aegis of the Bangsomoro talks. Nonetheless, the peace talks nearly unraveled on a few occasions, including in 2015 after an operation by the Philippine Special Action Force (SAF) in Maguindanao escalated into a major firefight that left 55 dead. As our map shows, however, the overall number of armed clashes between the Armed Forces and the three traditional separatist groups was significantly lower during this period than during the previous phase of conflict from 1997 to 2012.
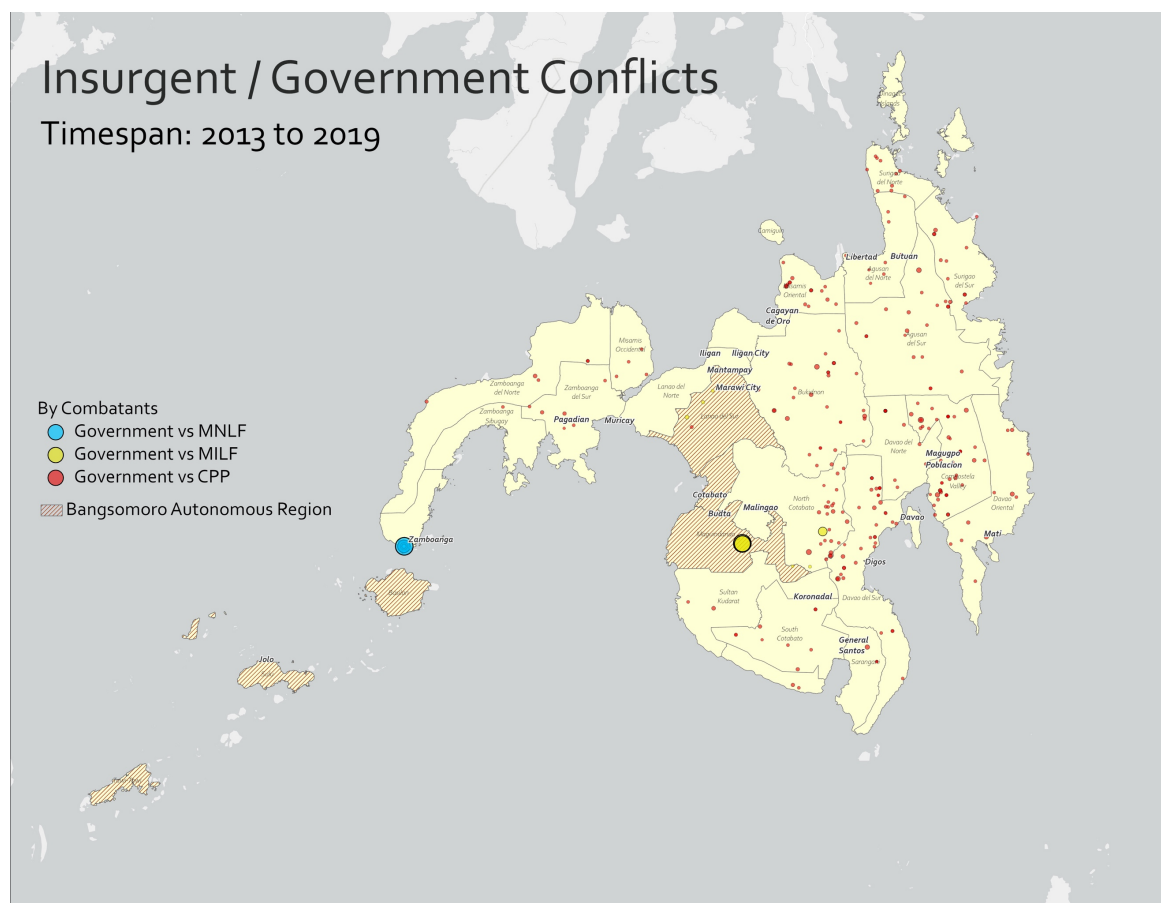
Figure 4: Conflict incidents on Mindanao from 2013 to 2019 involving the three traditional separatist groups (map produced by the Appraising Risk partnership).

The picture, however, changes when we examine conflict data involving other substate groups, especially Abu Sayyaf. Abu Sayyaf was created in 1989, but its radical nature and attacks on civilians have prevented it achieving the kind of broader support or legitimacy acquired by MNLF or MILF. The group was active in the 1990s and early 2000s, but came to special international attention in 2014 when senior leader Isnilon Hapilon swore allegiance to Abu Bakr al-Baghdadi, the self-styled caliph of the Islamic State (IS) in Iraq and Syria (FlorCruz 2014). Other groups directly connected to IS' global networks have conducted numerous attacks with Improvised Explosive Devices (IEDs)

The most devastating episode was a prolonged battle in Marawi City and surrounding municipalities, which began on May 23rd, 2017, and pitted government forces against militants from several groups linked to IS, including Abu Sayyaf. The battle lasted five months and displaced almost the entire civilian population of the city, with Amnesty

International reporting human rights abuses amounting to war crimes by all major parties, including government forces (Amnesty International 2017). While regional politics continue to heavily shape the recruitment strategies and geographical reach of various armed groups, the overarching influence of IS as an ideological lodestone for militants in the area has rendered the already blurry boundaries between various groups increasingly difficult to clearly define. For this reason, our final timeline map provides a zoomed in visualization of all conflict incidents from this period (2013 to 2019) in the western half of Mindanao, but does not attempt to disaggregate by faction. Points are still scaled by number of casualties, though figures related to the Marawi City battle especially should be regarded as approximate, given that huge disparity between government statistics and figures collected by independent journalistic and humanitarian sources.
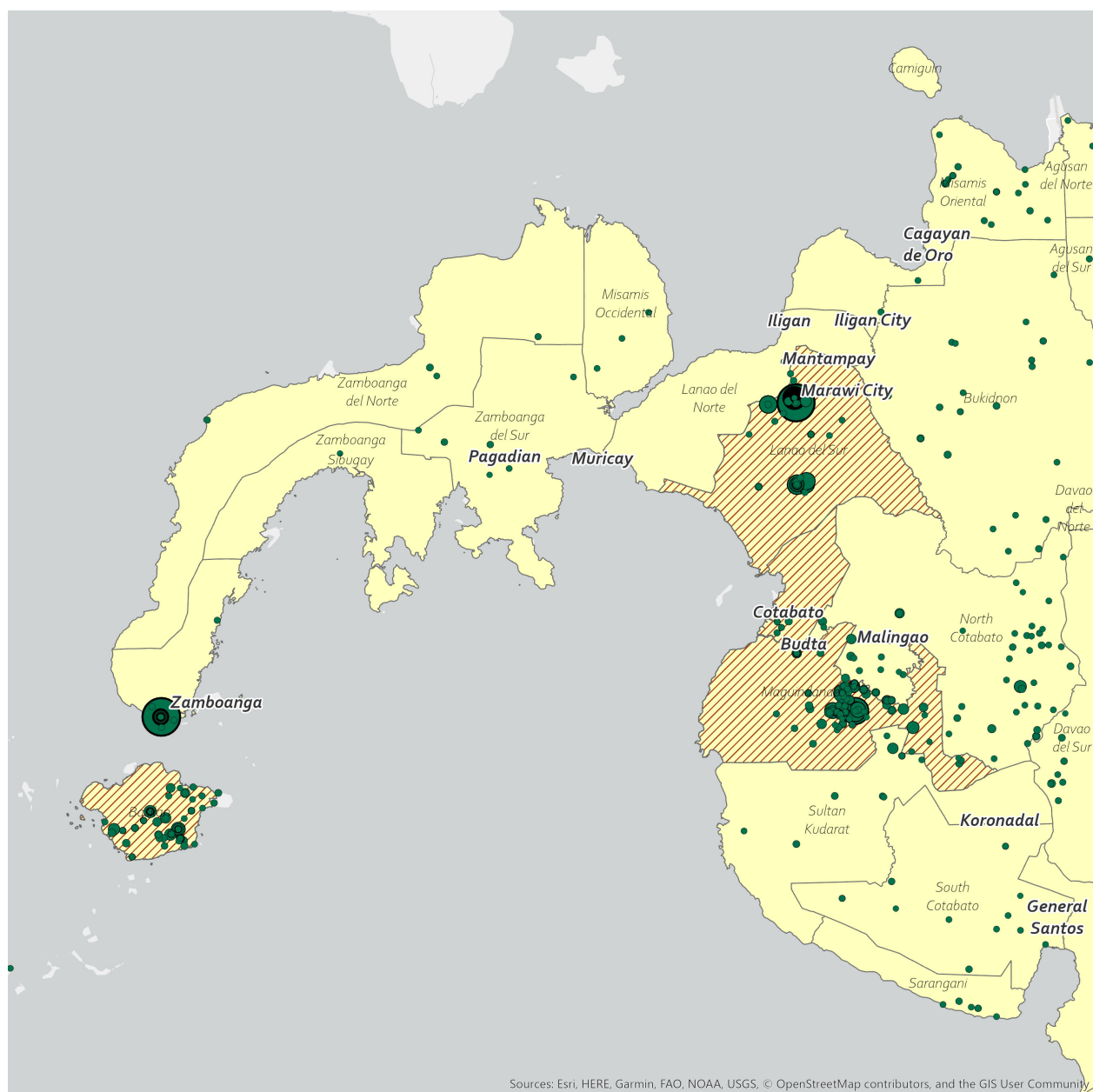
Figure 5: Conflict incidents by number of casualties, including all factions (map produced by the Appraising Risk partnership).

## Do Weather Patterns Influence Conflict?

The exact nature and dynamics of the relationship between environmental effects and incidences of violent conflict is hotly contested. Perhaps the most well-known debate within the literature is that over the role that a drought in Syria from 2007 to 2011 played in triggering the uprisings against President Bashar Al-Assad that soon devolved into civil war and the rise of the Islamic State. In an influential 2015 article in the *Proceedings of the National Academy of Sciences*, Colin P. Kelley and others argued that the drought exacerbated rural poverty, sparked a wave of migrations into urban centers, and thus provided the tinder for the full-blown uprising that erupted in 2011 (Kelley et al. 2015). The findings have proved controversial, with some supporting the paper's conclusions and others arguing that the authors overstate their claims, contesting both the role of anthropogenic climate change in creating conditions of drought and the purported link between drought and rural to urban migration (Selby 2017).

In the case of the Philippines, there is strong evidence that rainfall patterns affect cycles of armed conflict, with researchers showing that stronger extremes between wet and dry seasons caused an uptick in violence, even in years when the overall rainfall pattern remains stable (Crost et al. 2018). Given that climate change is predicted to cause wetter wet seasons and drier dry seasons, an escalation of armed conflict in the region is likely if these global environmental trends continue (Ide et al. 2020).

Beyond the effects of seasonal rainfall, climate change is predicted to increase the frequency and severity of extreme weather events, including typhoons (Holden and Marshall 2018). Given the increasing frequency of typhoon activity in the Philippines, we wanted to determine whether any correlation existed between typhoon landfall patterns and incidents of armed conflict. As with existing research on the relationship between conflict and other environmental or geological dynamics, the literature on natural disasters such as typhoons or tsunamis and their relationship to armed conflict presents a mixed picture. The deadliest weather-related disaster from the period between 2000 and 2016, Cyclone Nargis, had no measurable effect on exacerbating the various armed conflicts in Myanmar at the time (Brzoska 2017, p. 306), though qualitative research suggests that the government's mishandling of the crisis and resulting shortages may have helped fuel the political transition that soon followed (Myint-U 2019, p. 99). Jennifer Hyndman points out that the December 2004 tsunami that devastated swathes of the Indian Ocean littoral produced markedly different effects on existing conflicts in Sri Lanka and on the Indonesian island of Aceh. In the case of Sri Lanka, the crisis exacerbated tensions between the LTTE and government,

leading to a deterioration of the peace process, whereas in Aceh, the devastation provided grounds for compromise between the two sides (Hyndman 2009).

Our map draws on environmental data from 1986 to 2017, and charts typhoon paths and landfall points across the Philippines to contrast storm frequency on Mindanao with the northern islands such as Luzon. For this map, we relied on data sets already collected through the Appraising Risk partnership. Drawing on information available through the NOAA International Best Tracks Dataset, the Appraising Risk team has produced other visualizations with this data, including a map depicting cyclonic activity across the Indian Ocean World from 1833 to 2019. Previous research has shown that precipitation shocks in the Philippines exacerbated attacks by both insurgent and state forces during the period from 2001 to 2007 (Eastin 2018). Our project, however, is the first to map longer-term trends and relationships in typhoon pathways and conflict incidents from the reintroduction of democracy in 1986 to the present.

Figure 6: Typhoon Pathways Over the Philippines (map produced by the Appraising Risk partnership).
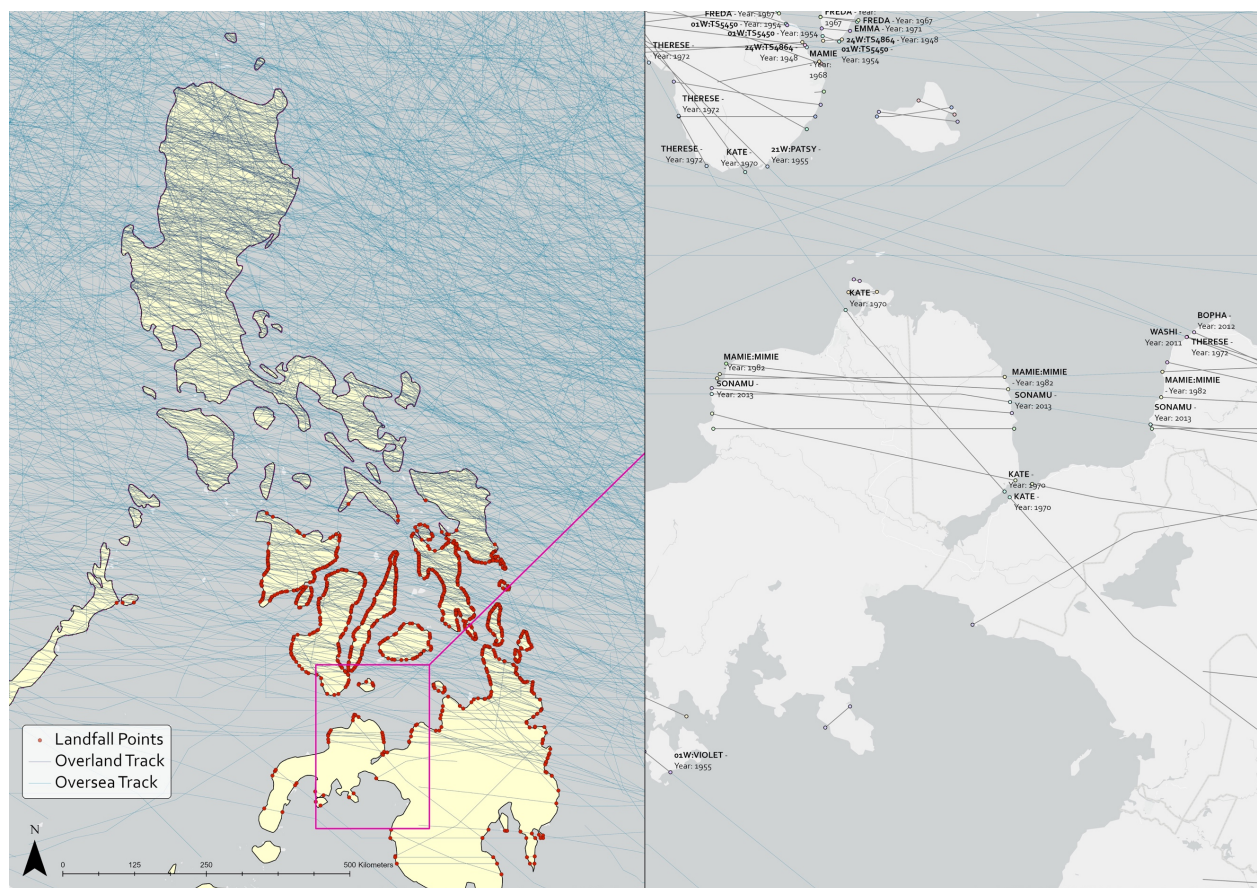
Our visualization shows that while typhoon activity is extremely frequent in the Philippines, Mindanao is hit far less frequently than the northern islands. If we compare this map with the aggregate conflict points presented in Figure 2, we can observe an inverse relationship between typhoon activity and conflict points. In other words, greater typhoon activity in the northern islands coincides with lower numbers of conflict points, while on Mindanao, relatively infrequent typhoon activity coincides with higher rates of armed conflict. By itself, this tells us very little. But if we account for recent research by Crost and Felter on banana production, the picture becomes more complex. Crost and Felter found that conflict on Mindanao is often financed through the taxation and extortion of banana plantation revenues, which necessarily funnel through choke points that can be monopolized or commandeered by armed groups. One explanation offered by Crost and Felter for the prevalence of banana plantations on Mindanao is the relative lack of typhoon activity compared to the northern islands (Crost and Felter 2020a). The inverse relationship we observe in Figure 5 between typhoon activity and conflict points can thus be at least partially accounted for by the political economy of insurgent groups, who can benefit from agricultural exports if the export commodities rely on easily commandeered choke points like roads and ports. Our next section takes up this question in greater detail.

How Do Land Use and Infrastructure Shape Conflict Patterns?

It is by now well-established in the literature that different types of land lend themselves to different types and frequencies of combat incidents (for example, Delang et al. 2013). Similarly, the nature of a conflict often shapes its geography, with asymmetrical conflicts, for example, more often occurring furthest from capital cities (Butcher 2015). As we have seen, agricultural land can be especially important for shaping conflict dynamics on Mindanao, where revenue from the taxation of banana plantations provides a key source of income for non-state actors (Crost and Felter 2020a).

For these reasons, our next two maps plot the conflict data collected by our team alongside land use data (Figure 6) and infrastructure (Figure 7). Land use data in this section came from SEDAC's Anthropogenic Biomes of the World (2000). Given that our project covers several decades we selected the 2000 data as a rough midpoint, but researchers wishing to achieve greater degrees of accuracy would need to provide a more fine-grained year-by-year approach that was outside the scope of the current project.
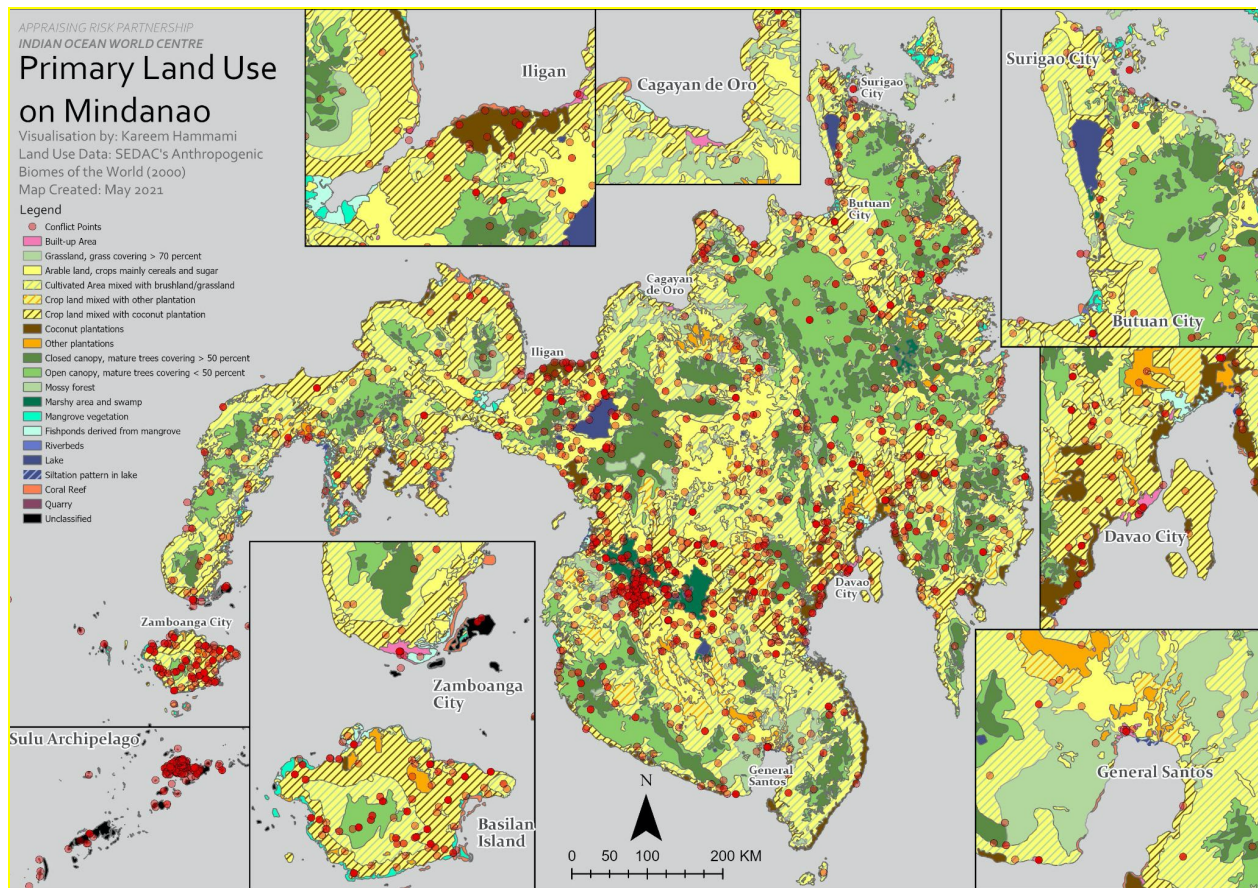
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Figure 7: Land use and conflict on Mindanao (map produced by the Appraising Risk partnership).

Calculating the number of conflict points per km2 and deaths per km2, our partners at Appraising Risk found the highest concentration of conflict points in built up areas. These conflict points also reflect a far higher fatality rate compared to other land use areas, with 4.416 deaths per km2 compared to unclassified land types and marshy areas (including swamps) coming in a distant second and third place with 0.782 and 0.550 per km2 respectively. Various arable, cultivated, and mixed crop lands with plantations reflected lower densities of conflict deaths than the previous three categories but generally greater densities than other land types like forests and grasslands. On arable land mainly used for cultivating cereals and sugar, the rate of death in conflict was 0.328 per km2, followed by crop land mixed with coconut plantations (0.212), coconut plantations (0.180), plantations other than coconut (0.175), cultivated areas mixed with brushland and grassland (0.075), crop lands mixed with plantations other than coconut (0.037).

Crost and Felter showed that the cultivation of export crops in the Philippines, specifically bananas, has a direct relationship to conflict intensity, with higher global commodity prices – and thus higher potential extortion revenues for militants – corresponding to a greater prevalence of violence in areas with high concentrations of banana plantations (Crost and Felter 2020a). Further work with our data set may help refine this argument by incorporating conflict points and casualties from coconut plantations and especially from crop land used for cultivation of sugar and cereals. Building on this research, we produced a map (Figure 7) that shows the density of conflict points in relation to potential 'chokepoints' like ports and major roads, to determine whether any patterns emerged in the spatial distribution of incidents of violence.
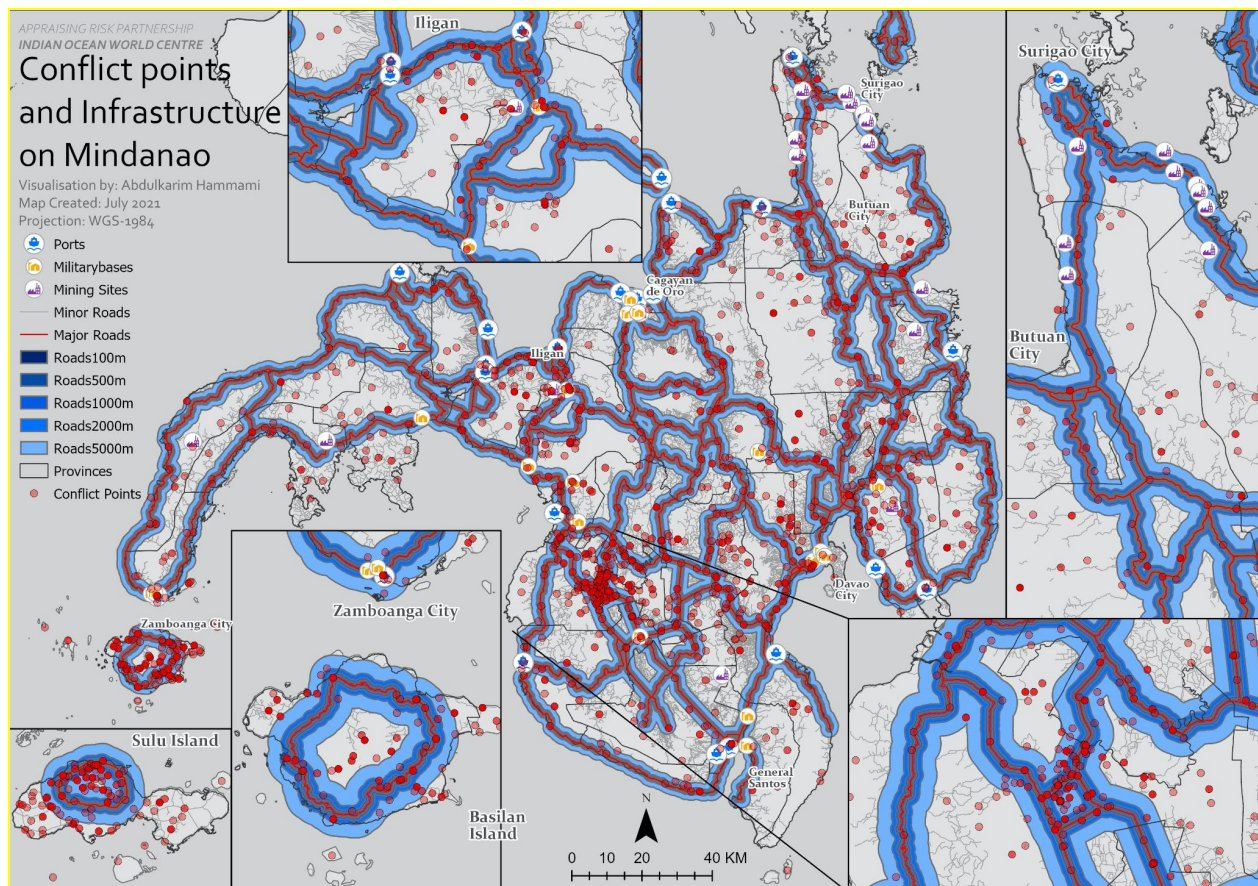

Figure 8: Infrastructure on Mindanao (map produced by the Appraising Risk partnership).

The results were striking. Focusing on deaths in conflict, we find a concentration of 0.976 deaths per km2 within a distance range of 100 meters from a major or minor road. As Appendix 1 shows, conflict deaths per km2 steadily decline the further one gets from a road - even a distance of 2-5 km reduces the concentration of conflict deaths per km2 to 0.136. A similar trend is present if we look at conflict points rather than conflict deaths, as seen in Appendix 1. We do not propose a mechanism for further exploring the relationship between proximity to roads and densities of conflict incidents/deaths, but Peer Schouten's new book tracing the link between roadblocks and conflict patterns in the Central African Republic and Democratic Republic of Congo may provide a useful theoretical framework for interpreting this data (Schouten 2021).

Our infrastructure map (Figure 7) also plots the locations of mines, ports, and military bases identified by our Research Interns. Control over mines and mineral deposits has played a role in armed conflicts and peaceful protest movements alike throughout various parts of Africa (Berman et al. 2017), Peru (Li 2015), and Bangladesh (Omar 2021), to name just a few examples. On Mindanao, control over mining sites and mineral deposits has been a key area of concern in every major agreement negotiated thus far between non-state groups and the Philippines government. As Holden and Jacobson have shown, the militarization of mining sites in the Philippines challenges mining-based development paradigms by showing how poverty, violence, and social exclusion can be exacerbated, rather than alleviated, by mining operations (Holden and Jacobson 2007; also Crost and Felter 2020b). More work is needed to interpret what relationship, if any, exists between conflict points and mining sites on Mindanao, but we hope that this visualization can provide a starting point.

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