Typhoons, Climate Change, and Climate Injustice in the Philippines

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This article discusses how climate change causes an intensification of Western North Pacific typhoons and how the effects of such amplified typhoons upon the Philippines exemplify the concept of climate injustice. Using a political ecology approach, the article begins with an examination of the concepts of climate change, climate injustice, background injustice, and compound injustice. This is followed by an examination of the causes of typhoons, the vulnerability of the Philippines to typhoons, and how climate change may generate stronger typhoons. These stronger typhoons that may be produced by climate change, and the risks that they pose to the Philippines, are an example of climate injustice, while the legacy of colonial exploitation in the Philippines is an example of background injustice. The struggles faced by the Philippines in coping with climate change augmented typhoons are an example of compound injustice. The article concludes with a discussion of the reluctance of developed countries, such as Australia, Canada, and the United States, to reduce their greenhouse gas emissions notwithstanding the consequences these emissions have on countries such as the Philippines.

Keywords: Climate Change; Climate Injustice; Philippines; Political Ecology; Typhoons

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INTRODUCTION: SUPER TYPHOON HAIYAN 8 NOVEMBER 2013

In the early morning hours of 8 November 2013 Super Typhoon Haiyan (referred to in the Philippines as Super Typhoon Yolanda) battered the Philippines (Figure 1). Haiyan was an extraordinary storm, bringing precipitation in some places of up to 615 mm, having an air pressure at its center of only 895 millibars, generating sustained one-minute wind gusts of up to 315 km/h (with wind gusts of up to 375 km/h), and was the strongest typhoon to ever make landfall in the entire Western North Pacific (Esteban et al., 2016; Primavera et al., 2016; Takagi et al., 2015; Takagi & Esteban, 2016). When Haiyan came ashore on the island of Panay, near Concepcion, Iloilo, it still had sustained wind speeds of 215 km/h (with gusts up to 250 km/h) and this was its fifth landfall (National Disaster Risk Reduction and Management Council, 2014). Perhaps the most destructive aspect of Haiyan was its storm surge of 7.4 meters, which inundated 98 km^2 of the island of Leyte and 93 km^2 of the island of Samar with the same force as a tsunami (Cardenas et al., 2015; Lander, Guard, & Camargo, 2014). Dr. Wei Mei, a climate scientist at the Scripps Institution of Oceanography, stated (when interviewed in La Jolla, California on 4 November 2015) that he was "shocked" by the strength of Haiyan.

Amalie Obusan, the Greenpeace Southeast Asia Country Director, indicated (interview, Quezon City, Philippines on 26 April 2017) that she had never seen devastation of this magnitude and, even though more than three years have passed, she still gets emotional thinking about it. While climate scientists and climate change activists may have wondered in amazement at the sheer power of Haiyan, its consequences for the people of the Philippines were catastrophic. Eight of the 17 regions of the Philippines were affected by Haiyan, it generated 28,626 injuries, caused 1,039 people to be reported missing, and officially caused 6,293 deaths – although some say the death toll could have been as high as 18,000 (IBON, 2015; Takagi & Esteban, 2016). The storm caused between USD 12 to 15 billion worth of damages and resulted in the destruction of one million homes (Primavera et al., 2016). Six months after Haiyan, two million people remained homeless (Rodgers, 2016).

The City of Tacloban, on the island of Leyte in the Eastern Visayas, bore the brunt of the winds and storm surge, and some estimate that up to 10,000 Tacloban residents were killed, mostly by the storm surge (IBON, 2015). San Pedro Bay's funnel shape (Figure 1), combined with its shallow bathymetry, stacked the water up and forced the storm surge into Tacloban (Soria et al., 2016). In the storm's aftermath the Philippine Army gathered dead bodies and buried them, unidentified, in a mass grave at the Archdiocese of Palo. For weeks after the storm, dead bodies lined the streets of Tacloban and over three years after the storm, human bones continue to wash up on its beaches. Although many residents of Tacloban had experienced typhoons, they were unprepared for its storm surge, warnings of which were issued beforehand but many of the *Waray-Waray* speaking residents of Tacloban had never heard the English term 'storm surge' before and did not understand its meaning. When local authorities relayed information to the communities they described the storm surge as *dagko nga balod* (huge waves), which was not considered serious by many people (Esteban et al., 2016). During the storm, two ships broke loose from their moorings and ran aground, crushing homes and people in Barangay Anibong, the bow of one of which, the MV Jocelyn (Figure 2), was left as a remembrance of the thousands of lives that were lost. In the immediate aftermath of Haiyan, someone painted "CLIMATE JUSTICE NOW!" on the side of the MV Jocelyn and, in doing so, raised the issues which this article seeks to address: First, does climate change cause an amplification of Western North Pacific typhoons; and second (assuming an affirmative answer to the first question), how do such amplified typhoons, and their effects upon the Philippines, exemplify the concept of climate injustice? Climate injustice is the situation where some people enjoy the benefits of energy use and other emissions-generating activities while those activities cause other people to suffer the burdens of climate change (Bell, 2013). This investigation of climate injustice is based upon an extensive review of the climate change and typhoons literature and was augmented by 40 fieldwork interviews conducted in California (in 2015) and in the Philippines (in 2016 and 2017). Informants were selected for their knowledge of the topic under study and they included climate scientists, government officials (from both national and local governments), environmental activists, and members of the Roman Catholic Church (a highly influential institution in Philippine society).

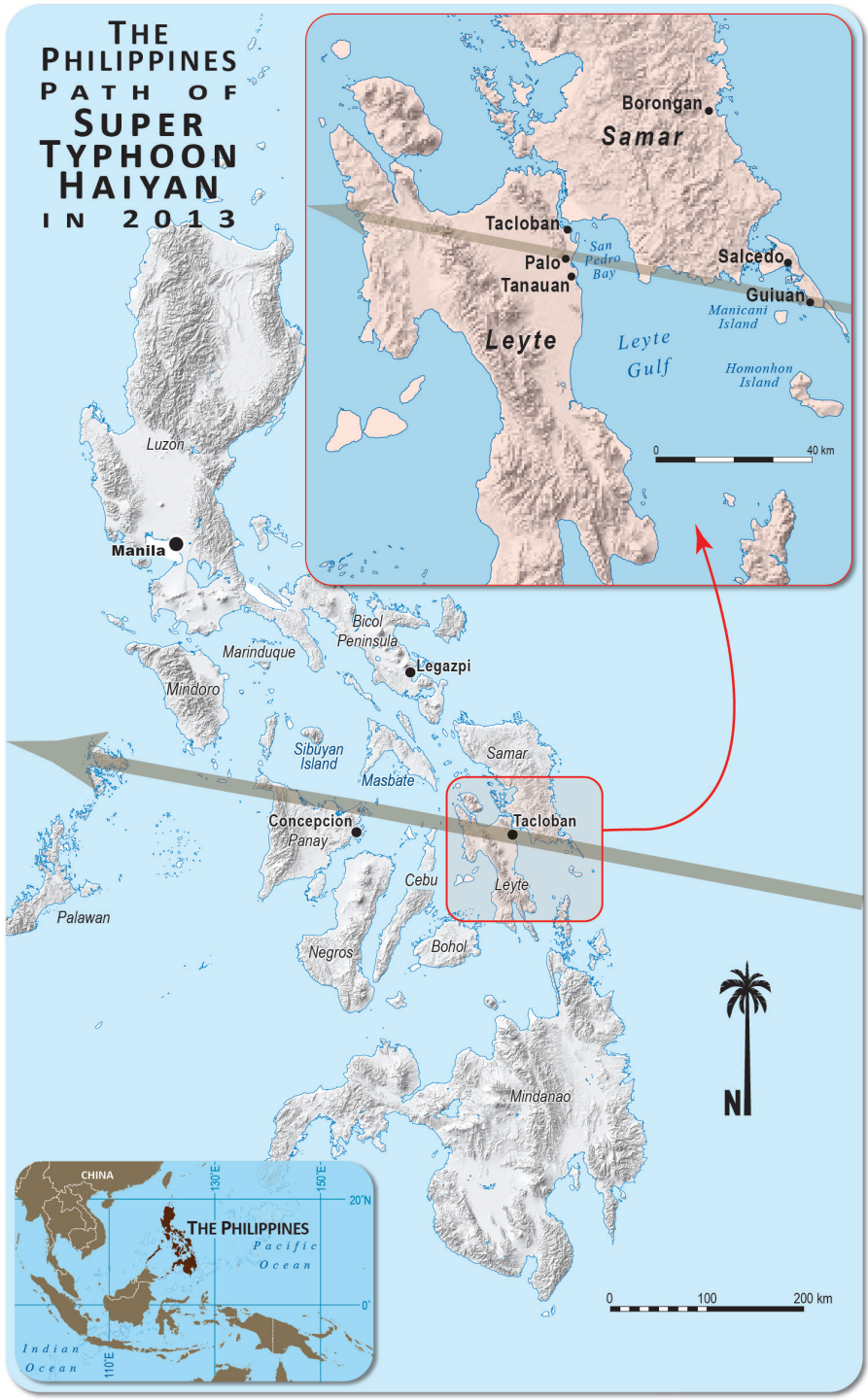

Figure 1. The path of Super Typhoon Haiyan in 2013. (figure by author).

Figure 2. The MV Jocelyn. (figure by author).

CONCEPTUAL FRAMEWORK

Political Ecology

This article approaches the issue of climate injustice by using political ecology, an epistemologically plural field of inquiry (Tetreault, 2017). Specifically, two subsets of political ecology are used: the study of ecological distribution conflicts and the political ecology of hazards. "Ecological distribution," is defined by Martinez-Alier (2002) as "the social, spatial, and intertemporal patterns of access to the benefits obtainable from natural resources and from the environment as a life support system" (p. 73). The capacity of the atmosphere to absorb greenhouse gases can be thought of as a natural resource. The developed nations of the world, with their historic emissions of greenhouse gases, have used up much of this resource leaving substantially less of it for the developing nations. In this respect, climate change is, essentially, an ecological distribution conflict because, as argued here, it has been caused by the developed countries. Yet, as this article argues, its consequences will be disproportionately borne by the developing nations. The political ecology of hazards is a concept developed by Clark, Chhotray, and Few (2013), which relates natural hazards and environmental injustice. The authors discuss that disasters are not just a combination of natural hazards with vulnerable populations and that it is now necessary to examine the precipitating events that cause these hazards. "This is most obviously the case," Clark, Chhotray, and Few (2013, p. 106) wrote "in hydrometeorological calamities – storms, floods, drought – which are predicted to intensify and become more frequent as global warming proceeds." Since this article examines the impact of typhoons on the Philippines and the extent to which these are augmented by climate change, the political ecology of hazards deserves further discussion herein.

Climate Change

Climate change is occurring due to the increasing concentration of greenhouse gases, such as carbon dioxide (CO_2), methane, and nitrogen oxides, released into the atmosphere from human activity. Once these gases are concentrated in the atmosphere, they intercept terrestrial radiation and prevent some of this from escaping to space, trapping the energy within the lower atmosphere and re-radiating some of this back to the surface. Many climate change activists (such as those at 350.org) hold out a benchmark maximum safe level of CO_2 in the atmosphere as being 350 parts per million (PPM). In 2016, atmospheric CO_2 crossed 400 PPM, is rising by approximately 2 PPM every year, and (as of 1 April 2018) stands at 410.03 PPM (Scripps Institution of Oceanography, 2018). Much of the atmosphere's CO_2 has been emitted in recent decades because of modern industrialization, with 75% of all anthropogenic CO_2 emitted from 1950 to 2010 and 50% having been emitted from 1980 to 2010 (Nixon, 2011). Although CO_2 concentrations have risen and fallen and do not display a linear upward trend the CO_2 levels currently present in the atmosphere are higher than they have been at any time in the last 800,000 years and they will have a warming effect for years to come (Motesharrei et al., 2016). Research conducted by Gillett, Arora, Zickfeld, Marshall, and Merryfield (2011) found that even if there was to be a complete cessation of all CO_2 emissions in 2100 the impact of emissions up to then would continue beyond the year 3000.

While the media, particularly in North America, may give people the impression that there is strong controversy about the existence of anthropogenic climate change, there is no debate about this amongst climate scientists (Text Box 1). The United States Global Change Research Program (2017), holds that it is extremely likely that human emissions of greenhouse gases, are the dominant cause of the observed warming since the mid-20th century and there is no convincing alternative explanation supported by the extent of the observed evidence. Although there will always be anomalies and some uncertainty will always exist, the case for a warming climate is about as solid as any scientific case can ever be (De Buys, 2011). While economists, journalists, politicians, and others may have the impression of confusion, disagreement, or discord among climate scientists, this impression is incorrect and there is a robust scientific consensus on climate change (Oreskes, 2004), As Alley (2000, p. xii) declared, "scientifically there is not another 'side' that deserves equal time."

Climate Injustice: The Disproportionate Causes of Climate Change

Climate change is an uneven process when it comes to the contribution of individual countries and the impact that climate change has, and will have, on individual countries (Hariharan et al., 2017). The developed countries of the world have contributed to what Hariharan, Kareem, Tandon, and Ziesemer (2017) describe as "a disproportionate amount of harmful anthropogenic emissions over the past couple of centuries and still contribute disproportionately more in per capita terms to global warming" (p. 19). The developed world is responsible for over 75% of all emissions from 1850 to 2000 (Motesharrei et al., 2016). It is not just the wealthier countries that have emitted more CO_2, but resource consumption within countries is skewed towards higher

income groups and the richest 10% of the world's population are responsible for 46% of all CO_2 emissions; this is eight times as much CO_2 per capita as the remaining 90% of the world's population (Motesharrei et al., 2016). Although the poor of the world have done disproportionately less to cause the problem of climate change they stand to suffer disproportionately more from its effects. The unequal burdens of causation and consequence is the essence of climate injustice; as Yamada and Galat (2014) wrote, "those who suffer climate change are not responsible for producing it" (p. 432).

Background Injustice

Much (but by no means all) of the poverty experienced by developing countries can be attributed to what Shue (2014) calls "background injustice" (p. 39), namely exploitation by their former colonial masters, which is the core argument of dependency theorists. Many developing countries experience varying degrees of poverty as a legacy of having been colonies of (what are now) the developed countries, i.e. they have found themselves in dependency relationships. These background inequalities are, according to Shue (2014), "the bitter fruit of centuries of colonialism, imperialism, unequal development, war, greed, stupidity, or whatever exactly one thinks are the main features of the history of the international political economy" (p. 128). The former colonial powers of today's developing countries became affluent through exploiting their colonial subjects and through their rampant use of fossil fuels. Today, these developed countries emit large amounts of greenhouse gases while their citizens maintain their affluent lifestyles. Differences in the levels of development resulting from exploitation by colonialism, and the differing emissions of greenhouse gases, created the differences in affluence between the industrialized world and the developing world (IBON, 2008).

When discussing climate change, the capacity of the atmosphere to absorb CO2 exemplifies an ecological distribution conflict because it can be thought of as a finite resource, capable of being used up by the countries of the world. According to Agarwal and Narain (1991) a distinction must be made "between those countries which have eaten up this ecological capital by exceeding the world's absorptive capacity and those countries which have emitted gases well within the world's cleansing capacity" (p. 6). The developed countries fit into the former category and the developing countries fit into the latter category. Indeed, Agarwal and Narain (1991) go so far as to state that an expression by the developed countries that the developing countries "must share the blame for heating up the Earth and destabilizing its climate" is an example of "environmental colonialism" (p. 1). The developed countries, through their historic emissions, have created climate change; for them to expect the developing countries to allocate part of their share of the atmosphere's ability to absorb CO2 is tantamount to coming and taking a resource (such as minerals or timber) from the developing countries just as was done during the colonial period.

Compound Injustice

Intimately related to the concept of background injustice is compound injustice – the difficulty experienced by the developing countries of the world in coping with

climate change. The poor countries of the world are starting out in a weaker position when they confront climate change, largely because of their exploitation by their former colonial masters (background injustice), and the poverty that exacerbates their ability to cope with climate change thus creating what Shue (2014) refers to as "compound injustice" (p. 39). As IBON (2008) stated, "The environmental consequences of the policies of industrialized nations have also had a detrimental and costly effect on developing countries – especially the poor in those countries – that are already burdened with debt and poverty" (p. 25).

TYPHOONS, CLIMATE CHANGE, AND THE PHILIPPINES

What Causes Typhoons?

Globally, tropical cyclones are the deadliest and most expensive natural hazard and "typhoon", originating from the Chinese *ta* (big) and *feng* (wind), is the term used to describe a tropical cyclone in the northwestern Pacific Ocean (Collett, McDougall, & Thomas, 2017). Tropical cyclones develop in the northern hemisphere during the months of July to November in an area ranging from 130°-180° East and 5°-15° North (Mei, Xie, Premeau, McWilliams, & Pasquero, 2015). To develop their rotation, tropical cyclones need to be located at a latitude where the relative speed of the earth's rotation differs sufficiently between their northern and southern sides; consequently, they usually do not develop or strike within 10° latitude of the equator (Sheppard, Davy, & Pilling, 2009). Tropical cyclones generally occur over the oceans in regions where sea surface temperatures exceed 26 °C. Such sea surface temperatures are found mainly in the tropics because solar energy per unit area of the ocean surface is greatest there and declines substantially as one moves away from the equator (Sheppard et al., 2009; Trenberth, 2005). Tropical cyclones develop when strong clusters of thunderstorms drift over a warm ocean and warm air from these thunderstorms combines with warm air and water vapor from the ocean's surface and rises. As these clusters of thunderstorms consolidate into one large storm, convergent winds blowing towards the area of low pressure on the ocean surface, along with rotation due to the Coriolis effect, cause the storm to begin spinning (counterclockwise in the northern hemisphere), while rising warm air creates divergence aloft, eventually, the storm will have a low-pressure center (the eye) with no clouds and calm winds, while winds in the eyewall and the outer part of the storm can be extremely strong. All typhoons have five characteristics: low air pressure, strong winds, cyclonic rotation, heavy rains, and storm surge. The air pressure reduction associated with a typhoon can cause the sea level to rise by up to 1 cm for every one millibar reduction in air pressure, and instances have been documented where sea levels have risen by 1.5 m due to air pressure reductions alone (Wang, Lee, & Wang, 2005). This means that when a typhoon strikes land the local sea level will be higher due to the reduction of the atmospheric pressure. Onshore winds add to the strength of the storm surge and the greatest storm surges, those over 5 m, occur when a typhoon makes landfall during a high tide. Storm surges are one of the most destructive aspects of a tropical cyclone and are feared by people living in coastal regions (Loy, Sinha, Liew, Tangang, & Husain, 2014). Since 2009, tropical cyclones have been divided into six categories,

which are presented in Table 1, and the Western North Pacific basin experiences, on average, 26 named tropical cyclones each year, accounting for about 33% of the global total (Wu & Wang, 2004).

TYPE OF STORM	WIND SPEEDS
Tropical Depression	63 km/h or lower
Tropical Storm	Between 63 to 89 km/h
Severe Tropical Storm	Between 90 to 119 km/h
Typhoon	Between 120 to 149 km/h
Severe Typhoon	Between 150 to 190 km/h
Super Typhoon	Greater than 190 km/h

Table 1. The six categories of tropical storms. (Abdullah et al., 2015).

Typhoons and the Philippines

The Philippines (Figure 1) are an archipelago of 7,100 islands located in Southeast Asia. In 2017, the population of the archipelago was approximately 105 million people spread over roughly 300,000 km^2 of land area generating a population density of 352 people per km^2 (Worldometers, 2018). The Philippines are a country firmly ensconced in the developing world and approximately 26% of all Filipinos live in poverty (Philippine Statistics Authority, 2016). The seas, and life near it, are integral components of life in the archipelago and it has approximately 36,289 km of coastline and 25,000 km^2 of coral reefs (Sheppard et al., 2009). More than 80% of its population live within 50 km of the coast, and much food is grown on land marginally above sea level (Broad & Cavanagh, 2011; Magdaong et al., 2014).

Bagtasa (2017) regards tropical cyclones as "the most destructive hydrometeorological hazards in the Philippines" (p. 3622) and Table 2 lists the ten deadliest tropical cyclones in Philippine history. Much of the Philippines is at risk from typhoons and each year about 20 of them, equivalent to 25% of the total number of such events in the world, enter Philippine waters with between seven to nine of these making landfall (Cruz et al., 2016). From 1970 to 2013, 856 tropical cyclones entered Philippine waters and 322 of these were destructive (National Disaster Risk Reduction and Management Council, 2014). Approximately 95% of these typhoons originated in the Pacific Ocean, south and east of the archipelago, between the months of July to November, and they travel in a northwesterly direction mainly affecting the eastern half of the country with the most heavily affected portions of the Philippines being Northern Luzon, the Bicol Peninsula, and Samar. Although the moisture provided by these storms has a somewhat positive effect (providing between 38 to 47% of the archipelago's average annual rainfall), their overall effects are profoundly negative setting off landslides, causing severe flooding, and being responsible for more loss of life and property than any other natural hazard.

TYPHOON	YEAR	FATALITIES
Haiphong	1881	20,000
Haiyan	2013	6,300
Thelma	1991	5,000
Washi	2011	1,901
Angela	1867	1,800
Winnie	2004	1,600
Fengshen	2008	1,501
1897 Typhoon	1897	1,500
Ike	1984	1,492
Durian	2006	1,399
Bopha	2012	1,268

Table 2. The eleven deadliest tropical cyclones in Philippine history. (Bankoff, 2003; Gaillard et al., 2007; Ribera et al., 2008; Soria et al., 2016; Takagi and Esteban, 2016; United Nations Office for the Coordination of Humanitarian Affairs, 2017).

Climate Change and Stronger Typhoons

The Intergovernmental Panel on Climate Change (IPCC) is cautious as to whether climate change will cause stronger tropical cyclones stating, "confidence remains low for long-term (centennial) changes in tropical cyclone activity" (Stocker et al., 2013, p. 50) and that globally, "there is low confidence in attribution of changes in tropical cyclone activity to human influence" (Stocker et al., 2013, p. 73.) The IPCC declared that it has "low confidence" in any basin-scale projections of tropical cyclone intensity (Stocker et al., 2013, p. 88) and gave the tepid prediction that "the frequency of the most intense storms will more likely than not increase in some basins" (Stocker et al., 2013, p. 107). Nevertheless, notwithstanding the conservative predictions of the IPCC (Text Box 2) a substantial body of scientific literature indicates that climate change is contributing to stronger tropical cyclones and this trend can be expected to continue due to the thermodynamics driving them (Bagtasa, 2017; Camargo, Ting, & Kushnir, 2013; Combest-Friedman, Christie, & Miles, 2012; Elsner, Kossin, & Jagger, 2008; Emanuel, 2005, 2013; Mei et al., 2015; Mei & Xie, 2016; Peduzzi et al., 2012; Rozynski, Hung, & Ostrowski, 2009; Takagi & Esteban, 2016; Takayabu et al., 2015; Trenberth, 2005; Webster, Holland, Curry, & Chang, 2005). Kerry Emanuel, an atmospheric scientist at Harvard University has written extensively on the impact of climate change on tropical cyclones and has found that stronger tropical cyclones "cannot be written off as mere climate perturbations to which we easily adjust" (Emanuel, 2007, p. 51). The National Academies of Sciences, Engineering, and Medicine are composed of some of the best scientists, engineers, and medical doctors in the United States. According to the National Academies of Sciences, Engineering, and Medicine (2016), maximum potential tropical cyclone intensities are projected to rise, and future observations of tropical cyclones with intensities substantially higher than those observed in the past are consistent with what is expected in a warming climate. As the National Academies of Sciences, Engineering, and Medicine (2016) wrote:

> Tropical Cyclones are projected to become more intense as the climate warms. There is considerable confidence in this conclusion, as it is found in a wide range of numerical models and also justified by theoretical understanding, particularly because there is a well-established body of theory for the maximum potential intensity of tropical cyclones. (p. 110)

The principal mechanism by which climate change generates stronger typhoons is the higher temperature of the world's oceans (Bagtasa, 2017). Emanuel (2007, p. 50) states that tropical cyclones are "responding to warming sea surface temperatures faster than we originally expected." As the surface of the oceans warms, the oceans provide more energy to convert into tropical cyclones (Elsner et al., 2008). The higher sea surface temperatures, and increased water vapor, act to increase the energy available for tropical cyclone formation (Trenberth, 2005). During 2013, for example, sea surface temperatures in the genesis location for North Pacific tropical cyclones exceeded 29 °C, providing ample energy for the formation of Super Typhoon Haiyan (Takagi & Esteban, 2016).

The increase in subsurface sea temperatures occurring over the last 30 years are an important component of how climate change leads to stronger tropical cyclones. Normally, during a tropical cyclone, the disturbance of the ocean's surface has an ameliorative effect because it causes an upwelling of cold water from below the surface. As this cold water upwells, sea surface temperatures decline thus acting as a natural break on tropical cyclone strength. Such upwelling of cold water can reduce surface temperatures by as much as 9 °C, which is enough to reduce surface water temperatures below that needed for tropical cyclone maintenance (Subrahmanyam, 2015). One of the first to suggest that climate change may lead to stronger tropical cyclones was Emanuel (1987) who raised this possibility but then discounted it due to "the tendency for strong cyclonic circulations to induce upwelling of cold water" (p. 485). However, research conducted by Mei et al. (2015) shows that over the period from 1985 to 2015 there has been a 0.75 °C rise in the temperature of the world's oceans at a depth of 75 m. Similarly, research conducted by Ortiz et al. (2016) has shown that by 2100, ocean temperatures will increase by up to 2 °C in the top 100 m of the world's oceans. These higher subsurface sea temperatures remove a natural buffer on the strength of tropical cyclones, favor rapid tropical cyclone intensification, and go a long way towards explaining why typhoon intensity from 2005 to 2015 has been, on average, the strongest over the period from 1955 to 2015 (Mei et al., 2015). According to Mei et al. (2015), by the end of the 21st century the average tropical storm will increase from being a severe tropical storm to a typhoon, and even typhoons of moderate intensity will increase by 14%. Takagi and Esteban (2016) predict an increase in the mean maximum tropical cyclone wind speed of between 2 to 11% by the end of the century, in association with deeper low pressures in the core of these systems. "The strengthened typhoon intensity," Mei et al., (2015) wrote, "poses heightened threats to human society" (p. 4). In the opinion of Dr. Wei Mei (interview in La Jolla, California on 4 November 2015), people in the Philippines must be concerned about the intensity of tropical cyclones in the coming future; if he lived in the Philippines he would be very worried about tropical cyclones. The inhabitants of the archipelago are aware of the risks posed by climate change and typhoons. Research conducted by

Combest-Friedman et al. (2012) shows that Filipinos have perceived that there has been an increase in storm intensity over the 40 years from 1970 to 2010. The government of the Philippines is also cognizant of the risks posed by amplified tropical cyclones. In 2010, the Philippine Congress enacted the Philippine Disaster Risk Reduction and Management Act of 2010 (Republic Act 10121), which emphasizes disaster preparedness and mitigation and created the National Disaster Risk Reduction Management Council (NDRRMC) to reduce disaster risks. Republic Act 10121 mandates all Provinces, Cities, and Municipalities, to have their own Disaster Risk Reduction Management Councils to reduce disaster risks locally. Amalie Obusan, from Greenpeace Southeast Asia stated (interview in Quezon City on 26 April 2017) she reacts to these predictions "with trepidation" because she has seen what these typhoons can do and the idea of more extreme, and more intense, weather events is very frightening.

When these predictions of stronger typhoons are combined with predictions of sea level rise of between 0.9 to 2.9 m that are expected by the year 2100 their severity increases as a higher sea level generates an even higher storm surge (Brauch, 2012; Church et al., 2013; IBON, 2008). Indeed, these concerns of rising sea levels appear quite justified in a Philippine context as the islands of the archipelago have experienced above-average increases in sea-level. Since 1970 mean sea-level readings taken at Legazpi, in the Bicol Peninsula of Luzon (Figure 1), indicate an increase of 200 mm per year (Lander et al., 2014). While such rates of sea level rise exceed those predicted by climate change and must owe part of their rapid rates to geophysical forces such as land subsidence (or even a tectonic sinking of the Philippine Plate), their consequences are serious. They could cause the Philippines to lose up to 17% of its land area. The Philippines, along with the Caribbean and Sundaland, is one of the three places in the world most vulnerable to land loss due to sea-level rise (Bellard, Leclerc, & Courchamp, 2014).

DISCUSSION: CLIMATE INJUSTICE IN THE PHILIPPINES

This article argues that the stronger typhoons affecting the Philippines are a manifestation of climate change. While the IPCC is reluctant to declare that climate change causes stronger typhoons, other authors, such as Bagtasa (2017), Camargo et al. (2013), Combest-Friedman et al. (2012), Elsner et al. (2008), Emanuel (2005, 2007, 2013), Mei et al. (2015), Mei and Xie (2016), National Academies of Sciences, Engineering, and Medicine (2016), Peduzzi et al. (2012), Rozynski et al. (2009), Takagi and Esteban (2016), Takayabu et al. (2015), Trenberth (2005), and Webster et al. (2005), regard climate change as augmenting typhoon intensity. If it is assumed that climate change is indeed amplifying typhoon intensity the discussion can proceed to the climate injustice aspects of stronger typhoons. Enhanced tropical cyclones, wrote Flannery (2005), "have the potential to kill many more people than the largest terrorist attack" (p. 314). Eight years later, Flannery was (sadly) proven correct when Super Typhoon Haiyan killed more people than were killed on 11 September 2001 (and arguably killed many more people than officially acknowledged). Climate change amplified typhoons are a departure from the gradually unfolding destruction (slow violence), inherent in climate change. Climate change usually has consequences, such as gradually receding glaciers, occurring slowly in "unspectacular time" (Nixon, 2011, p. 6). Spectacularly

violent tropical storms, however, transcend this slow violence; unlike a gradually retreating glacier, Super Typhoon Haiyan needed no montage of images taken over several decades to reveal the effects of climate change- a comparison of pictures from Tacloban taken on 7 and 8 November 2013 would have been enough. Climate change amplified typhoons move the discussion of climate change from unspectacular time to "spectacular time" (Nixon, 2011, p. 6). As Flannery (2005, p. 314) wrote, tropical cyclones "focus attention on climate change in a way that few other natural phenomena do". At the 19th yearly session of the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP 19), held in Warsaw, in the days immediately after Super Typhoon Haiyan, Yeb Sano, the lead negotiator of the Philippine delegation (and a Tacloban resident), called for urgent action on climate change. Sano then announced that he would commence a fast during COP 19 to be in solidarity with the people of Tacloban (Vidal, 2014).

COUNTRY	CO_2 EMISSIONS PER CAPITA
Australia	16.3
Canada	13.5
United States of America	16.4
Philippines	1.01

Table 3. CO_2 emissions per capita, 2013. (World Bank, 2017).

1	Vanuatu	12	Timor-Leste
2	Tonga	13	Mauritius
3	Philippines	14	Nicaragua
4	Guatemala	15	Guinea-Bissau
5	Bangladesh	...	...
6	Solomon Islands	121	Australia
7	Brunei Darussalam	...	...
8	Costa Rica	127	United States of America
9	Cambodia	...	...
10	Papua New Guinea	145	Canada
11	El Salvador		

Table 4. The 15 Countries Most at Risk to Climate Change. (Alliance Development Works, 2016).

The Philippines have contributed disproportionately less to cause climate change, yet the archipelago is also disproportionately more vulnerable to its effects. According to Albert Magalang, Head of the Philippine Government's Department of the Environment and Natural Resources Climate Change Office, and the Designated National Authority for the UNFCCC (interview in Quezon City on 20 April 2017), the

top three obstacles to negotiating climate change are the governments of Australia, Canada, and the United States. Table 3 displays the 2013 per capita CO_2 emissions in these three countries along with those of the Philippines, demonstrating that Filipinos are responsible for substantially less emissions than the residents of these countries.[1] Indeed, to some extent, this data understates the difference in per capita CO_2 emissions between these countries and the Philippines. This data compares the emissions of all Filipinos with these countries and does not make it clear that the poorest Filipinos have extremely low emissions. Indeed, it has been estimated that there are 54 million Filipinos who each emit less than 0.42 metric tons of CO_2 per year (Oxfam, 2015). Table 4 displays the 15 countries most at risk to climate change and the Philippines is behind only Vanuatu and Tonga while Australia, Canada, and the United States are substantially less vulnerable to climate change. While damage caused by climate change will be more expensive to repair in these countries, they are substantially more affluent and thus are better able to afford repairing such damage. To Magalang, climate injustice means that climate change impacts are more pronounced in poor communities and in poor countries and those who have done the least to cause the problem bear most of its costs; as Gaspar (2014) wrote:

> The irony of the world today is in the reality of climate injustice: those most responsible for climate change – owing to affluent lifestyles and wasteful consumption patterns that involve the burning of fossil fuels – are the least affected when climate disasters occur. When a Yolanda [Haiyan] unleashes its fury, the poor are far more battered and have the least capacity to recover. (p. 45)

The archipelago's poor are vulnerable because they lack the capacity to absorb and recover (Gaillard et al., 2007; Morin, Ahmad, & Warnitchai, 2016). "Vulnerability", Huigen and Jens (2006) state, "is the opposite of resilience, where resilience is low, vulnerability is high and vice versa" (p. 2117). The vulnerability of a community, such as a coastal *Barangay* in Tacloban, is determined by class, gender, education levels, and access to resources (Huigen & Jens, 2006). Bankoff (2003) aptly described the vulnerability of the poor writing: "Vulnerable populations are those at risk, not simply because they are exposed to hazard, but as a result of a marginality that makes their life a 'permanent emergency'" (p. 12). The vulnerability of the residents of Samar and Leyte, combined with the ferocity of Haiyan, created a perfect storm of hazard meeting vulnerability – essentially an irresistible force meeting a movable object! The "socioeconomic vulnerability" of the Eastern Visayas was, wrote IBON (2015), "the single biggest circumstance that caused the damage wrought to be so vast" (p. 12). In 2012, the last poverty estimates prior to Haiyan, the poverty rate for the Eastern Visayas Region (where Leyte and Samar are located) was 45.2% while the poverty rate for the Philippines was 25.2% (National Statistical Coordination Board, 2013). The economy of these two islands is based largely on subsistence aquaculture and agriculture. From 2013 to 2014 this region's rice production fell by 1.62%, while

1 Other data sources, such as the Organization for Economic Co-operation and Development (2018), give substantially higher emissions numbers for Australia, Canada, and the United States but do not provide an emissions estimate for the Philippines. World Bank data has been used because it provides an estimate for all four countries.

corn production fell by 5.19%, and inland municipal fish production fell by 2.30% (IBON, 2015). In 2013, the Eastern Visayas was responsible for 5.40% of all rice produced in the Philippines, 1.20% of all corn, and 3.20% of all inland municipal fish production; by 2014, these shares had fallen to 5.18%, 1.13%, and 2.70% respectively (Philippine Statistics Authority, 2014, 2015). The affected areas had poor, backward, agrarian economies and were profoundly challenged by Haiyan. In the words of Gaspar (2014):

> The Warays have constantly faced hunger, deprivation and powerlessness owing to various factors- slave raiders from the south, oppressive colonization, the vagaries of a tropical climate, the difficulties of producing bountiful harvests despite available fertile lands, the prevalence of schistosomiasis and the tight grip of political dynasties. Migrants from Samar have flooded Tacloban through the years, hoping to improve their lot, only to find themselves barely able to eke out a living. (p. 14)

Background injustice exists in the Philippines as the archipelago was colonized by Spain (1565 to 1898) and by the United States (1898 to 1946). The Spanish used the islands as a source of agricultural commodities and to facilitate the trade of precious metals from their New World colonies for Chinese goods on the Manila Galleons, which were built using Filipino forced labor (Francia, 2010). By the 1890s, much of the archipelago was in what Linn (2000) described as "severe distress, plagued by social tension, disease, hunger, banditry, and rebellion" (p. 16). In 1898, the United States acquired the Philippines from Spain, as an unintended consequence of the Spanish-American War, and ruthlessly repressed an insurgency led by Filipino nationalists during the Philippine-American War of 1899 to 1902 (Linn, 2000). During this war, the Americans killed more Filipinos in three years than the Spanish killed in 300 (Nadeau, 2008). American businesses were given an import monopoly in the archipelago while Filipino commodities were given tariff-free access to the United States (Karnow, 1989). Allowing American manufactured goods tariff-free access to the Philippines stunted the growth of Philippine manufacturing and locked the islands into being an agricultural society dependent on the American market According to Father Edwin Gariguez, the Executive Secretary of the National Secretariat for Social Action, Caritas-Philippines (interview in Tagaytay, Cavite on 26 April 2017), "the Philippines were colonized and exploited and now we need to cope with climate change, which was not caused by us but by our former colonizer". Father Meliton Oso, the Social Action Director of the Archdiocese of Jaro stated (interview in Tagaytay, Cavite on 26 April 2017) that climate injustice is:

> the destruction caused by capitalism and imperialism that cause those who did not cause the problem to suffer the most; the concept of background injustice is very true. We are ill-prepared and we lack the capacity to cope. We suffer because of the evil done to the environment by other countries, which compounds our suffering.

The opinion of Suyin Jamoralin, the Executive Director of the Citizens Disaster Response Center (interview in Quezon City on 21 April 2017), is that the entire Philippines suffered during American colonization as resources were extracted. To Jamoralin it seems that, "the Philippines should not be punished for something it did not contribute to. The industrialized countries should do more to address the problem. This is very sad and disappointing". To Denise Fontanilla, the Climate Policy Coordinator for the Institute for Climate and Sustainable Cities (interview in Quezon City on 23 April 2017), one cannot talk about historical responsibility without acknowledging the history of the colonization of the Philippines.

However, one must not overemphasize background injustice when discussing the vulnerability of the archipelago to climate change. The Philippines has been a sovereign country since 1946 and not all its problems emanate from colonialism; as Amalie Obusan, from Greenpeace Southeast Asia, stated (interview in Quezon City on 26 April 2017):

> The poverty experienced by the Philippines is not totally the responsibility of the former colonial masters of Spain and the United States. As a people, we have never managed becoming a prosperous country. There are just too many political players, there is such a fertile ground for things to be done poorly. As a people, we have not arrived at a place where there is enough political maturity.

The high levels of inequality in the Philippines are an impediment to widespread prosperity in the archipelago. "The Philippines," wrote Yamada and Galat (2014, p. 433), is a nation with severe economic inequalities: the assets of the 25 richest people equal the income of the 73,808,000 poorest." "If your vision of capitalism is one in which a genetically predestined elite runs everything", wrote Mason (2012, p. 201), "then the Philippines is the ideal embodiment of it". There has been a historical pattern of development in the Philippines known as a "plunder economy" (Broad & Cavanagh, 1993, p. 51). The archipelago is ruled by an oligarchy "far more concerned about their intertwining networks of family and friends rather than the needs of a people in distress" (Kirk, 2005, p. 20). This predatory oligarchy has taken control of the state and uses it as a vehicle for furthering its own interests; it has consistently managed natural resources for the benefit of those who control the state. As Broad (1995, p. 331) wrote about natural resources management in the Philippines:

> [The] problem in … the Philippines is not a lack of political will but a political will that represents elite … interests. Policy failure on environmental grounds needs to be grasped for what it is- not an oversight, nor as a faulty judgment. The direction of public policy … is too often shaped, both directly and indirectly, by those with a vested interest in the continued mismanagement of natural resources. In other words, one cannot accurately label these as general policy failures or as mismanaged resources. Rather, they are political successes in managing natural resources for the benefit of the controllers.

The archipelago also suffers from compound injustice because it is a developing country, yet it must now cope with the challenge of climate change. To Albert

Magalang (interview in Quezon City on 20 April 2017), those who have done the emitting should support the developing countries with finance, technology transfer, and adaptation. Historical emissions should always be converted into concrete support that should be given to developing countries to assist them in coping with climate change. One aspect that has contributed to compound injustice in the islands has been the embrace of neoliberalism by various Philippine governments. Neoliberalism can be defined as "a theory of political economic practices [proposing] that human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets, and free trade" (Harvey, 2005, p. 2). From 1992 to 2016, governments have adopted neoliberal policies promoting large-scale mining, industrial shrimp farming, timber harvesting, and agribusiness plantations (Holden, 2012, 2013, 2014, 2015). The environmental degradation caused by these activities (such as the removal of mangrove forests for shrimp farms, run-off from deforested hillsides that covers coral reefs, or the chemical wastes from mining that also kills corals) all reduce resilience to the amplified typhoons expected with climate change (Broad & Cavanagh, 1993; Holden, 2015; Primavera et al., 2016). To Father Edwin Gariguez (interview in Tagaytay, Cavite on 26 April 2017), the most glaring localized environmental degradation is the prolific expansion of large-scale mining. Mining causes deforestation, gives off chemical poisons, removes overburden, and has a tremendous impact on indigenous peoples and farmers. Much mining occurs within critical watersheds and causes flooding. When mining is combined with climate change it increases the destruction caused by climate change. Suyin Jamoralin stated (interview in Quezon City on 21 April 2017) that illegal logging is a substantial contributor to a lack of resilience, there have been a lot of disasters because of illegal logging; the effects of mining are also not insignificant. Big companies, who are only interested in profit, are conducting the mining. Amalie Obusan, from Greenpeace Southeast Asia, indicated (interview in Quezon City, Philippines on 26 April 2017) that she regards the types of localized environmental degradation that can weaken resilience to climate change more than deforestation and mining. Paul Yang-Ed, a member of *Agham* Youth, articulated his view (interview in Quezon City on 22 April 2017) that logging, mining, and plantation agriculture for exports reduce resilience to climate change – the latter does so by creating monocultures and reducing genetic diversity.

One may ask why developed countries, such as Australia, Canada, and the United States (cited as the top three obstacles to negotiating climate change by Albert Magalang) are so reluctant to reduce their emissions? Canada, as recently as 2015, had a government that openly disregarded the significance of climate change (Dearden & Mitchell, 2016). Canada has been reluctant to make the transition to a low carbon economy because it is among the few countries that might conceivably (at least in the short term) benefit from a warming climate as crops may be grown further north and the loss of Arctic sea ice opens new fuel and mineral resources for exploitation; Canada also has large supplies of oil in its tar sands, which themselves require large amounts of energy to extract, and thus generate large CO_2 emissions (Rodgers, 2016). The undue attention given by the media in these countries to climate change skeptics, and the media's discussion of climate change as a theory (as if it is not scientifically proven), manufactures uncertainty about climate change (Vanderheiden, 2008).

Owen Migraso, an environmental activist with the Center for Environmental Concerns (interview in Quezon City on 25 April 2017) expressed familiarity with the concept of manufacturing consent, developed by Herman and Chomsky (1988/2002), and believes that people in developed countries do not want to reduce fossil fuel use because their consent for high emission activities has been manufactured. According to Herman and Chomsky (1988/2002, p. xi) "the media serve, and propagandize on behalf of, the powerful societal interests that control and finance them". These interests include coal and oil companies who have substantial control over what is said on media outlets by purchasing advertisements. The media in Australia, Canada, and the United States are reluctant to discuss climate change, and earn the displeasure of fossil-fuel interests, and will accord climate change skeptics equal air time with mainstream climate scientists without assessing the qualifications of these skeptics (Dearden & Mitchell, 2016). This exemplifies how the media not only allows these disinformation sources to prevail but also protects them against disclosures revealing their dubious credentials (Herman & Chomsky, 1988/2002). Residents in Australia, Canada, and the United States also benefit from an ability to distance themselves from the simple facts of their own existence (Goodell, 2006). Residents in these developed countries tend to enjoy a prosperous life based upon the extensive use of fossil fuels. Indeed, the idea that fossil fuels are an indispensable condition for prosperity has become so well entrenched in these countries that Antonio Gramsci's concept of hegemony may be used to describe this attitude. To Gramsci (1971), when a concept becomes unequivocally accepted it can be said to be hegemonic. Once this occurs, the concept will never be challenged, and it will operate as guiding principle controlling all thought processes. These fossil fuels impart CO_2 emissions into the atmosphere, which have their impact upon those in distant places (such as Tacloban) who may be thrust into the media spotlight for a week or so after events (such as Super Typhoon Haiyan) and are then forgotten as attention returns to ensuring the prosperity of these developed countries. In this regard, it may be thoughtful to consider the words of Othelia Versoza, a survivor of Super Typhoon Haiyan who stated (interview in Tacloban City on 21 December 2016), "The capitalists of the developed countries only think about the rich people of the world who can buy their products while the rest of the world are only their slaves". Versoza feels that she is one of the "slaves of the developed world" and developed countries are getting rich by emitting greenhouse gases when they should be providing funds to help people affected by climate change.

CONCLUSION

This article has approached the issue of climate injustice by using political ecology, a field that facilitates a study of ecological distribution conflicts and the political ecology of hazards. Ecological distribution conflicts are conflicts about accessing the benefits obtainable from natural resources and the environment. The ability of the atmosphere to absorb CO_2 is a natural resource and much of this absorptive capacity has been taken up by the developed countries of the world and, consequently, they are disproportionately more responsible for climate change. The political ecology of hazards is applicable as this article has argued that the stronger typhoons affecting

the Philippines are a manifestation of climate change. The IPCC is unenthusiastic about such a conclusion, but other authors, as discussed in this article, regard stronger typhoons to be a corollary of climate change.

The relevance of this article can be shown by the discussion at the Decarbonizing South East Asia Forum attended by the author on 25 April 2017 at the University of the Philippines Diliman, in Quezon City. This was a forum attended by members of civil society organizations from across Southeast Asia who were gathering simultaneously with an Association of Southeast Asian Nations Summit in Manila. At this forum the participants called on their respective governments to challenge the governments of the developed world to reduce their CO_2 emissions. The participants were mindful of the threats that climate change poses to Southeast Asia, as demonstrated by Super Typhoon Haiyan in the Philippines in 2013. They called for their governments to put pressure on developed countries to reduce their emissions as soon as possible, as well as for the developed world to provide mitigation and adaptation. The main argument that emerged was that the nations of Southeast Asia did not cause the problem of climate change but, as the world progresses further into the 21st Century, they will disproportionately bear its consequences. As humanity progresses further into a world affected by climate change, what happened in Tacloban in 2013 shows how those who have caused climate change must assist those who have not caused the problem and stand only to be hurt by it. Ultimately, as humans we only have one planet and all of humanity must share this planet. In the words of Pope Francis (2015, p. 125), "reducing greenhouse gases requires honesty, courage, and responsibility, above all on the part of those countries which are more powerful and pollute the most".

Text Box 1. Increased Solar Radiance as a Cause of Climate Change

An explanation of climate change frequently cited by climate change sceptics is the claim that solar radiation is increasing- essentially a claim that the sun is getting more powerful. This is relevant to tropical cyclones as the principal impetus for their formation are the high levels of solar energy received by the ocean's surface in tropical latitudes. Demonstrating that solar radiance is increasing requires evidence that Earth is receiving fewer cosmic rays from space. When cosmic rays enter the atmosphere, they interact with it and create new types of atoms including beryllium-10. When the sun is more active, solar radiation protects Earth from cosmic rays and less beryllium-10 falls on Earth; conversely, a less active sun allows more beryllium-10 to fall on Earth. During the current warm period, ice cores taken from Antarctica and Greenland show little, if any, change in beryllium-10 over thousands of years and they do not show the marked decrease in beryllium-10 indicative of increased solar radiance (Alley, 2000). Indeed, the number of cosmic rays reaching Earth's atmosphere are now at near record high levels thus indicating that Earth is currently experiencing historically low levels of solar activity (Lean, 2010; Lockwood, 2010). Lockwood (2010) argues that "the popular idea that solar changes are some kind of alternative to greenhouse gas forcing in explaining the rise in surface temperatures has no credibility with almost all climate scientists" (p. 323).

Text Box 2. Lowest Common Denominator Science at the Intergovernmental Panel on Climate Change (IPCC)

The lack of confidence expressed by the IPCC with respect to whether climate change will generate stronger typhoons is an example of what Flannery (2005) describes as its tendency to engage in "lowest common denominator science" (p. 246). The operations of the IPCC demonstrate how the fossil fuel industry uses proxies to tone down, and slow down, its work. Although the fossil fuel industry is not directly represented at the IPCC it acquires a voice through the government appointees of fossil fuel dependent nations, such as those in the Middle East and the United States. When the IPCC issues any form of statement the world's largest oil exporter (Saudi Arabia), the world's largest oil user (the United States), and the world's largest coal burner (China) are eager to water down wording and slow progress. This imparts a tendency into the IPCC to always avoid any alarming or overly dramatic declarations. According to Flannery (2005), "the pronouncements of the IPCC do not represent main stream science, nor even good science, but lowest common denominator science" (p. 246). Shue (2014) echoes Flannery and regards "the conservative estimates made by the IPCC" to be a result of "the need to reach consensus on its reports" (p. 288).

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