A Just Climate Response: Asymmetric Vulnerability to Climate Change within the Emerging Economies of Southeast Asia

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Abstract

The existential threat posed by anthropogenic climate change manifests differently in different global regions, demanding a complex, varied and reflexive approach from the global community. Adopting a focus on the Southeast Asia region, this article identifies intrastate social inequalities, alongside interstate geographic and social differences, as two key factors necessitating a just climate transition. In analysing the severity of climate hazards and their disproportionate impact on the most vulnerable groups, this article contends that the Southeast Asia region requires a climate response that integrates principles of justice and intergenerational resilience to truly address the intertemporal nature of climate change threats.

Introduction

As a region of growing presence and centrality in global markets, Southeast Asia faces impending climate effects from a unique standpoint. While on the cusp of becoming a net fossil fuel importer to sustain this growth, the region has been identified as one of the most globally threatened regions in regard to exposure to climate variability (IEA, 2019; Prakash, 2018). A 'wicked problem' brought into focus by recent generations, climate change will shape lives and policy for centuries to come. Wicked problems are defined by their complexity and an interdependency of contributing factors; the impossibility of identifying direct causation often renders solutions contradictory. This article seeks to understand the pre-existing relationship between the ecological sphere and the political, economic and social structures of Southeast Asia. In underscoring intrastate social inequalities, as well as strong interstate geopolitical differences, the region is thus understood to be one facing a unique, complex, and existential threat. We take an approach that builds on the interplay between these socio-political realities and adverse climate change and build the case for a just, rapid climate response that seeks security and resilience for all members and generations of society.

Firstly, this article explores Southeast Asia as a region comprising incredibly diverse geographies, ranging from landlocked and mountainous Laos to the volcanic archipelago of the Philippines. Identified as a highly susceptible region to extreme climate changes, Southeast Asia will face increasingly frequent and severe discrete weather events, as well as intensified slow-onset events. Thus, the challenges faced between Southeast Asian states will differ highly and demand reflexivity within the region. Importantly, these interstate geographical differences will continue to complicate the process of creating and executing comprehensive climate responses. This piece draws strongly on the global scholarship of the Intergovernmental Panel on Climate Change (IPCC), an apolitical body leading climate research and communication. The Fifth Assessment Report of the IPCC established 'unequivocal' evidence supporting the anthropogenic nature of global warming, and already observed temperature increases expected to continue in the future. The report outlines a series of Representative Concentration Pathways (RCPs),

projecting climate pathways according to a certain degree of warming. It is important to note that RCPs 4.5 and 8.5 refer to scenarios of intermediate and worst-case scenarios respectively.

Secondly, the article moves to an exploration of intrastate inequity and inequality as realities that have the potential to be substantially amplified and deepened by climate effects. Beyond the region's marked geographic diversity, it is equally important to underscore the role of intrastate dynamics in shaping an understanding of just climate responses. Already disadvantaged demographics, whether influenced by gender, ethnicity, religion or socioeconomic status, will disproportionately bear the brunt of climate hazards as the most vulnerable groups in Southeast Asian societies. These existing group vulnerabilities are established, observable and crucial considerations for climate responses.

Ultimately, this article interweaves the two realities of ever-intensifying climate threats and pre-existing social inequity to underscore the necessity for just climate responses. Industry and state policy decisions must actively consider the intertemporal dynamics of both policy and climate hazards to protect the most vulnerable groups within society. A failure to do so not only has the potential to put millions of lives at risk, but equally promises incredibly high future economic costs.

Climate risk and geographical diversity in Southeast Asia

Southeast Asia is a diverse region home to many countries, each encompassing its own unique composition of environmental, social, and economic conditions. However, the countries in the region face the common and imminent threat of climate change. Due to a number of climatic and geographical factors, several countries in Southeast Asia are particularly susceptible to negative impacts on human and environmental health. According to the Global Climate Risk Index, four of the world's ten countries most affected by extreme weather events between 1998 and 2018 are located in Southeast Asia: Myanmar, the Philippines, Vietnam, and Thailand (Germanwatch, 2019).

Under RCP8.5, a high-emissions climate change scenario with no attempt at mitigation, the median increase in surface temperature by 2100 in Southeast Asia could potentially exceed 3.7°C

(Raitzer et al, 2015). As such, the frequency and severity of extreme weather events including storm surges, sea level rise, and coastal flooding can be expected to increase. Beyond the immediate risks of physical harm and damage due to discrete weather events, anthropogenic global warming amplifies climatic shifts behind such events and will result in extensive threats to both human settlements and the natural environment.

Rapid onset events demand immediate responses

One consequence of ongoing anthropogenic climate change is increased frequency and severity of natural disasters and extreme weather events. Since 1970, 59% of the global death toll from natural disasters has occurred in the Asia-Pacific region (UNESCAP, 2019). As global temperatures increase, rapid onset events such as typhoons, cyclones, high-intensity storms, and earthquakes are projected to become more frequent. These events pose high risks of physical injury, death, or forced displacement. Approximately one third of the Southeast Asian population live in 'high risk' areas, including Vietnam, where 67.8% of people are endangered by potential coastal flooding (Prakash, 2018). In addition to these risks, extreme weather events can damage infrastructure. In Indonesia, flash flooding in 2003 caused approximately USD $205 million worth of damage to roads, bridges, settlements, and agricultural areas, further compounding the threats to lives and livelihoods caused by the initial natural disaster (Weiss, 2009).

The Ring of Fire is a geographic region associated with a high frequency of earthquakes, tsunamis, and volcanic disasters, and is thus a major risk hotspot for this type of climate-related infrastructure damage (UNESCAP, 2019). Parts of Indonesia and the Philippines are located within the Ring and have a comparatively higher risk of infrastructure damage, which can make evacuation during the emergency phase of disasters difficult, as well as increase the incidence of energy failures. An example of this was Typhoon Washi of 2011, which hit the Philippine island of Mindanao. The typhoon displaced over 430,000 people, many of whom were unable to evacuate or effectively seek assistance due to infrastructure damage (Gemenne et al., 2015).

Alongside the immediate risk of injury from storm-related events, such events also impact water security in vulnerable regions (Hoque et al., 2016). The majority of drinking water in Southeast Asia is sourced from groundwater and stored at ground level. This means that freshwater resources in low-lying areas, including Vietnam’s Mekong Delta region and Ho Chi Minh City,

are vulnerable to episodic inundation caused by storm surges or excessive rainfall. This process is known as salinity intrusion and results in the contamination of potable water with seawater. People in such vulnerable areas often have no alternative source of drinking water and may have no choice but to consume saline water, which can increase the probability of hypertension and cardiovascular health issues (Hoque et al., 2016).

Slow-onset hazards require long-term vision and preparedness

In addition to the discrete, extreme meteorological events that endanger human settlements, climate change also creates conditions for slow-onset hazards, such as sea-level rise, increasing mean temperatures, and drought. When the cumulative effect of slow-onset disasters is considered, annual economic losses in the Asia-Pacific region are over four times higher than previously estimated, amounting to USD $86.5 billion (UNESCAP, 2019). In an RCP8.5 scenario, the sea-level in South-East Asia is expected to at least rise 70 centimetres by 2100 (Raitzer et al., 2015). Floods are a regular occurance in Ho Chi Minh City, with 40-45% of land in the city less than one metre above sea level (McKinsey Global Institute, 2020). The indicative value of infrastructure at risk of climate change-related flood damage in Ho Chi Minh City is approximately USD $71 million. However, this valuation only considers the risk to hospitals, electricity substations, and road intersections; the economic damage would increase significantly with the consideration of a wider range of infrastructure (Weiss, 2009).

Under an RCP8.5 scenario, the Asia-Pacific region is expected to warm over 2°C by 2050 compared to pre-industrial levels. This increase in heat and humidity is projected to have negative effects on human health, labour productivity, and peatland areas (Raitzer et al., 2015). Rising mean temperatures have strong implications for human health, with the potential to increase the number of heat-related injuries such as dehydration and heatstroke. Across Indonesia, the Philippines, Thailand, and Vietnam, deaths due to heat-related respiratory illnesses are expected to increase by 25% by 2100 (Raitzer et al., 2015). Furthermore, there is an expected increase in the prevalence of vector-borne diseases such as dengue fever due to the proliferation of insects, such as mosquitoes, in increasingly humid environments (Weiss, 2009).

In addition to this direct impact on human health, rising heat and humidity also bear devastating environmental consequences. Southeast Asia is home to the world’s largest area of tropical

peatlands, which are areas of partially decomposed vegetation. These peatlands play an important role in regulating regional and global climate systems by acting as a carbon sink, covering over 24 mega hectares and storing over 76% of the world's carbon stock (Dohong et al., 2017). Peatland degradation poses an environmental threat due to the release of excess carbon into the atmosphere, which creates a feedback loop that contributes heavily to global warming (Osaki, 2016).

Indonesian peatlands in particular are at risk, due to the commencement of plantation agriculture and exploitation practices for commercial logging in the 1970s. When combined with the increased frequency of high temperatures and droughts, these factors contribute to recurrent peatland fires. In 1997 and 1998, widespread fires in Indonesia released approximately 0.95 gigatonnes of carbon, equal to 15% of the world's fossil fuel emissions at that time (Turetsky et al., 2015). The burning of peatlands also creates layers of haze, which can cause respiratory diseases due to decreased air quality. A 2015 haze event triggered respiratory illnesses in almost 500,000 people in Indonesia, and transboundary haze events regularly affect the air quality in Singapore and Malaysia (Zhang and Savage, 2019).

In addition to endangering large areas of tropical peatlands, rapid and slow-onset hazards combine to threaten biodiversity more broadly throughout Southeast Asia. Approximately 200 million people in the region directly rely on forest ecosystems for needs such as medicine, food, and aquaculture. Furthermore, ecosystem services such as natural pollination and flood prevention support the livelihoods of billions of people in the Asia-Pacific region (Sodhi et al., 2010). However, despite the integral role that biodiversity plays in Southeast Asia, the region faces the highest risk of biodiversity loss in the Asia-Pacific region (UNESCAP, 2019). Anthropogenic land use has been a major driver of diversity loss in Southeast Asia. Based on deforestation rates from 1990 to 2005, 13-85% of biodiversity in Southeast Asia could be lost by 2100 (Sodhi et al., 2010). Long-term climatic shifts are also complicated by short-term factors, such as extreme weather events like landslides, decreasing the capacity of a region to mitigate biodiversity loss. As such, Southeast Asian countries are at particular risk of negative outcomes including species extinction, food insecurity, and damage to climate-dependent industries.

Climate fragility risks

The region's recent rapid economic growth has markedly improved living standards while cementing the region as increasingly influential in the global political sphere. However, in considering negative environmental externalities, there is an indication of a divergence between capital investment in the private and public sectors and the associated social costs. Due to industry prerogatives and the need for capital, the region has mediated an unsustainable balance between economic development and environmentally sustainable policy and systems. This has led to the overconsumption of natural resources and increased waste generation (Prabhakar, Shaw, Rüttinger and Mori, 2017). Southeast Asia's heavy reliance on coal is expected to grow with development and urbanization to support population growth. Such dependencies impede regional environmental sustainability efforts and result in the overexploitation of natural resources. This includes significant changes to land use, deforestation, threats to biodiversity and water scarcity, which only continues to exacerbate climate change disasters (Prakash, 2018). With the region's increasing dependence on fossil fuel industries and the expansion of fossil fuel infrastructure, both emissions trajectories and funding capacities for mitigation and welfare appear fixed. Given the heightened frequency of climate events, the cost of disaster response has synchronously outpaced the growth of many emerging economies within the region, with the United Nations Economic and Social Council predicting costs will rise from 0.1 to 0.3% of the region's gross domestic product (GDP) (UNESCAP, 2019).

Furthermore, an analysis of the region's riskscape indicated that with the inclusion of slow-onset disasters, harsh economic demands create a harmful feedback loop. The increasingly disaster-prone region faces substantial economic costs as a result of both immediate and indirect consequences of climate change. Moreover, limited government budgets constrain investment to counter such effects (Wade and Jennings, 2015). This creates barriers to effective resource allocation, impacting social health and livelihoods, and putting those most at risk in an even more susceptible situation. Cao and Zheng (2016) argue that socioeconomic development and measures towards adaptation should be addressed in tandem, in order to make both social and ecological progress to combat the cascading effects of climate change.

Disproportionate climate susceptibility and vulnerability

Evidently, Southeast Asia faces a unique threat from both slow and rapid onset hazards that threaten the natural environment and the 655 million people living in the region. Moreover, the impact of these climate events will not be shared evenly amongst these diverse populations, but disproportionately shouldered by the vulnerable. Climate change is deeply regressive; disadvantaged communities are both more exposed and susceptible to climate events, and less equipped to recover from the damages.

A large proportion of Southeast Asia's impoverished populations live on land and work in industries that are most exposed to climate hazards. One such industry is agriculture. Though decreasingly so, the agriculture sector remains an important driver of economic growth in Southeast Asia, accounting for 12.72% of Indonesia's GDP in 2019 and 13.96% of Vietnam's GDP (The Global Economy, 2020) . Moreover, 70% of people below the poverty threshold in Southeast Asia live and work in rural areas, largely employed in the agriculture sector (Balisacan, Edillon, & Piza, 2005). The agriculture industry is increasingly at risk of climate hazards, with steadily rising daytime temperatures decreasing crop yields. In Thailand and Vietnam, the annual probability of a 10% crop yield reduction by 2050 has increased from 2 to 8% (McKinsey Global Institute, 2020). Several regions are also expected to see decreasing annual rainfall in coming decades, threatening a further decline in crop yields. Moreover, many poor and rural populations rely on subsistence agriculture, presenting not only the risk of decreased income but also a severe threat to food security. This phenomenon can be exemplified by the rice industry. Southeast Asia is the world's largest rice exporter, and rice drives the region's economies. Yet the International Institute of Rice's modelling reveals that for each 1ºC increase in growing season minimum temperature, rice yield decreases by 10% (Weiss, 2009). A failed rice harvest would be both an economic and 'humanitarian disaster', as already impoverished and vulnerable communities lose vital access to their income stream and their food source.

Marine industries are also at particular risk of hazardous climate events. In Indonesia, coastal and marine activities provide employment to around 20 million people, many of whom live below the poverty line (Weiss, 2009). Similarly, in Vietnam, the greatest number of poor people in

absolute numbers live in coastal areas, including the Red River and Mekong Deltas (Oxfam, 2020). Along with increasing temperatures, experiences of rural farmers living in Vietnam's Mekong Delta reveal the range of other climate-change induced conditions that are threatening coastal areas: typhoons, sea-level rise and extreme salinisation caused by flooding.

Not only are vulnerable communities more exposed to climate disasters, they are also more susceptible to the event's effects. People living in the same region, with the same exposure to climate events, will nonetheless be unevenly impacted. A key reason for this is infrastructure; wealthier people can afford climate-resilient housing where impoverished people cannot. This extends to public infrastructure. For example, in the Mekong Delta, only one-fourth of schools are constructed from climate-resilient materials (Oxfam, 2020). The same trend is mirrored in urban regions. The last few decades have seen the increasing expansion of settlements arising on the peripheries of Southeast Asia's cities, populated predominantly by poor migrants. The houses in these settlements are mostly constructed of cheap materials that cannot withstand weather events. Photos on Twitter of flash flooding in Jakarta demonstrate this stark inequality. An aerial photograph shows Jakarta's Shangri-la Hotel, built on an elevated plane 3-feet above street level, virtually untouched, whilst a neighbouring slum is completely submerged by water. This is a clear visual representation of the jagged, disproportionate susceptibility faced by vulnerable people in Southeast Asia.

Disadvantaged groups are also more susceptible to health risks created by climate change. Several studies have traced the link between increased rainfall and temperature and increased outbreaks of malaria, dengue, diarrhea and cholera (IPCC, 2014). A range of conditions make poor communities more susceptible to these illnesses, including limited access to potable and clean water, or exposure to open drains (UNESCAP, 2019). Those living in poverty are also less likely to have heating and cooling amenities like air conditioning units, increasing the prevalence of heatstroke and other health issues (UNESCAP, 2019).

Evidently, poor people living in Southeast Asia are and will continue to be disproportionately exposed and susceptible to climate hazards. But there are select subgroups that face yet another layer of increased vulnerability to climate change: women, children and the elderly. Women are

at a heightened risk of climate events for a range of reasons. For one, due to their lack of assets and social restrictions, female farmers often work on more marginal land which face greater climate-related hazards. Moreover, whilst men are projected to increasingly relocate from rural and coastal areas towards cities in the advent of climate events, women are left behind in the most exposed pockets of land. Women are also more likely than men to collect water and firewood, often travelling long distances to do so (UNDESA 2017). These journeys once again increase women's exposure to climate risks. Along with women, children and the elderly are disproportionately affected by the health risks posed by climate change. Heat exposure especially affects the elderly and very young, and one study from Ho Chi Minh City reveals that children were more vulnerable to health conditions following flooding than the rest of the population (Hallegatte et al., 2016).

The reinforcing natures of disasters, inequality and poverty

The cyclical effects of climate change are characterised by both direct and indirect impacts on affected and vulnerable groups and the mutually reinforcing nature of socioeconomic impacts. The economic damage inflicted on climate-dependent industries, including ecotourism, marine and agricultural sub-sectors increases the susceptibilities of vulnerable groups. Simultaneously, environmental effects also widen intrastate inequities, which can exacerbate intergenerational poverty and create significant barriers to escaping persistent poverty. In response to increasing population growth, the region has also experienced rapid urbanization, with more than 50% living in urbanised areas (UNEP, 2017). Inequality is high on both a regional and national level; while the region has seen far reaching and consistent economic growth, the gains fail to trickle down to the most impoverished communities. There are already long-term implications on human welfare and as climate impacts are similarly regressive in nature, the adverse effects are felt the most deeply by the impoverished than the rich.

The vicious poverty cycle and its interplay with climate hazards

There is a relationship between climate change effects and worsening poverty alleviation. Nonlinear socioeconomic impacts, worsened by exposure and susceptibility to climate

variability, decreases impoverished people's ability to cope with the damage (McKinsey Global Institute, 2020). The IPCC (2014) report stated that 'interventions generally confront many barriers in rural and sensitive regions, such as a lack of financial or human resources to support project planning and implementation, and this is especially true in impoverished communities'. As household, community and publicly available resources become out of reach for disadvantaged groups (UNESCAP, 2019), opportunity and availability for recovery measures are extinguished and their abilities to cope lessened. Immediate and slow-onset disasters can permanently affect livelihood; whereby natural capital and physical assets are lost through climate change-related phenomena. There is a plethora of literature that suggests that through foregone education, housing, employment and health, climate variabilities can slow down existing poverty reduction measures, and lead to the deepening of poverty traps as stated by the IPCC (2007). Instances of climate variability perpetuate the consequences of self-reinforcing factors that lock vulnerable individuals and communities into intergenerational poverty traps (Hallegatte et al., 2016).

The World Bank (2013) outlines the risk of environmental negative feedback loops on poverty resulting within low-income countries, leading to the potential for climate-driven poverty traps. Inefficiencies in governance, poor education, and market failures are recognised by the UN DESA (2017) as such mechanisms. Meanwhile, a lack of infrastructure and costly disaster relief to recover from climate hazards can push vulnerable groups below the poverty trap threshold. Extensive capital investment into natural resources detracts from public services that are foundational to community adaptation and resilience (Cao and Zheng, 2016). Such services include inclusive financial services and welfare programs, ultimately sacrificing opportunities for ongoing community capacity-building. Inadequate funding and lack of access to resources only exacerbates the already devastating implications on the poorest and most vulnerable to physical climate risks. This undermines many of the fundamental and crucial pillars to enable poverty alleviation, including access to public health services, housing and financial services, education, and sustainable income and assets (UN DESA, 2017). By increasing household income and providing education access, communities may reduce the risk of famine and poverty (Adger et al., 2011; Eakin et al., 2014). It is crucial to strengthen and localise the adaptive capacity of affected communities before attempting to escape the poverty cycle. Thus, it is clear that there is

a need for policies and resource allocation that strive for intergenerational progress and combat the complex drivers of the poverty trap. This requires an understanding of growth as a product of immediate responses and investment in preparedness. In this way, projected economic gains are fed back into sustainable and just mitigation investment opportunities.

Pursuing a just climate response while addressing intertemporality

This article has explored how the wicked problem of climate change systematically perpetuates inequalities among vulnerable groups in the Southeast Asian region. Several key questions face policymakers, companies and individuals alike. How can we mitigate climate change effects without perpetuating poverty and inequality? How can we adapt to the current pressures of climate change without sacrificing resources that promote long-term sustainability? Hence, we highlight a number of synergies that we find essential for a systemic response to a systemic issue and consider adaptation and mitigation, policymakers and local communities, in both the short-term and long-term.

Firstly, it is important to consider the disparity in temporal effects between adaptation and mitigation. Often, the benefits of allocating resources towards mitigation are not immediately realised or even discernible, and are instead accrued several years into the future. As such, choosing trade-offs that reap uncertain future benefits for present costs can be exceedingly difficult, especially when beneficiaries of such a response are not the same as those who made the initial sacrifice.

For example, Thailand's Power Development Plan (PDP) (Energy Policy and Planning Office, 2019) and Alternative Energy Development Plan (2015-2036) (Ministry of Energy, 2015) see the nation committed to accelerating investment and development of renewable energy sources, and in particular solar, biomass, and wind. With a focus on security, the economy, and ecology, the government aims to have around 30-34% of its power generation in 2037 come from renewable energy sources (Hashizume, 2019). This target requires a significant present investment for benefits which may not be realised for several years.

In order to increase its current generation from 3,500 megawatts to 15,574 megawatts by 2037, the licensing process for rooftop solar has been made more convenient, with owners now permitted to sell excess electricity to the grid (Tuorila, 2020). Through the AEDP policy, households will likely be the main source of solar power (Pugnatorius Research, 2020). The 'Energy for All' scheme aims to make waste-to-power generation accessible to each local community, promoting power plants powered by biomass (local agriculture and forestry-based), refuse-driven fuels (particularly from communities who sell their farm waste) and solar panels (Praiwan, 2020). As of 2019, Thailand's wind turbines generated a total wind power capacity of 1.532 gigawatts, half of the three gigawatt target as outlined by the AEDP Plan (Banerjee, 2020). As of March this year, the PDP has set a target to boost the country's wind power generation to 90 megawatts per year by 2023-2025 (Qiao, 2020).

Similarly, Vietnam's biogas program has been in place since 2003, aiming to build a sustainable and commercially viable biogas market specifically within the animal agriculture sector (IRENA, 2018). Vietnam's construction of approximately 250,000 domestic biogas digesters makes it one of the largest programs in the world, aiming to provide 'clean, renewable and reliable energy' (IRENA, 2018) while simultaneously addressing waste management. Biogas digesters produce biogas for cooking, fuel for lighting and power, as well as bio-slurry, which is used as fertiliser to increase crop yield and quality (IRENA, 2018). Bioenergy and bio-slurry have been identified as enablers for women to carry out a wider variety of activities that contribute to improved gender equality (IRENA, 2018). For example, women have been able to undertake income-generating activities outside of the farm, while men have been shown to take more interest in cooking since biogas was introduced. Vietnam's biogas market has reaped multiple socio-economic and environmental benefits through its 15-year 'long-term commitment, tailored incentives and a focus on local capacity building' (IRENA, 2018).

Such mitigation-based responses often span decades, serving to highlight the inherent need for time when transitioning into a decarbonised or environmentally sustainable society. With transitions demanding such substantial timeframes, the goals of newly implemented policies and restructuring plans may fail to fully actualise until after 2030. However, IPCC predictions under both RCP4.5 and RCP8.5 include realised damages over the next decade, including the possibility of up to 100 million forced into extreme poverty by 2030 (UN ESCAP, 2018). Thus,

traditional policy timelines designed to afford a gradual and reasonable transition into new industries, are insufficient in addressing the short term threats posed to the region.

Secondly, it is also important to combine climate responses with the intentional pursuit of social justice and equity (IPCC, 2020). There is a complex relationship between climate change responses and disadvantaged groups. While efforts to alleviate the impacts of climate hazards can benefit these groups, there may be short term negative impacts on vulnerable industries and communities through climate change transition costs and a delayed positive effect.

For example, despite the numerous benefits of hydropower, the construction of hydroelectric dams are often associated with social conflict due to the displacement of communities (Ha, 2019) and with negative effects on land resources, agricultural-based livelihoods, income structures and even social relationships (Nguyen et al., 2017).

This was seen in Bo Hon, Vietnam, where villagers had to be resettled due to the construction of the Binh Dien hydroelectric dam. The recovery of their livelihoods was found to have taken approximately 8 years (Nguyen et al., 2017). Although the community has arguably recovered well, government compensation was 'short-lived or inequitably distributed' (Nguyen et al., 2017). Such scenarios underscore the importance of actively integrating social considerations into industrial decisions. While Vietnam's rigorous pursuit of hydropower has been incredibly successful, wherein the benefits will be reaped for decades, if not centuries to come, that does not dispel possibilities for harm to occur within the transition phase. In Bo Hon, villagers who relied heavily on land for rice and other crops, forests for common resources such as honey and rattan, and the river for fish, were significantly affected by the resettlement to a different section of the river (Nguyen et al., 2017). Fortunately, several factors assisted in their slow but steady recovery; a resettlement location that had greater access to infrastructure, health and other services (Nguyen et al., 2017). Paired with the assistance of local authorities and INGOs, resettlement has eventually helped to improve overall livelihood outcomes (Nguyen et al., 2017).

As previously shown, climate change impacts are already amplified within vulnerable communities, such as those within developing countries in Southeast Asia already facing 'droughts, floods and slow-onset changes such as temperature rise and changing rainfall patterns'

(Stuart, 2017). Just as the Bo Hon village was able to adapt and eventually thrive after their displacement and resettlement, adaptation-based policies play a large role in helping frontline communities deal with present effects and responses to climate change.

A key example would be adaptive measures in response to an increase in the frequency and intensity of natural disasters, which will be immediately useful in handling existing threats in addition to future ones. The Asian Development Outlook (Asian Development Bank, 2020) put forward a 'triple resilience dividend framework' for disaster risk management: reduce damage and loss of life, unblock development, and gain development co-benefits. Such policies include flood management, mangrove reforestation, and meteorological services.

For example, the Philippines utilises a community-based early warning system and evacuation in Dagupan City developed in conjunction with the indigenous communities (Luneta and Molina, 2008). For example, the *kanungkong*, a communication device that uses bamboo poles, is used in Dagupan City, where one is positioned every five houses to relay the warning (Luneta and Molina, 2008). The local authorities and community have designed a specific rhythm (strikes and intervals) and sound for each specific action to be taken in preparation for a disaster (Luneta and Molina, 2008). An early warning system not only reduces the material losses to a community due to better preparedness but also drives the development of alternative livelihood options (Luneta and Molina, 2008). As vulnerable communities are then able to generate a more sustainable income, the response helps to unblock economic development for those facing the consistent barrier of natural disaster recovery (Luneta and Molina, 2008). Therefore, co-benefits arise as adaptive measures increase disaster resilience while stimulating social, economic, and infrastructural development for the local community.

As aforementioned, poverty also creates a strong barrier for those who are recovering from the impacts of natural disasters and other effects of climate change. Policymakers can assist those in need by 'utilising a range of instruments to expand access to traditional financial services, including microfinance, small loans, insurance and mobile banking' (UNESCAP, 2019). In this manner, adaptation policies can promote equity and justice by removing barriers to land access, reliable early warning systems, financing, and decision-making structures.

The Myanmar Government's Financial Inclusion Roadmap (2020) highlights their plans to expand their rural outreach and tackle barriers to access such as interest rate caps, lack of a dense population, and use of different dialects to assist both microfinance institutions and rural communities. In particular, the 'leave no one behind' principle is reflected by the Myanmar government's effort to address excluded populations that do not hold identity cards, especially the disabled, internally displaced, and those living in minority ethnic and conflict areas (Government of Myanmar, 2020). As Myanmar has been identified as highly vulnerable to severe flooding, agro-insurance products are being explored to help farmers manage or mitigate their losses, especially from crop failure or loss of livestock due to pests, plant diseases, price volatility, and natural disasters (Government of Myanmar, 2020). In this manner, the heavy reliance on savings and credit can be reduced.

In understanding multiple factors that underpin conceptions of climate resilience, it is clear that no single approach takes precedence in approaching this wicked problem. Further measures to preserve and expand wellbeing beyond those covered in this piece are essential to ensuring a comprehensive transition that is cognisant of current capabilities and future needs. Moreover, there are political implications associated with differentially affected stakeholders and susceptible groups, both of which require careful thinking to navigate intertemporal actions and impacts. Climate change stakeholders and policymakers need to consider the effects of their approach to climate change on the people of today and tomorrow, and strive for justice as they pursue climate resilience. As such, any serious attempt at combating climate change should incorporate adaptation and mitigation efforts in a synchronous, equitable, and innovative way.

Conclusion

Climate change remains a wicked problem that permeates time, ecology, institutions, structures, and people. In viewing the ecological crisis from this perspective, a truly just transition is one that is achieved through transformative and systemic change.

This piece explores climate change effects and responses in Southeast Asia as a region that faces disproportionate environmental impacts and varying adaptation needs. The climate crisis perpetuates and amplifies pre-existing intrastate social inequalities such as gender and class, which can result in furthering intergenerational poverty. A concurrent mitigation and adaptation framework alone is insufficient in addressing current and impending climate hazards faced by Southeast Asia; the recognition of local development needs and asymmetric vulnerability demands the active integration of climate justice principles. In acknowledging regional successes in sustainable development, we recognise that the current climate crisis also presents an unprecedented opportunity for inclusion and empowerment across the riskscape, recognising both current capabilities and future potential.

As captured by Hijioka, Y., Lin, E. and Pereira, J. (2014), this intersectional approach considers adaptation, mitigation and sustainable development efforts, considerations which are found in broader climate change literature and systems-based analysis.

Humanity exists within a global environmental commons, where emissions bear global ramifications regardless of the region responsible for their production. Southeast Asia's economic and environmental conditions must be contextualised within this broader context; the ever-increasing interconnectivity and interdependence tied to globalisation demands global collaboration on such existential threats. Technology transfer and global capital investment exemplify areas where global support mechanisms can play a powerful role in accelerating and fortifying regional climate responses. Such international efforts must continue to be guided by the long-standing climate policy principle of common but differentiated responsibility. A synchronous and equitable global response requires acknowledgement of global differences with respect to adaptive capacity, vulnerability, and responsibility.

A just, rapid climate response must balance the immediate reality of existing social inequality with the complex and existential threat of climate change. Critically, the potentially destructive intersection of these realities will continue to play out for decades, if not centuries, to come. Industry and policy decisions that fail to break free of a short-termist vision risk not only the profits made from short-term investments, but the lives of the most vulnerable.

References

Adger, W. N., Brown, K., Nelson, D. R., Berkes, F., Eakin, H., Folke, C., … & Ruitenbeek, J. (2011). Resilience implications of policy responses to climate change. *Wiley Interdisciplinary Reviews: Climate Change*, *2*(5), 757-766.

Asian Development Bank. (2020). *Asian Development Outlook 2019: Strengthening Disaster Resilience*. Manila: Asian Development Bank. Retrieved from http://dx.doi.org/10.22617/FLS190070-3

Balisacan, A. M., Edillon, R. G., & Piza, S. F. (2005). Rural Poverty in Southeast Asia: Issues, Policies, and Challenges. *Asian Journal of Agriculture and Development, 2*(1).

Banerjee, N. (2020). Wind Energy Sector Likely to Benefit from Thailand's New Power Development Plan (PDP) - Climate Scorecard. Retrieved from https://www.climatescorecard.org/2020/04/wind-energy-sector-likely-to-benefit-from-thailands-new-power-development-plan-pdp/

Cao, S, & Zheng, H. (2016). Climate change adaptation to escape the poverty trap: role of the private sector. *Ecosystem Health and Sustainability*, *2*(10), 1-9.

Dohong, A., Aziz, A. A., & Dargusch, P. (2017). A review of the drivers of tropical peatland degradation in South-East Asia. *Land Use Policy*, *69*, 349-360.

Eakin, H. C., Lemos, M. C., & Nelson, D. R. (2014). Differentiating capacities as a means to sustainable climate change adaptation. *Global Environmental Change*, 27, 1-8.

Energy Policy and Planning Office. (2019). *Power Development Plan (PDP) 2018-2037*. Bangkok. Retrieved from http://climatepolicydatabase.org/index.php/Power_Development_Plan_(PDP)_2018-2037

Gemenne, F., Blocher, J., De Longueville, F., Perrin, N., Vigil, S., Zickgraf, C., & Ozer, P. (2015). How climate extremes are affecting the movement of populations in the Asia Pacific region. *Global Implications of Development, Disasters and Climate Change:*

Responses to Displacement from Asia Pacific, 21-40. Retrieved from https://www.researchgate.net/publication/292994243_How_climate_extremes_are_affecting_the_movement_of_populations_in_the_Asia_Pacific_region

Germanwatch (2019). *GLOBAL CLIMATE RISK INDEX 2019 Who Suffers Most From Extreme Weather Events? Weather-related Loss Events in 2017 and 1998 to 2017.* Retrieved from https://germanwatch.org/sites/germanwatch.org/files/Global%20Climate%20Risk%20Index%202019_2.pdf

Government of Myanmar. (2020). *Myanmar Financial Inclusion Roadmap 2019-2023*. Government of Myanmar.

Ha, T. (2019). *Power play- who's winning Southeast Asia's renewables race?*. Eco-Business. Retrieved from https://www.eco-business.com/news/power-play-whos-winning-southeast-asias-renewables-race/?sw-signup=true

Hallegatte, S., Bangalore, M., & L., Bonzanigo. (2016). *Managing the Impacts of Climate Change on Poverty* (Rep.). Retrieved from httpwledge.worldbank.org/bitstream/handle/10986/22787/9781464806735.pds://openknof

Hallegatte, S., Vogt-Schilb, A., Bangalore, M., & Rozenberg, J. (2016). Vicious Circles: Disasters keep people in poverty. *Unbreakable: building the resilience of the poor in the face of natural disasters* (p. 63-77). Washington: World Bank Publications.

Hashizume, S. (2019). *Thailand: Eastern Economic Corridor Independent Power Project*. Australian Development Bank. Retrieved from https://www.adb.org/projects/53239-001/main

Hijioka, Y., Lin, E., & Pereira, J. (2014). *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Rep.).

Retrieved from https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap24_FINAL.pdf

Hoque, M.A.A., Phinn, S., Roelfsema, C. and Childs, I. (2016) Assessing tropical cyclone impacts using object-based moderate spatial resolution image analysis: a case study in Bangladesh. *Int J Remote Sens 37(22)*. 5320–5343

International Energy Agency (IEA). (2019). *Southeast Asia Energy Outlook 2019.* Retrieved from https://www.iea.org/reports/southeast-asia-energy-outlook-2019

Intergovernmental Panel on Climate Change (IPCC). (2007). *Climate Change 2007: impacts, adaptation and vulnerability*. Cambridge, UK: Cambridge University Press.

Intergovernmental Panel on Climate Change (IPCC). (2014). *Climate-Resilient Pathways: Adaptation, Mitigation, and Sustainable Development.* Retrieved from https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap20_FINAL.pdf

Intergovernmental Panel on Climate Change (IPCC) (2020). *Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C approved by governments* . Retrieved from https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/

IRENA. (2018). *Renewable Energy Market Analysis: Southeast Asia*. Abu Dhabi: IRENA. Retrieved from https://www.irena.org/publications/2018/Jan/Renewable-Energy-Market-Analysis-Southeast-Asia

Islam, N., & Winkel, J. (2017). *Climate Change and Social Inequality* (Rep.). Retrieved from https://www.un.org/esa/desa/papers/2017/wp152_2017.pdf

Luneta, M. and Molina, J.G. (2008). Community-based early warning system and…… properties from flood risks in Dagupan City, Philippines. *Safer Cities, 20*. 1–8.

Ministry of Energy. (2015). *Alternative Energy Development Plan (AEDP) 2015-2036*. Retrieved from http://www.eppo.go.th/images/POLICY/ENG/AEDP2015ENG.pdf

McKinsey Global Institute. (2020). *Climate Risk and Response in Asia: Research Preview.* Retrieved from https://www.mckinsey.com/featured-insights/asia-pacific/climate-risk-and-response-in-asia-research-preview#

Nguyen, H., Pham, T., & Lobry de Bruyn, L. (2017). Impact of Hydroelectric Dam Development and Resettlement on the Natural and Social Capital of Rural Livelihoods in Bo Hon Village in Central Vietnam. *Sustainability*, *9*(8), 1422. doi: 10.3390/su9081422

Osaki M., Nursyamsi D., Noor M., Wahyunto, Segah H. (2016) Peatland in Indonesia. In: Osaki M., Tsuji N. (eds) Tropical Peatland Ecosystems. Springer, Tokyo. Retrieved from https://doi.org/10.1007/978-4-431-55681-7_3

Oxfam (2008) .*Viet Nam Climate Change, Adaptation and Poor People* (Rep.). Retrieved from: https://reliefweb.int/sites/reliefweb.int/files/resources/B43CE1314019DA55C1257507004B2D76-Full_Report.pdf

Prabhakar, S., Shaw, R., Rüttinger, L., & Mori, H. (2017). Climate Fragility Risks in Asia: The Development Nexus. *Institute for Global Environmental Strategies.* Retrieved from http://www.jstor.org/stable/resrep02892

Praiwan, Y. (2020). Energy for All scheme to open at end of the month. Retrieved from https://www.bangkokpost.com/business/1931012/energy-for-all-scheme-to-open-at-end-of-the-month#:~:text=Energy%20for%20All%20aims%20to,between%20community%20enterprises%20and%20investors

Prakash, A. (2018). 'Boiling point'. *Finance and Development, 55*(3), pp. 22-26. Retrieved from https://www-imf-

org.eu1.proxy.openathens.net/external/pubs/ft/fandd/2018/09/pdf/southeast-asia-climate-change-and-greenhouse-gas-emissions-prakash.pdf

Pugnatorius Research (2020). *Seven opportunities in Thailand's Solar Energy: Outlook 2021*. Retrieved from https://pugnatorius.com/solar/

Qiao, L. (2020). Driving forward Thailand's wind energy industry | REVE News of the wind sector in Spain and in the world. Retrieved from https://www.evwind.es/2020/03/03/driving-forward-thailands-wind-energy-industry/73872

Raitzer, D. A., Bosello, F., Tavoni, M., Orecchia, C., Marangoni, G., & Samson, J. N. G. (2015). *SouthEast Asia and the economics of global climate stabilization*. Retrieved from https://www.adb.org/sites/default/files/publication/178615/sea-economics-global-climate-stabilization.pdf

Sodhi, N. S., Posa, M. R. C., Lee, T. M., Bickford, D., Koh, L. P., & Brook, B. W. (2010). The state and conservation of Southeast Asian biodiversity. Biodiversity and Conservation, 19(2), 317-328.

Stuart, C. (2017). *Energy and Climate Change Adaptation in Developing Countries*. Eschborn: European Union Energy Initiative Partnership Dialogue Facility. Retrieved from http://www.euei-pdf.org/sites/default/files/field_publication_file/euei_pdf_2017_energy_and_climate_change_adaptation_in_developing_countries.pdf

The Economics of Climate Change in Southeast Asia: A Regional Review (Rep.). (2009) Retrieved from http://hdl.handle.net/11540/179

The Global Economy (2020). *Indonesia GDP share of agriculture - data, chart. (n.d.).* Retrieved from https://www.theglobaleconomy.com/Indonesia/share_of_agriculture/

Tuorila, K. (2020). Renewable Energy in Thailand to double by 2030. Retrieved from https://asianinsiders.com/renewable-energy-in-thailand-to-double-by-2030/

Turetsky, M. R., Benscoter, B., Page, S., Rein, G., Van Der Werf, G. R., & Watts, A. (2015). Global vulnerability of peatlands to fire and carbon loss. Nature Geoscience, 8(1), 11-14.

UNESCAP. (2019). Summary of the Asia-Pacific Disaster Report 2019. In *Committee on Disaster Risk Reduction, Sixth Session*. Bangkok. Retrieved from https://www.unescap.org/intergovernmental-meetings/committee-disaster-risk-reduction-sixth-session

UNESCAP. (2020). *Fast-Tracking the SDGs: Driving Asia-Pacific Transformations.* Bangkok: UNESCAP. Retrieved from https://www.adb.org/sites/default/files/publication/605796/sdgs-driving-asia-pacific-transformations.pdf

United Nations Department of Economic and Social Affairs (UN DESA). (2017). *Climate Change and Social Inequality.* Retrieved from https://www.un.org/esa/desa/papers/2017/wp152_2017.pdf

United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). (2019). *Summary of the Asia-Pacific Disaster Report 2019.* Retrieved from https://www.unescap.org/sites/default/files/Summary%20of%20the%20Asia-Pacific%20Disaster%20Report%202019_English.pdf

United Nations Environment Programme (UNEP). (2017). Summary Report: Waste Management in ASEAN Countries. Retrieved from https://environment.asean.org/wp-content/uploads/2020/03/Summary-Report-Waste-Management-in-ASEAN-Countries-UNEP.pdf

Wade, K & Jennings, M. (2015, July 26). Climate change and the global economy: regional effects [Blog post]. Retrieved from https://www.schroders.com/en/us/insights/economic-views/climate-change-and-the-global-economy-regional-effects/#fn1

Weiss, J. (2009). *The Economics of Climate Change in Southeast Asia: A Regional Review*. Asian Development Bank.

World Bank. (2013). *Turn down the Heat: Climate Extremes, Regional Impacts, and the Case for Resilience*. Retrieved from http://documents1.worldbank.org/curated/en/975911468163736818/pdf/784240WP0Full00D0CONF0to0June19090L.pdf

Zhang, J. J., & Savage, V. R. (2019). Southeast Asia's transboundary haze pollution: Unravelling the inconvenient truth. Asia Pacific Viewpoint, 60(3), 355-369.