Indonesia	
Population	267.7 million
GDP per Capita	US$3,900
Life Expectancy	72 years
CO_2 Emissions per Capita	1.8 metric tons

Country Profile

Indonesia is the world's largest archipelagic nation made up of over 17,000 islands and has the fourth largest population in the world. The country is located between the Pacific and Indian Oceans and is one of the coral triangle countries. The coral triangle is a highly productive area for marine fauna, and contains the most biodiversity of anywhere on the planet. As a result of the large number of islands, the coastline of Indonesia is over 54,000km and approximately 65% of the population resides in low lying, coastal areas.

Indonesia is the third largest global emitter of greenhouse gases, an estimated 65% of which is from agriculture, forestry, and other land-use activities (Wijaya et al. 2017). Originally, trees removed from the forest were used to develop the nation's paper pulp industry. More recently, large swaths of land are cleared to support palm oil production. Palm oil is a monetarily valuable but environmentally devastating commodity and approximately 80% of Indonesia's palm oil is exported to other nations for a variety of products ranging from food items to makeup (ICCT 2016).

In recent years, the Indonesian economy has been steadily growing by about 5-6% annually (World Bank 2019). Despite an increasing GDP, reduction in the rate of poverty, and growing middle class, nearly a third of Indonesians remain vulnerable to falling back into poverty (World Bank 2019). Additionally, the rate of poverty reduction is uneven across provinces. The urban-rural divide is salient and Indonesia has the sixth greatest wealth inequality in the world.

Climate-dependent occupations are overwhelmingly common in Indonesia and contribute significantly to the economy. Over 6 million people are engaged in capture fisheries, and in 2010 marine fisheries were valued at USD $5.1 trillion (ADB 2014). It is estimated that approximately 94% of the fisheries industry is small-scale, meaning they are primarily household level businesses. The industry is also highly important for local food security with more than half of Indonesian animal protein consumption coming from fish and other seafood (FAO 2014).

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Industries that are highly dependent on natural resources, including fishing, are often more vulnerable to poverty due to the rapid changes that can occur in resource availability (Thomas and Twyman 2005). For example, West Sumatran fishers have seen an increased rate of poverty despite efforts to increase income in the region (Stanford et al. 2013). Meanwhile, fisheries contribute fairly little greenhouse gas emissions compared to other food production industries (Parker et al. 2018). Given climate change impacts on oceanic conditions, marine resources, and natural disasters, climate change poses the possibility of making already vulnerable individuals in rural, coastal areas of Indonesia even more susceptible to remaining in or falling back into poverty (Fuji 2016).

How is Indonesia experiencing climate change?

Despite greenhouse gas emissions primarily deriving from land-based activities, coastal areas and ocean dependent industries in Indonesia have and will continue to face the brunt of climate impacts. With the majority of Indonesians residing on the coast, sea level rise (SLR), erosion and flooding pose significant risks to a large number of people (Muis et al. 2015). Assuming no adaptation or mitigation, Indonesia is projected to have SLR by .45 meters, threatening nearly 5.9 million people by 2100 (Kulp and Strauss 2019; McIeod et al. 2010). Mangrove forests and coral reefs are vital for protecting coastlines from erosion and flooding during storms (Guannel et al. 2016). However, coral reef health has been diminishing from combined climate effects and mismanagement. For example, approximately 40% of mangroves in Indonesia have been cleared for aquaculture production or exported to other nations as coal for many years, severely reducing their numbers (ADB 2014; Murdiyarso et al. 2015).

Children play in flood waters after torrential rains in Kampung Melayu, South Jakarta, Indonesia.

Not only do increased storms threaten the coastline, but an increase in storm and extreme weather events limits fishers' ability to go and harvest fish or incentivize fishing trips in dangerous, sometimes lethal, conditions to maintain income (Mulyasari et al. 2019).

Coral reef ecosystems are vital to the marine fisheries industry, as they provide important nursery habitat for commercially important species. Indonesia's coral reefs are among the most threatened in the world (Burke et al. 2011). Consequently, of all the nations around the globe that engage in marine fisheries, Indonesia is expected to experience the largest loss of fish production by 2055 as a result of climate change (Cheung et al. 2010). Increasing ocean temperatures have been associated with migration of fish to cooler waters out of harvestable areas. With over 6 million participants in capture fisheries, a reduction in fish productivity can have significant negative implications for household income and food security for an already vulnerable population.

How is Indonesia responding to climate change?

The United Nations Framework Convention on Climate Change Conference of the Parties (UNFCCC COP) in 2007 was hosted in Bali by the Government of Indonesia (GoI). Subsequently, this meeting along with the G-20 summit in 2009 set the stage for the development of national priorities for emissions reduction and mitigation efforts. The GoI has a stated goal of reducing emissions unilaterally by 26% by 2030 and by 41% with international assistance. Significant doubts stand as to whether or not this will be achievable (Wijaya et al. 2017). In 2011, Indonesia declared a two-year moratorium on new forest clearing permits and in 2019, this moratorium was extended indefinitely to curb greenhouse gas emissions from land use changes. Despite this, forest clearing and fires remains a significant issue and questions remain regarding the effectiveness of the moratorium (Busch et al. 2015).

The unique entity that has been created by the GoI was the Indonesian Climate Change Trust Fund (ICCTF) in late 2009. The ICCTF is a nationally owned entity under the Ministry of National Development. By centralizing international funds, the ICCTF is meant to support the GoI goals of reducing emissions unilaterally by 26% by 2030, and by 46% with international assistance. The original focus areas of the ICCTF included land-based mitigation, adaptation and resiliency, and energy. However, a new focus area of marine projects has been added to ICCTF's priorities underpinning the importance of increasing the resiliency of coastal and resource-dependent communities in the face of climate change. Despite strong initial commitments to reduce greenhouse gas emissions and support resiliency and adaptation, however, the implementation by ICCTF has been slow and has only had minimal impact (Halimanjaya et al. 2014). Additionally, even though less developed and poorer regions will continue to feel the effects of climate change more strongly, the majority of mitigation and adaptation plans by the GoI have focused on urban, comparatively wealthier areas (Glaeser and Glaser 2010).

Meanwhile, efforts in rural, poorer areas have been primarily a result of international aid or actions by NGOs. For example, coral transplanting to increase coral cover has become more common among government agencies, NGOs, and the private sector (ADB 2014). Mangrove forest rehabilitation has occurred as well, originating as a grassroots effort by fishers in Sulawesi (Choudhury 1996). Since then, the Ministry of Forestry has undertaken mangrove restoration, supposedly planting nearly 780,000 seedlings. However, unlike long term projects that focus on coral reef restoration, mangrove restoration efforts are typically short-term and lack consistency (ADB 2014).

It is clear that Indonesia's efforts to mitigate and adapt to climate change in the marine sector are scattered and highly dependent on local community action, NGO involvement, and foreign aid. This is likely due to the fact that the nation is so spread out geographically. Vulnerability and needs vary greatly by region, socioeconomic status, and relative dependence on the natural resource industry. If operationalized to its fullest potential, ICCTF can be extremely valuable in centralizing funding resources and streamlining priorities across sectors to ensure equity in the adaptation process and assist the most vulnerable to be protected from climate change impacts in the future.

Indonesia is one of the main producers of tuna in the world. The harvest of tuna has continued to rise, and most tuna species in Indonesia are considered fully exploited or over-exploited (Sunoko and Huang 2014).

References

ADB. 2014. Asian Development Bank. *State of the Coral Triangle: Indonesia*. Manila: ADB. ©ADB. https://www.adb.org/sites/default/files/publication/42409/state-coral-triangle-indonesia.pdf

ADB. 2017. Asian Development Bank. *A Region at Risk: The Human Dimensions of Climate Change in Asia and the Pacific*. Manila: ADB. ©ADB. https://www.adb.org/sites/default/files/publication/325251/region-risk-climate-change.pdf CC BY 3.0 IGO.

Burke, L., Reytar, K., Spalding, M., Perry, A. 2011. Reefs at Risk Revisited. Washington, D.C.: World Resource Institute (WRI), The Nature Conservancy, WorldFish Center, International Coral Reef Action Network, UNEP World Conservation Monitoring Centre and Global Coral Reef Monitoring Network, 114p.

Busch, J., Ferretti-Gallon, K., Engelmann, J., Wright, M., Austin, K.G., Stolle, F., Turubanova, S., Potapov, P.V., Margono, B., Hansen, M.C., Baccini, A. 2015. Reductions in emissions from deforestation from Indonesia's moratorium on new oil palm, timber, and logging concessions. *PNAS* 112(5), pp. 1328-1333.

Cheung, W.W.L., Lam, V.W.Y., Sarmiento, J.L., et al. 2010. Large-scale redistribution of maximum fisheries catch potential in the global ocean under climate change. *Global change biology* 16(1), pp. 24–35.

Choudhury, JK. 1996. Mangrove forest management. Mangrove rehabilitation and management project in Sulawesi, p. 297.

FAO. 2014. Food and Agriculture Organization of the United Nations. *Impacts of climate change on fisheries and aquaculture: Synthesis of current knowledge, adaptation, and mitigation options*. Rome: FAO. Available online at: http://www.fao.org/3/i9705en/i9705en.pdf

Fujii, T. 2016. Climate Change and Vulnerability to Poverty: An Empirical Investigation in Rural Indonesia. ADBI Working Paper 622. Tokyo: Asian Development Bank Institute. Available: https://www.adb.org/publications/climatechange-vulnerability-poverty-indonesia.

Glaeser, B. and Glaser, M. 2010. Global change and coastal threats: The Indonesian case. An attempt in multi-level social-ecological research. *Human Ecology Review* 17(2), pp. 135–147.

Guannel, G., Arkema, K., Ruggiero, P., and Verutes, G. 2016. The Power of Three: Coral Reefs, Seagrasses and Mangroves Protect Coastal Regions and Increase Their Resilience. *PLoS ONE* 11(7): e0158094.

Halimanjaya, A., Nakhooda, S. and Barnard, S. 2014. *The effectiveness of climate finance: a review of the Indonesia Climate Change Trust Fund*. Overseas Development institute.

ICCT. 2016. International Council on Clean Transportation. Petrenko, C., Paltseva, J., Searle, S. *Ecological Impacts of Palm Oil Expansion in Indonesia.* Washington D.C.: ICCT. ©ICCT. Available online at: https://theicct.org/sites/default/files/publications/Indonesia-palm-oil-expansion_ICCT_july2016.pdf

Kulp, S.A. and Strauss, B.H. 2019. New elevation data triple estimates of global vulnerability to sea-level rise and coastal flooding. *Nature Communications* 10(1), p. 4844.

Mcleod, E., et al. 2010. Sea-Level Rise Vulnerability in the Countries of the Coral Triangle. Sustainability Science 5(2): 207–222.

Ministry of Environment (MoE). 2010. Indonesia second national communication under the UNFCCC, Republic of Indonesia.

Muis, S., Güneralp, B., Jongman, B., Aerts, J.C.J.H. and Ward, P.J. 2015. Flood risk and adaptation strategies under climate change and urban expansion: A probabilistic analysis using global data. *The Science of the Total Environment* 538, pp. 445–457.

Murdiyarso, D., Purbopuspito, J., Kauffman, J.B., Warren, M.W., Sasmito, S.D., Donato, D.C., Manuri, S., Krisnawati, H., Taberima, S., Kurnianto, S. 2015. The potential of Indonesian mangrove forests for global climate mitigation. *Nature Climate Change,* 5: 1089-1092.

Mulyasari, G., Irham, Waluyati, L.R., Suryantini, A., Prawito, P. 2019. Climate Change Represented by Seasonal Rainfall, Temperature, and Wind Speed Trends in North Coastal of Java, Indonesia: Implications on Marine Capture Fisheries. *International Journal on Advanced Science Engineering Information Technology,* 9(6): 2067-2073.

Parker, R.W.R., Blanchard, J.L., Gardner, C., Green, B.S., Hartmann, K., Tyedmers, P.H.,Watson, R.A. 2018. Fuel use and greenhouse gas emissions of world fisheries. *Nature Climate Change*, 8: 333-337.

Stanford, R.J., Wiryawan, B., Bengen, D.G., Febriamansyah, R. and Haluan, J. 2013. Exploring fisheries dependency and its relationship to poverty: A case study of West Sumatra, Indonesia. *Ocean & coastal management* 84, pp. 140–152.

Sunoko, R. and Huang, H.W. 2014. Indonesia tuna fisheries development and future strategy. *Marine Policy* 43: 174-183.

Thomas, D.S.G. and Twyman, C. 2005. Equity and justice in climate change adaptation amongst natural-resource-dependent societies. *Global Environmental Change* 15(2), pp. 115–124.

Wijaya, A., H. Chrysolite, M. Ge, C. Wibowo, A. Pradana, A. Utami, and K. Austin. 2017. "How Can Indonesia Achieve its Climate Change Mitigation Goal? An Analysis of Potential Emissions Reductions from Energy and Land-Use Policies." Working Paper. Jakarta, Indonesia: World Resources Institute. Available online at www.wri.org/publication/how-can-indonesia-achieve-itsclimate-goal.

World Bank 2019. *Indonesia Economic Quarterly: Investing in People*. Washington D.C.: The World Bank.