InJAST
Volume 4, Number 2, October 2023
Pages: 64-66

P - ISSN: 2722 - 0133
E - ISSN: 2722 - 0141
DOI: 10.33751/injast.v4i2.9661

NEWS, NOTES, & EVENTS

Climate Change and Its Implications on Wildlife Conservation

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The Intergovernmental Panel on Climate Change (IPCC) Synthesis Report (IPCC, 2023), released nearly a year ago, summarized five years of reports on global temperature rises, fossil fuel emissions and climate impacts and emphasised that there was "a rapidly closing window of opportunity to secure a liveable and sustainable future for all." It demonstrated an undeniable scientific consensus about the urgency of the climate crisis, its primary causes, its current devastating impacts − especially on the most climate vulnerable regions − and the irreversible harm that will occur to both the natural world and human society if warming surpasses 1.5°C, even temporarily.

For Indonesia, climate change poses a formidable challenge for its people and its rich terrestrial and marine biodiversity that encompasses such a diverse array of ecosystems ranging from lush rainforests and dry savannas to extensive swamps and coral reefs (Sala et al,. 2000). As the world's fourth most populous nation and the biggest archipelagic country in the world, Indonesia consists of some 17,000 islands, with over 8,000 km of coastline and is therefore extremely vulnerable to the impacts of global climate change. The nation's rich biodiversity, encompassing iconic species such as the Sumatran tiger, orangutan, and Komodo dragon, is intricately linked to the health of its ecosystems. Rising temperatures, changing precipitation patterns, and the increasing frequency of extreme weather events disrupt these ecosystems, leading to shifts in species composition and distribution (Parmesan & Yohe, 2003).

Indonesia is highly vulnerable to long-term changes from sea level rise. Coastal ecosystems, including coastal peat swamps, mangroves, and estuaries, face salt-water encroachment, affecting the breeding and feeding grounds of numerous species of aquatic and terrestrial species (Priatna et al., 2021). The loss of these vital habitats disrupts not only the wildlife dependent on these habitats, but also the numerous local village communities dependent directly on coastal waters for their survival, as well as the larger fishing industries extracting resources for the increasing urban populations. In addition, the very existence of many coastal settlements is under threat, not least, Jakarta, the capital city, where the threat posed by sea-level rise exacerbates the impacts of a combination of groundwater extraction and land subsidence.

Extreme weather events, such as floods, heatwaves, and droughts, are becoming more frequent and intense in Indonesia as in the rest of the world. These events lead to habitat destruction, wildfires, soil erosion, altered water availability, and increased invasive species (Alisjahbana & Busch (2017). The impact on biodiversity can be extensive, affecting species that are not only directly exposed to these events but also those dependent on specific environmental conditions for their subsequent survival.

More persistent and continuous changes in temperature patterns pose significant threats especially to Indonesia's rare habitats, from coral reefs to high mountain tops. Over the past few decades, the country has experienced a discernible increase in mean temperatures. Elevated temperatures can have direct and indirect effects on biodiversity, influencing species' physiology, behaviour, and distribution. Coral reefs, among the most diverse marine ecosystems globally, are especially vulnerable. Indonesia's coral reefs, including those in the Coral Triangle, face the threat of coral bleaching, driven by elevated sea temperatures. The bleaching events not only endanger the rich marine life but also affect the livelihoods of coastal communities dependent on fisheries.

The interconnected nature of ecosystems means that the loss of certain species can have cascading effects throughout the food web. For instance, the decline of pollinator species, crucial for plant reproduction, can lead to a reduction in plant diversity and negatively impact other species dependent on these plants for food and shelter.

Changes in temperature, rainfall patterns, and extreme weather conditions have a direct impact on habitats and food resources. Subsequent changes can include shifts in animal migration patterns (Miller-Rushing et al., 2019), alterations in growing and reproductive seasons, and changes in the geographical distribution of habitats. These changes, in turn, affect food resource availability, wildlife population abundance and distribution, and overall their health levels (Acevedo-Whitehouse & Duffus, 2009). Additionally,

they can influence the patterns of wildlife interaction with other wildlife species and, increasingly, with humans (Abrahms, 2023).

The consequences of biodiversity loss extend of course beyond ecological concerns to encompass economic and social dimensions (Monk & Priatna, 2022). Indigenous and local communities, often deeply connected to the land and sea and directly dependent on natural resources for their livelihoods, face increased vulnerability. Changes in the distribution of fish stocks, alterations in agricultural productivity, and disruptions to traditional practices through habitat loss all contribute to the challenges faced by these communities. Furthermore, the loss of biodiversity undermines the potential for academic and general education and for further applied scientific discoveries, such as genetic resources that could be critical for medicine, agriculture, and industry (Rahman et al., 2023).

In addition immediate ecological and socio-economic impacts, the loss of biodiversity in Indonesia exacerbates the global challenge of climate change itself. Forests, acting as carbon sinks, play a crucial role in mitigating climate change by absorbing and storing carbon dioxide. Indonesia's vast rainforests are, however, under threat from deforestation and degradation, driven by poorly planned and manage logging (Adnan & Dadi, 2023), agricultural expansion, and palm oil production. The release of stored carbon into the atmosphere intensifies the greenhouse effect, contributing to further warming and creating a feedback loop that amplifies the challenges posed by climate change.

Climate change therefore poses significant challenges to Indonesia's, and the world's, conservation and restoration efforts. One major consequence is the exacerbated changes in habitat distribution, already significantly affected by land-use changes brought about by increasing commercial exploitation, that increase the risk of extinction for species unable to move or adapt quickly. Population management becomes more complex due to increased interactions among previously isolated species. Disrupted migration patterns complicate conservation efforts to protect vital pathways and habitats.

This environmental shift introduces considerably more uncertainty into conservation planning and management (Wilkening et al., 2022). Predicting climate projections and impact estimates affects long-term strategies to protect endangered or vulnerable species. Climate change influences disease spread among wildlife and between wildlife and humans, necessitating new disease management approaches in conservation environments. Successful conservation efforts require an adaptive, climate-oriented approach that considers future climate scenarios and land use changes (Johnson et al., 2023).

The global strategy to address climate change's impact on wildlife conservation involves expanding shelter areas, emphasizing microrefugia, microrefugia, environmental gradients, and areas connecting current and future climates (Hannah et al., 2007). Maintaining ecosystem processes through robust conservation strategies is crucial, along with restoring degraded lowland areas for landscape-level climate resilience (Lestari & Priatna, 2020; Pertiwi et al., 2021; Priatna et al., 2022). Literature highlights the importance of management recommendations addressing climate change impacts, including protected areas, invasive species, adaptive management, and conservation facilities (Hannah et al., 2007). However, further research on local-scale interventions is vital. Socio-political factors, particularly weaker governance and lower GDP, contribute to greater species losses due to climate change. International coordination is essential for effective conservation across changing cross-border areas.

Indonesia, as a mega biodiversity country, needs to implement effective conservation strategies to preserve its biodiversity and wildlife in the face of a changing climate. One important strategy is the establishment of biobanks, which can supplement in situ conservation efforts and help preserve genetic diversity. However, current biobanking efforts in Indonesian wildlife are limited and need to be expanded to include neglected taxa and regions (Sushadi, 2023). Furthermore, effective law enforcement measures, such as site-based monitoring networks and responsive government agencies, are crucial in addressing the illegal wildlife trade and protecting nationally protected species (Adhiasto et al., 2023). Also, there is a need for more ambitious ocean-conservation legal standards and policies to protect the ocean and its ecosystems from emerging threats. Lastly, spatial prioritization and expansion of protected areas can maximize environmental values and contribute to meeting post-2020 global biodiversity targets (Pusparini et al., 2023). By implementing these strategies, Indonesia can effectively preserve its biodiversity and wildlife in the face of climate change and human pressures.

Indeed, Indonesia faces a complex challenge, but international collaboration can provide shared knowledge, resources, and technology for more effective conservation measures. Through concerted efforts, Indonesia can protect its biodiversity, ensuring the continued existence of unique ecosystems and the benefits they provide to the nation and the world.

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