

Introduction

Around 1.41 – 2.15 million tones of plastic flow into the oceans from rivers annually [1]. However, the effects of plastic pollution on terrestrial and freshwater environments remain understudied [2]. Beyond oceans and rivers, plastic was found in soil [3], and our atmosphere [4]. The presence of plastic in the bodies of humans and animals have been linked to adverse health effects; ranging from reproductive health to cancer [5]. Plastic accumulating in forests raises questions about how it may affect forest ecosystems and people relying on them. Humans and **non-human primates** have shared habitats for thousands of years and formed a co-ecological relationship, which many **indigenous people** maintain today [6]. Through these relationships, plastic pollution may affect biological and cultural biodiversity.



Source: [10]

Non-human primates (NHP)

Human activities have threatened ~60% of all NHP species [7]. NHP face various threats, such as habitat loss, fragmentation, disease, hunting and climate change [8]. Out of the wide range of unsustainable anthropogenic activities, plastic pollution may act as an accelerator to these threats. It is crucial to investigate the ways plastic pollution may affect the health and environment of NHP and their key role as seed dispersers in forests [7,9].

Indigenous people (IP)

Indigenous people around the world are victims of social and environmental injustice, disproportionately affected by climate change, resource extraction and pollution. IP's lands are often high in resources and biodiversity which they rely on, and therefore are highly vulnerable to these threats [11,12]. In the fast-developing world, IP are facing cultural change, being forced to abandon traditional practices and relying more on Western goods, among them - plastic. Non-biodegradable plastic waste accumulates and even dumped in IP's environments affecting their health and food choices [11].

How does plastic get into forests?

► Exploitation and resource extraction

Logging, mining, road building and other forms of exploitation increase human activity and can create accumulation of plastic waste. For example, road impact in Uganda's Kibale National Park showed a high level of plastic pollution [13].

► Rivers

10 rivers contribute to most of the plastic entering our oceans every year [14], of which six overlap with NHP habitats [8]. Plastic waste is polluting the ecosystems along the way and is getting trapped in mangroves and flooded forests [15,16].



Source: [8,13].

► Tourism

Plastic waste and food packaging left behind tourists, littered or discarded improperly, can attract wildlife to play or scavenge for food and potentially carried further into the forest.

► Research

NHP research is an emerging source of plastic pollution in their habitats, most of which are in forests. A NHP field sites survey showed an increase in plastic pollution on site and reports on primates manipulating plastic [17].

Direct & indirect impacts

Air pollution

Burning of plastic are common in areas that lack waste management. Polluting the air can contaminate soils, groundwater and plants with toxins [18]. The toxic compounds that sink into the soil, may affect plant growth [19], and infiltrate the food chain in forest habitats. Tropical areas are more susceptible to this process due to high levels of rainfall [20].



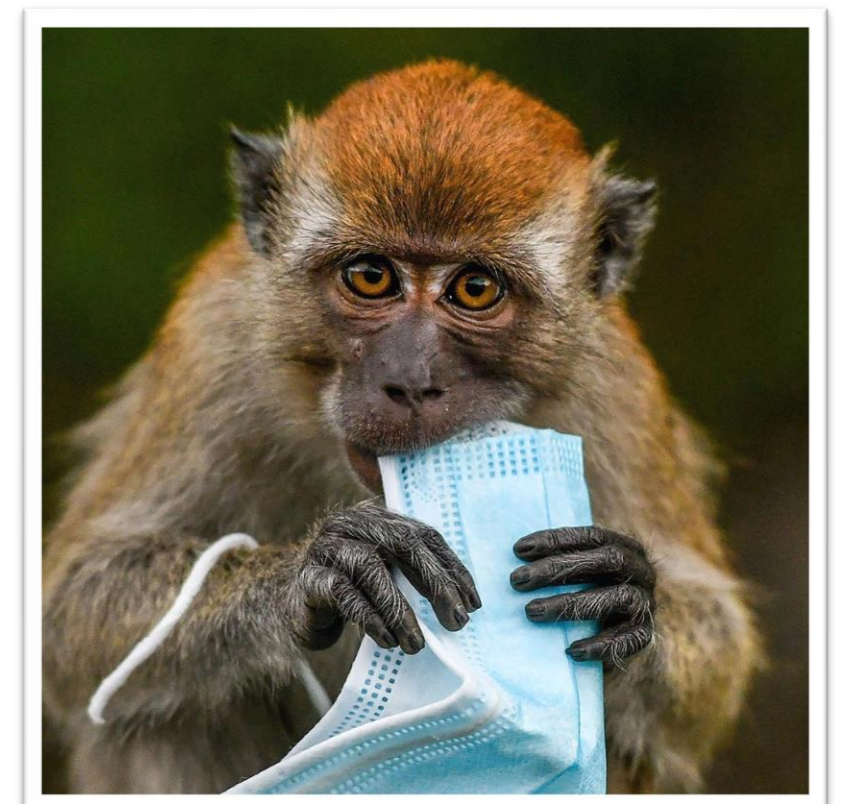
Source: [23].

Habitat degradation

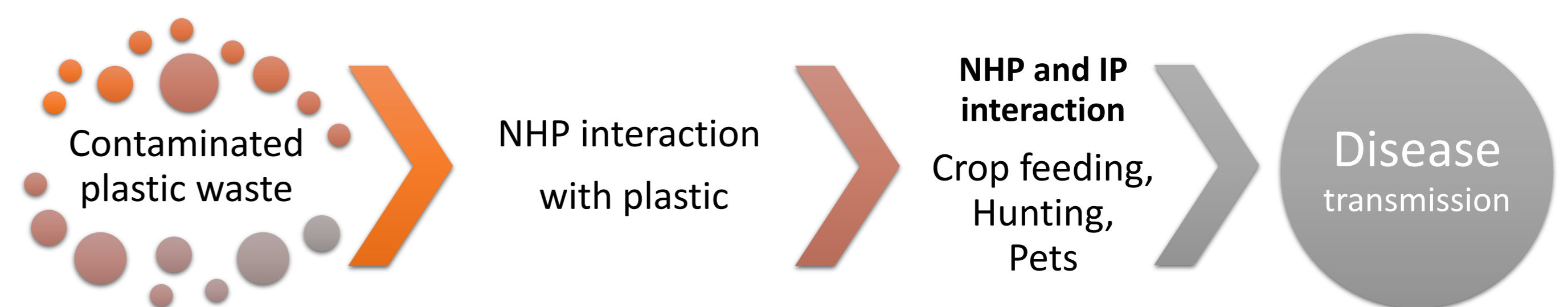
Plastic and other forms of waste can affect habitat quality. Plastic trapped in mangrove forests harms tree growth by remaining for long periods of time leading to tree stress and suffocation [14,15]. This can impact NHP that utilize mangrove ecosystems for shelter, sleep and food [21,22].

Disease transmission

Plastic can carry a wide range of pathogens and viruses, including influenza and COVID-19 [24]. Plastic surfaces can act as a vector for the transmission of pathogens and viruses from humans to NHP and vice versa [25].

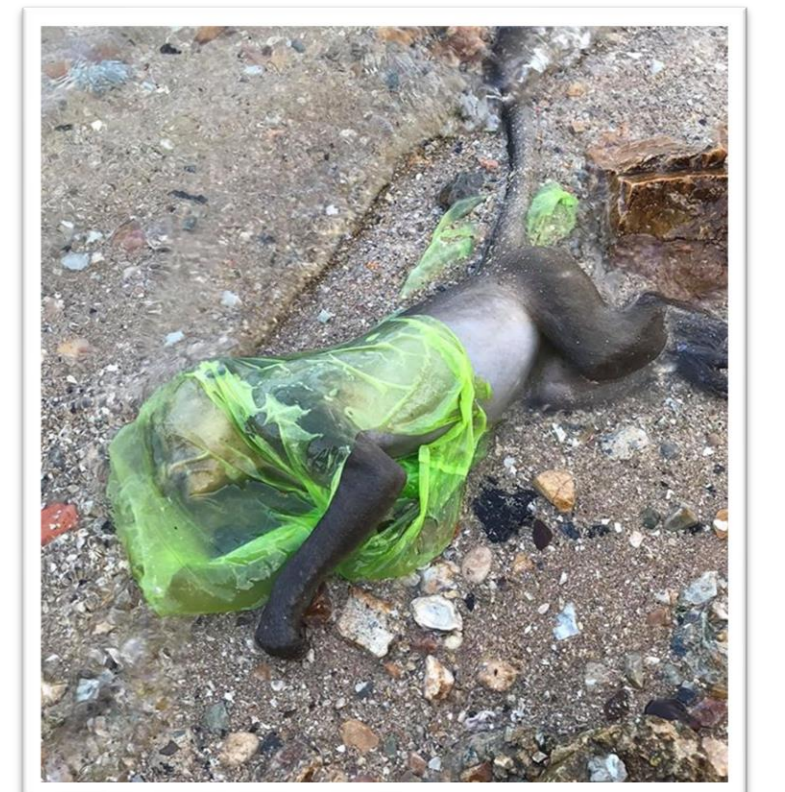


Source: [26].



Ingestion and entanglement

Plastic can be mistaken for food by NHP or lead to suffocation. For example, Rhesus macaques are often seen eating plastic bags in Delhi [27]; howler monkeys have been found entangled in fishing gear [28]; In Thailand, monkeys have been suffocated in plastic bags[29].



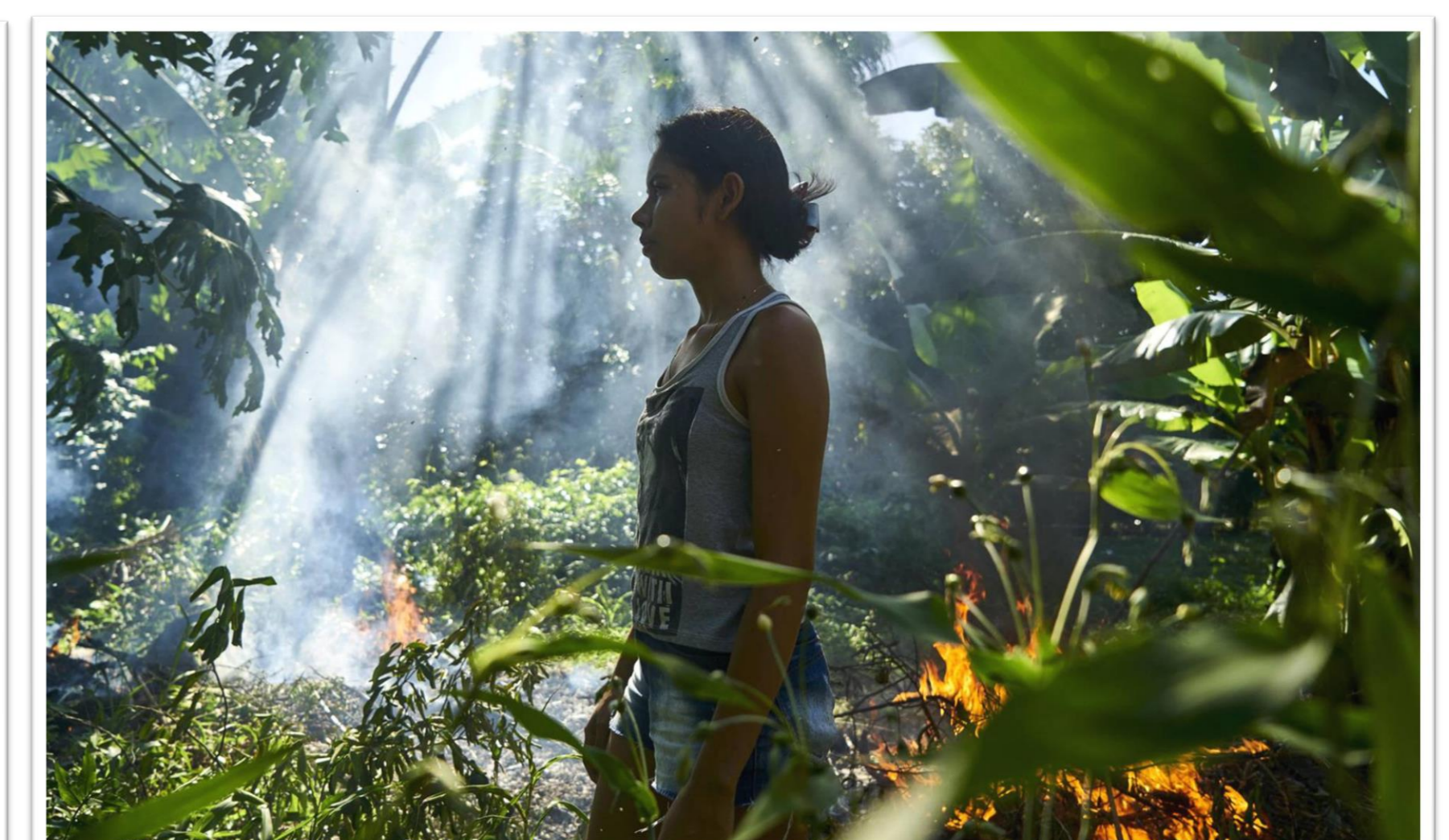
Source: [29].

Conclusions

- Plastic pollution is not the main threat to NHP, but of high importance for the conservation and health of remaining populations. Due to the similarity between humans and NHP, more research is needed to explore the effects of plastic on NHP health and environment.
- Disease transmission is another concerning aspect of plastic pollution. NHP are more vulnerable to external infections. Therefore, it is crucial to investigate the survival of pathogens and viruses on plastic surfaces in tropical forests and how NHP and IP relationships may contribute to their transmission.
- Plastic already exists in food sources consumed by IP [30,31]. IP consume most animal parts, some in which pollutants accumulate [11] and are further exposed to harmful chemicals. Plastic exposure in IP should be assessed to understand the health effects in comparison to those documented in non-IP.



Source: [32,33].



References

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