

NEWS AND NOTES

Human induced changes to the jet-stream

Most scientists agree that the Earth is currently undergoing a significant warming. However, in what way it will affect the various climatic parameters is still very much being debated. Ever since 2012, scientists have presented a complex idea about how a warming planet will alter our weather. If it's correct, it could have profound implications across the Northern Hemisphere and especially in its middle latitudes, where hundreds of millions of people live.

The idea is that climate change doesn't necessarily only alter meteorological variables (e.g. rainfall, heat surges), but it could possibly change the

flow of weather itself. By altering massive planet-scale air patterns like the jet stream (Fig.1), which flows in waves from west to east in the Northern Hemisphere, a warming planet causes the weather to become fixed. In practise, this means that a given weather pattern, for example, drought or flood, may persist for longer, thus driving extreme weather patterns (e.g. droughts, heat waves, downpours).

While this hypothesis continues to attract criticism and stir debate, more evidence seems to suggest that the idea is not that far fetched after all. Michael Mann of Pennsylvania State University, in collaboration with scientists from the United States, Germany and the Netherlands recently published new findings that indicate that at least in the spring and summer, the large scale flow of the atmosphere is indeed changing in such a way

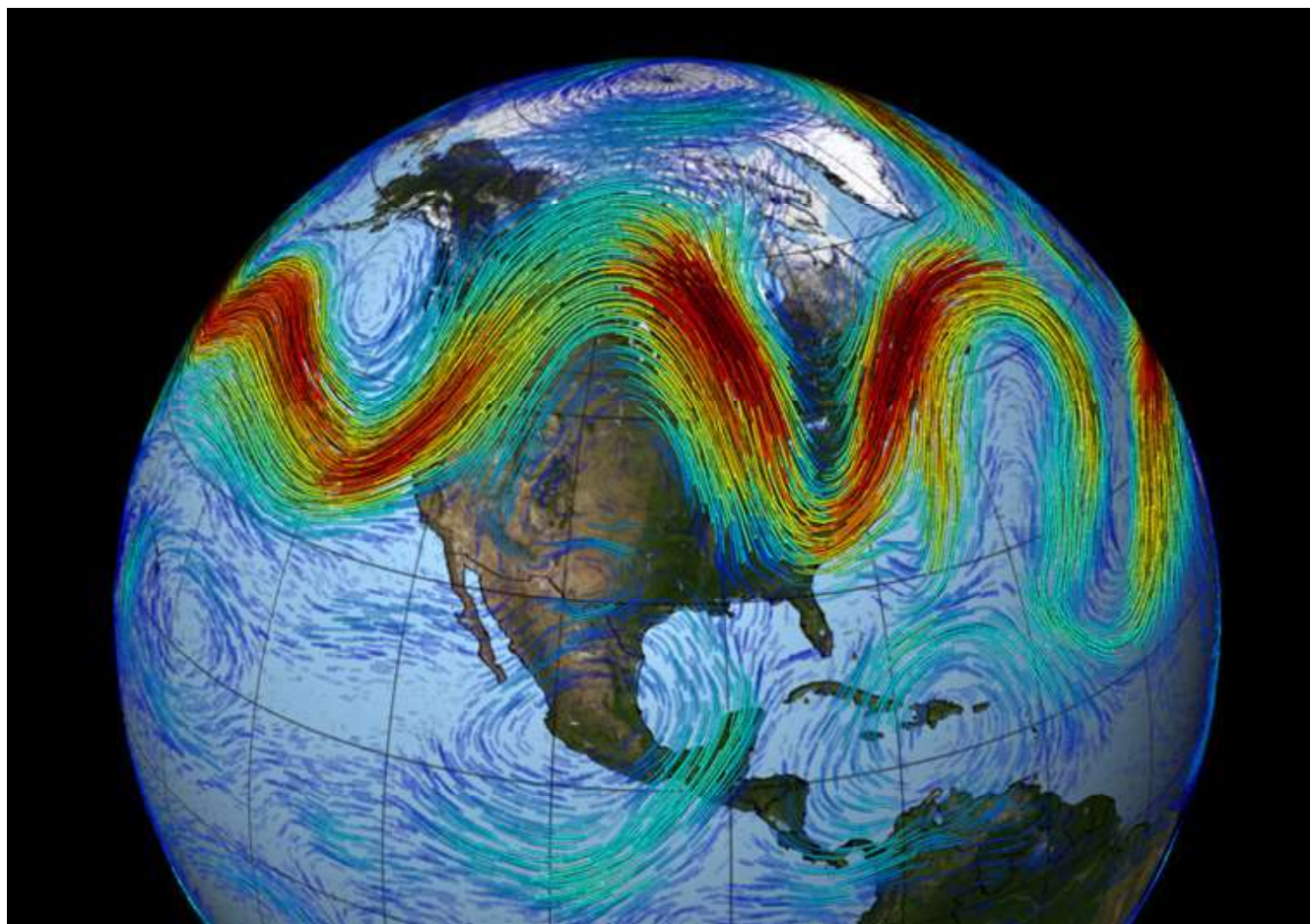


Figure 1. New research suggests that the northern hemisphere “jet stream” may be come fixed in space, due to rising global temperature, causing extreme weather patterns.

as to cause weather to get stuck more often. The idea is that the Northern Hemisphere jet stream flows in a wavy pattern from west to east, driven by the rotation of the Earth and the difference in temperature between the equator and the North Pole. The flow is stronger when that temperature difference is large. The problem arises when the Arctic warms up faster than the equator does, because the jet stream's flow can become weakened and elongated, hence causing weather extremes. The recent study predicts that this type of effect will likely occur during summertime, because the Arctic is much warmer.

Whereas an increasing number of scientists begin to praise the theory and the latest study, other have expressed considerable skepticism of these kinds of ideas. A recent study published in *Nature Geoscience*, for instance, called into question whether the Arctic's melting, and in particular its sea ice loss, has been causing winter cooling over Eurasia (McCusker et al, 2016), another idea that has been swept up in the debate over the jet stream and weather extremes. One of the authors of this study, John Fyfe, does not yet believe that Mann et al.'s theory is fully developed, although he confesses that it is a good start. Mann concurs and highlights that the current study only covers weather extremes in the spring and summer, and it is important that winter extremes are also included in the model in the future.

While the debate continues, so does science and the evidence that changing climate is leading to a changing pattern of atmospheric flow, with major implications for the weather. Exactly how it will play out across the Earth and who will feel the main brunt of it will probably only be known when it is too late.

Mann, M.E., Rahmstorf, S., Kornhuber, K., Steinman, B.A., Miller, S.K and D.Coumou (2017). Influence of Anthropogenic Climate Change on Planetary Wave Resonance and Extreme Weather Events. *Sci. Rep.* 7: 45242; doi: 10.1038/srep45242 (2017).

McCusker, K.E., Fyfe, J.C. and M. Sigmond (2016). Twenty-five winters of unexpected Eurasian cooling unlikely due to Arctic sea-ice loss. *Nature Geoscience* 9: 838–842

Antarctica is melting

Surface meltwater drains across ice sheets, forming melt ponds that can trigger ice-shelf collapse, acceleration of grounded ice flow and increased sea-level rise. Numerical models of the Antarctic Ice Sheet that incorporate meltwater's impact on ice shelves, but ignore the movement of water across the ice surface, predict a metre of global sea-level rise this century in response to atmospheric warming. In 2016, several new publications revealed increasing evidence that the Antarctic is melting --- and it is melting faster than ever. Kingslake et al. (2017) provide compelling evidence of widespread drainage of meltwater across the surface of the ice sheet through surface streams and ponds as far south as 85° S and as high as 1,300 metres above sea level. The teams findings were based on satellite imagery from 1973 onwards and aerial photography from 1947 onwards and are consistent with similar results published earlier in 2016 by Marsh et al (2016). Since surface drainage has persisted for decades, transporting water up to 120 kilometres from grounded ice onto and across ice shelves, feeding vast melt ponds up to 80 kilometres long. Large-scale surface drainage could deliver water to areas of ice shelves vulnerable to collapse, as recorded by Elsworth and Suckale (2016). There is nothing new in Antarctic surface melt ponds formation, however, Kingslake et al. discovered that ponds often form part of widespread, large-scale surface drainage systems. In a warming climate, enhanced surface drainage could accelerate future ice-mass loss from Antarctic, potentially via positive feedbacks between the extent of exposed rock, melting and thinning of the ice sheet.

With the ongoing Global temperature rise, Antarctic is getting warmer, providing new potential "settlement" opportunities for a range of

microbes and other organisms. The ramification of this rapid icemelt on the sealevel is also well documented, however, the general response to the climate change challenge remains insignificant and sluggish across most of the world today.

Marsh, O.J., Fricker, H.A., Siegfried, M.R., Christianson, K., Nicholls, K.W., Corr, H.F.J and G. Catania (2016). High basal melting forming a channel at the grounding line of Ross Ice Shelf, Antarctica. *Geophysical Research Letters* **43(1)**: 250-255. DOI: 10.1002/2015GL066612

Elsworth, C. W., and J. Suckale (2016), Rapid ice flow rearrangement induced by subglacial drainage in West Antarctica, *Geophysical Research Letters* **43(22)**: 11, 697–11,707. doi:10.1002/2016GL070430.

Kingslake, J., Ely, J.C., Das, I and R.E. Bell (2017). Widespread movement of meltwater onto and across Antarctic ice shelves. *Nature* **544**: 349-352.

Antarctica is greening

On the 17th of January, 1773, the British maritime explorer, James Cook, became the first recorded human being to cross the Antarctic circle. For two months, Captain Cook and his crew, on board the two ships *Resolution* and *Adventure*, sailed along the ice-shelf in the hope of finding a gateway to the great southern continent (Fig.2). Captain Cook made two more attempts to find a passage through the ice in 1774 and 1775 before returning to England on the 30th of July, 1775. During the height of three southern summers, the sea ice stretched all the way to the Antarctic Circle and at the furthest southern point Captain Cook wrote that the ice “*extended east and west far beyond the reach of our sight, while the southern half of the horizon was illuminated by rays of light which were reflected from the ice to a considerable height...It was indeed my opinion that this ice extends quite to the Pole, or perhaps joins to some land to which it has been fixed since creation*”. Little did he know two and half century later, Antarctica is greening.

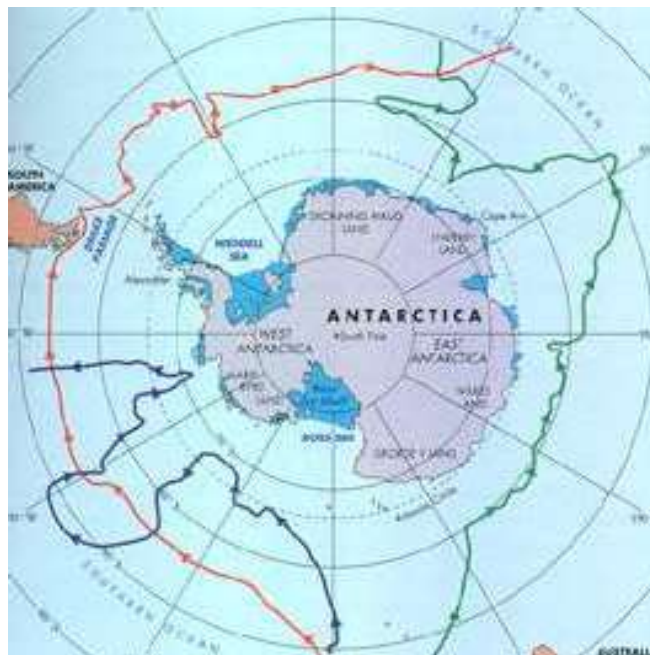


Figure 2. Captain Cook's journeys in his attempt to find the southern continent in 1773-1775.

Plant life only exists on about 0.3% of Antarctica and for centuries, it has been known as the desolate southernmost continent. However, a new study reveals that plant life has returned to Antarctica and is growing rapidly due to climate change. A team of scientists studying moss have found a sharp increase in biological activity in the last 50 years. They tested five cores from three sites and found major biological changes had occurred over the past 50 years right across the Antarctic Peninsula.

The recorded an increasing temperature over the past 50 years that have had a significant effect on the moss banks growing in the region. The team predicts that if this continues, and with increasing amounts of ice-free land from continued glacier retreat, the Antarctic Peninsula will be a much greener place in the near future.

Recent climate change on the Antarctic Peninsula is well documented, with warming and other changes such as increased precipitation and wind strength (see above news). Although weather records mostly began in the 1950s, biological records preserved in moss bank cores can provide a longer-term trends in climate change. The study analysed data for the last 150 years, and found clear evidence of increased biological activity in the past

half century. This could result in Antarctic greening to similar levels as in the Arctic, where well-established observations have been ongoing for decades. The same group of researchers published a study focussing on one site in 2013, and the new research confirms that their unprecedented finding can be applied to a much larger region.

Amesbury, M.J., Roland, T.P., Royles, J, Hodgson, D.A., Convey, P., Griffiths, H. and D.J. Charman (2017). Widespread biological response to rapid warming on the Antarctic Peninsula. *Current Biology* **27**: 1616-1622. DOI: 10.1016/j.cub.2017.04.034

Carbon trading - current trends

In December, 2015, 195 nations signed on the Paris Climate Accord. This milestone agreement allows each nation to pursue its own way to limit CO₂ excretion. One of the more common approaches is to tax CO₂ indirectly by creating a carbon market,

or directly by associating carbon with a tax. Forty countries and 24 sub-national regions (e.g. states, provinces) have already or are scheduled to make CO₂ polluters pay with a national or regional price on carbon. Together, these carbon pricing initiatives cover almost 7Gt of carbon dioxide or about 13 percent of annual global GHG emissions. One notorious absentee from such systems, which most of the developed nations have implemented, including China and South Africa, is USA.

The World Bank, in collaboration with Ecofys and Vivid Economics, published its *State and Trends of Carbon Pricing* (2016). The Report summarises every Nation in the Paris Climate Accord's progress in reducing carbon excretion through putting a price on carbon itself. Whereas USA are notoriously absent and with the current government threatening to withdraw from the Paris Climate Accord, some states are taking independent steps towards developing a carbon free economy, along with most other nations in the world.

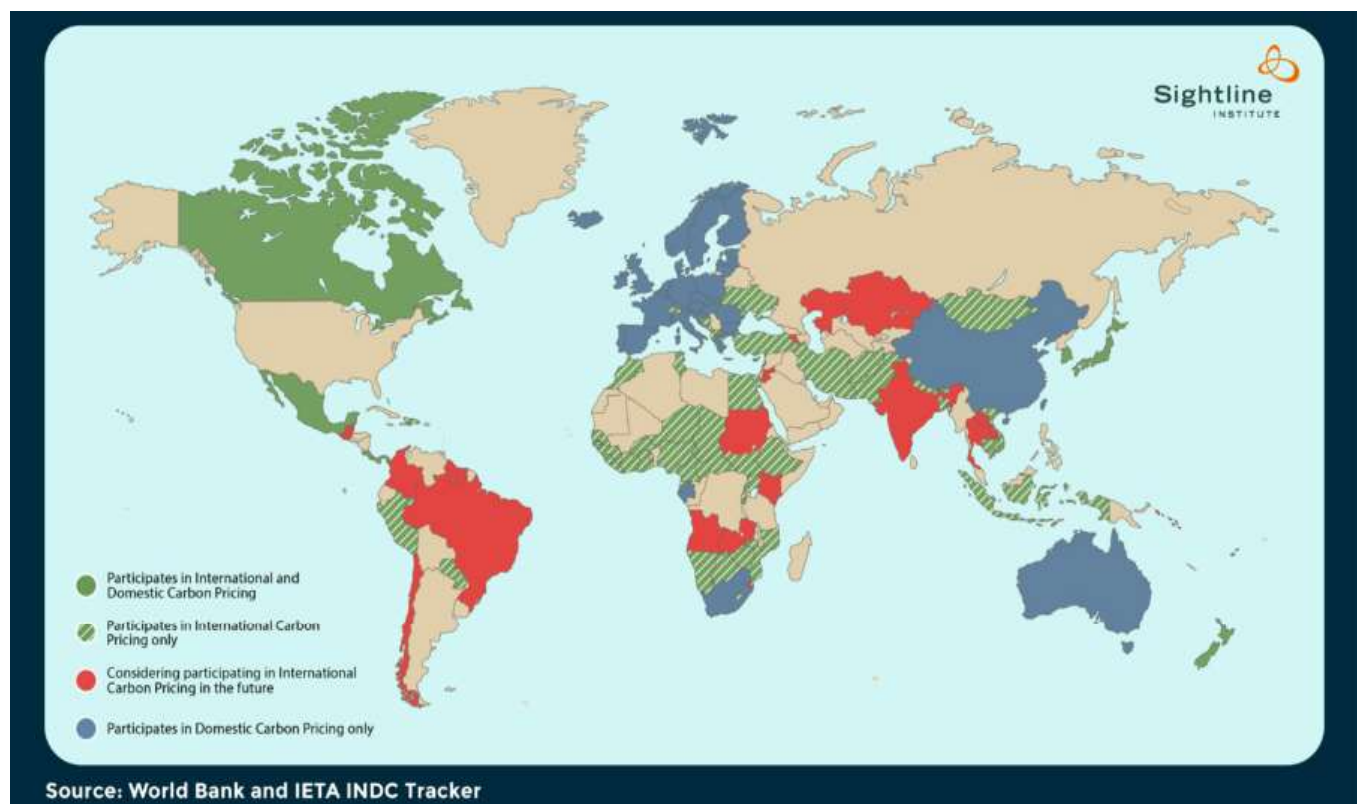


Figure 3. An increasing number of countries are using carbon price to regulate excessive CO₂ excretion and to meet the Paris climate goals. One noticeable absentee is the world's largest CO₂ polluter, USA.



Indonesia is one of the World's top contributors of CO₂ as a nation. Per capita, however, Indonesia ranks as one of the lowest in the World. Nevertheless, Indonesia is exploring carbon trading opportunities, in stark contrast to wealthier countries like Thailand and Malaysia.

Globally, roughly two-thirds of covered emissions are covered by a cap-and-trade program, about one-third are covered by a carbon tax, and about one-quarter of the jurisdictions use both. Indonesia has the opportunity to implement both the systems in the near future.

World Bank, Ecofys and Vivid Economics (2016). *State and Trends of Carbon Pricing*. World Bank, Washington, DC.

Conservation priorities for SE Asia

Southeast Asian biodiversity is a global priority for conservation, due to the high levels of diversity and endemism, combined with some of the

greatest levels of threat. Conservation planning is essential to ensure that hotspots of biodiversity and endemism have the protection needed to prevent deforestation, hunting and other forms of exploitation in some of the Southeast Asia's most diverse areas, yet this requires data which in many cases does not exist.

Growing volumes of online available data provides the ability to develop accurate models of species distributions, and gain new perspectives on regional diversity patterns and provide essential baseline data for planning and conservation.

Here, using the best available information I develop maps of the ranges of 2471 vertebrate (birds, mammals, reptiles and amphibians) and 1198 plant species, and explore patterns of biodiversity and the adequacy of protection. Each taxon shows different patterns of diversity, and no taxa provided an effective surrogate for diversity patterns in different groups. I show that for the majority of biodiversity hotspots fall outside protected areas, with between 10 and 55% of areas with at least > 75% of the maximum number of species unprotected. The percentage of species ranges protected areas also varies by taxa, from a maximum of 40% to reptiles with a mean of only 13.5% of species ranges protected. Furthermore comparison between my predictions and IUCN maps of diversity differed greatly for all taxa examined, with IUCN hotspots covering a much larger portion of the region and potentially overestimating the ranges of many species. Further efforts are needed to better protect centres of diversity, and the inclusion of these methods into regional conservation planning may greatly assist in increasing the effectiveness of conservation.

Hughes, A.C. (2017). Mapping priorities for conservation in Southeast Asia. *Biological Conservation* 209: 395–405.

Biological trade-offs and socio-economy of

trophy hunting

Although the contribution of trophy hunting as a conservation tool is widely recognised, there is perpetual debate and polarization on its sustainability. This review integrates five themes mostly considered in isolation, as independent research fields in wildlife conservation: (1) trophy quality and population ecology of hunted species, (2) behavioural ecology of hunted populations and associated avoidance mechanisms, (3) physiological stress in hunted populations, (4) genetic variability and desirable traits, and (5) socio-economic imperatives in wildlife conservation. We searched for

articles on search engines using specific key words and found 350 articles from which 175 were used for this review under five key themes. Population and trophy quality trends of commonly hunted species seem to be declining in some countries. Elevated hunting pressure is reported to influence the flight and foraging behaviour of wildlife thus compromising fitness of hunted species. Selective harvesting through trophy hunting is attributed to the decline in desirable phenotypic traits and increased physiological stress in most hunted species. Though it provides financial resources need for conservation in some countries, trophy hunting works well in areas where animal populations are healthy and not threatened by illegal harvesting and other disturbances. There remains much polarity on the sustainability of trophy hunting in modern-day conservation. More research need to be conducted across the five themes examined in this review for broader analytical analysis and comparison purposes. A new research agenda is needed regarding wildlife sustainable use principles and their sustainability and acceptability in modern-day conservation.

Muposhi, V.K., Gandiwa, E., Makuza, S.M. and P. Bartels (2017). Ecological, physiological, genetic trade-offs and socio-economic implications of trophy hunting as a conservation toll: a narrative review. *The Journal of Animal & Plant Sciences* **27(1)**: 1-14.

Disrupting criminal wildlife trading networks

The onslaught on the World's wildlife continues despite numerous initiatives aimed at curbing it. We build a model that integrates rhino horn trade with rhino population dynamics in order to evaluate the impact of various management policies on rhino sustainability. In our model, an agent-based sub-model of horn trade from the poaching event up through a purchase of rhino horn in Asia impacts rhino abundance. A data-validated, individual-based sub-model of the rhino population of South Africa provides these abundance values. We evaluate policies that consist of different combinations of legal trade initiatives, demand reduction marketing campaigns, increased anti-poaching measures within protected areas, and transnational policing initiatives aimed at disrupting those criminal syndicates engaged in horn trafficking. Simulation runs of our model over the next 35 years produces a sustainable rhino population under only one management policy. This policy includes both a transnational policing effort aimed at dismantling those criminal networks engaged in rhino horn trafficking. Decoupled with increases in legal economic opportunities for people living next to protected areas where rhinos live. This multi-faceted approach should be the focus of the international debate on strategies to combat the current slaughter of rhino rather than the binary debate about whether rhino horn trade should be legalized. This approach to the evaluation of wildlife management policies may be useful to apply to other species threatened by wildlife trafficking.

Haas T.C. And S.M. Ferreira (2016) Combating Rhino Horn Trafficking: The Need to Disrupt Criminal Networks. *PLoS ONE* **11(11)**: e0167040. doi:10.1371/journal.pone.0167040

Hunting in SE Asia

Although deforestation and forest degradation have long been considered the most significant threats to tropical biodiversity, across Southeast Asia (North-east India, Indochina, Sundaland, Philippines) substantial areas of natural habitat have few wild animals (>1 kg), bar a few hunting-tolerant species. To document hunting impacts on vertebrate populations regionally, we conducted an extensive literature review, including papers in local journals and reports of governmental and nongovernmental agencies. Evidence from multiple sites indicated animal populations declined precipitously across the region since approximately 1980, and many species are now extirpated from substantial portions of their former ranges. Hunting is by far the greatest immediate threat to the survival of most of the region's endangered vertebrates. Causes of recent overhunting include improved access to forests and markets, improved hunting technology, and escalating demand for wild meat, wildlife-derived medicinal products, and wild animals as pets. Although hunters often take common species, such as pigs or rats, for their own consumption, they take rarer species opportunistically and sell surplus meat and commercially valuable products. There is also widespread targeted hunting of high-value species. Consequently, as currently practiced, hunting cannot be considered sustainable anywhere in the region, and in most places enforcement of protected-area and protected-species legislation is weak. The international community's focus on cross-border trade fails to address overexploitation of wildlife because hunting and the sale of wild meat is largely a local issue and most of the harvest is consumed in villages, rural towns, and nearby cities. In addition to improved enforcement, efforts to engage hunters and manage wildlife populations through sustainable hunting practices are urgently needed. Unless there is a step change in efforts to reduce wildlife exploitation to sustainable levels, the region will likely lose most of its iconic species, and many others besides, within the next few years.

Harrison, R. D., Sreekar, R., Brodie, J. F., Brook, S., Luskin, M., O'Kelly, H., Rao, M., Scheffers, B. and Velho, N. (2016), Impacts of hunting on tropical forests in Southeast Asia. *Conservation Biology*, 30: 972–981. doi: 10.1111/cobi.12785

Abstract

Hunting is a major driver of biodiversity loss, but a systematic large-scale estimate of hunting-induced defaunation is lacking. We synthesized 176 studies to quantify hunting-induced declines of mammal and bird populations across the tropics. Bird and mammal abundances declined by 58% (25 to 76%) and by 83% (72 to 90%) in hunted compared with unhunted areas. Bird and mammal populations were depleted within 7 and 40 kilometers from hunters' access points (roads and settlements). Additionally, hunting pressure was higher in areas with better accessibility to major towns where wild meat could be traded. Mammal population densities were lower outside protected areas, particularly because of commercial hunting. Strategies to sustainably manage wild meat hunting in both protected and unprotected tropical ecosystems are urgently needed to avoid further defaunation.

Benítez-López, A., Alkemade, R., Schipper, A. M., Ingram, D. J., Verweij, P. A., Eikelboom, J. A. J. and M.A.J Huijbregts (2017). The impact of hunting on tropical mammal and bird populations. *Science* **356(6334)**: 180-183. doi:10.1126/science.aaj1891