Primates in Flooded Habitats

Ecology and Conservation

Nearly half the world's primate species use flooded habitats at one time or another, from swamp-going Congo gorillas and mangrove-eating proboscis monkeys, to uacaris in Amazonian river-side forests. This first-ever volume on the subject brings together experts from around the world in a ground-breaking volume spanning fossil history, current biology, and future research and conservation priorities. Flooded habitats are a vital part of tropical biology, both for the diversity of the species they house, and the complexity of their ecological interactions, but are often completely overlooked.

This book will set the stage for a new wave of research on primates in these extraordinarily productive and highly threatened areas, and is ideal for researchers and graduate students in primatology, zoology, ecology, and conservation.

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Foreword

Soggy But Separate, Why Flooded Habitats Need Special Conservation Attention

When people think of apes, monkeys or even lemurs the image that comes to mind is usually an animal in a tall tropical forest with a dense understory or maybe a baboon group in the savanna. However, as this book so superbly demonstrates, many primates, both in terms of numbers and species richness, occur in habitats that are flooded. For example, in Reserva de Desenvolvimento Sustentável Mamirauá, Brazil, the *várzeas* (flooded forests) can flood to a depth of 10 m for at least 5 months (Peralta *et al.* this volume) and this forest supports 11 primate species. For a human observer, it is difficult to follow primate groups in flooded forests (e.g. in Brazil's *várzeas* one has to canoe in the flooded season) and in some swamp habitats, it is literally impossible. For example, I have tried to follow chimpanzees and baboons through papyrus swamps, where they are eating either papyrus or fruits of trees in the swamp, and while they seem to be able to balance themselves well using four limbs, I was frequently plunging through the papyrus mat, sinking up to my waist in water and soon losing the groups I was trying to follow. Such difficulties have resulted in primate populations in flooded habitats being very poorly studied and, in some cases, these habitats not even being considered as primate habitats. From reading the compilation of chapters from flooded habitats from around the globe by Adrian Barnett, Ikki Matsuda, and Katarzyna Nowak in *Primates in Flooded Habitats: Ecology and Conservation*, we now know that flooded habitats can be very important for some primate species. This should ignite a burst of research and, by the end of the next decade, we will know much more about how important flooded habitats are for primates and their behavioural adaptations to them.

Unfortunately, just as we are discovering that these flooded habitats can be very important for primates, and as stated by Galat-Luong *et al.* and Nowak *et al.* (this volume), these habitats might be a temporary refuge from bushmeat hunting and habitat clearing, but they are being degraded and destroyed at an alarming rate. Flooded habitats can be very extensive in all continents; for example large wetlands in Africa cover 2 072 775 km^2, which is approximately 9% of the landmass (Mitchell 2013), thus they have the potential to support large numbers of primates. However, these areas are gravely threatened. In fact, many consider surface freshwaters, lakes, wetlands and rivers, to be among the most extensively altered ecosystems on earth (Carpenter *et al.* 2011). Let me provide you with some examples of different types of flooded habitats and how they are threatened. Since 1990, approximately 50% of the world's wetlands have been drained and converted to some other use (Michener *et al.* 1997). North America and Europe often lead the way in flooded habitat destruction. For example, approximately 90% of the floodplains in North America and Europe have been converted and are now cultivated lands; in the tropics, this conversion is occurring at an accelerating rate (Tockner and Stanford 2002). This rate is bound to increase as the human population expands, creating an increased demand for agricultural products.

In addition to direct anthropogenic disturbance, coastal flooded habitats are additionally threatened by global warming. In the next 50 years, average global temperature is projected to rise 2.5°C, which is predicted to lead to an 80–100 cm sea-level rise (Michener *et al.* 1997). This will have a significant effect on coastal flooded forests. For example, the Niger Delta is an important area for primates (Baker and Oates, this volume), but the estimated sea-level rise that is projected to occur in the next century would lead to 18 000 km^2 of the delta being inundated with salt water and lost (Brown and Thieme 2005). This sea-level rise will also negatively impact important mangrove forests, which a number of chapters in the book point out as an important primate habitat. Mangrove forests are already facing serious threats from shrimp fisheries and timber extraction and are declining by 1% each year (Polidoro *et al.* 2010).

In this volume, Cheyne and colleagues demonstrate that tropical peat swamp forest across Borneo and Sumatra supports 11 monkey species (possibly up to 14), 8 gibbon species (including the siamang), both orangutan species and 2–3 nocturnal species. Given this diversity, it is a tragedy that only 36% of the historical tropical peat swamp forest remains (Posa *et al.* 2011) and, as Cheyne and colleagues point out, annual deforestation rates in the region between 1990 and 2010 were 3% and 5% for Borneo and Sumatra, respectively.

As a final example, it should be recognized that global demand for water increased ten fold in the last century (Junk 2002). As more agricultural land is needed to feed the growing human population, there will be increased pressure to draw water away from wetlands for irrigation or to convert flooded habitats to agricultural land. Associated with increasing agricultural demand for water and a demand for energy there is a rapid increase in the number of dams built (see Harrison-Levine

et al., this volume, to discover primate responses to widespread flooding caused by dams), which often draws water away from wetlands and deprives them of nutrients. There are 1269 dams in Africa (Junk 2002). On the 26 August 2012, Aljazeera reported that globally 780 million people currently lack access to safe drinking water, according to the United Nations. By 2030, 47% of the world's population will be living in areas of high water stress, according to the Organization for Economic Co-operation and Development's 'Environmental Outlook to 2030' report. This creates strong incentives to draw water away from flooded habitats like wetlands, which often leads to the total loss of these important habitats.

The studies in this volume cover all types of flooded habitats where primates are found and do a remarkable job of covering all geographic areas. The book includes 45 chapters organized into seven parts. The first part includes six chapters and is an introductory part that gives the reader a greater understanding of why flooded habitats are of interest and some of the methodological challenges researchers have to deal with, such as how to survey flooded habitats and how do researchers assess fruit production when fruit floats away. The next series of chapters covers primates occupying or using different types of flooded habitats, including mangrove and coastal forests, beaches, swamps and freshwater flooded forests. The sixth part of this volume directly deals with conservation case studies involving primates that use flooded habitat. Topics in this part range from the responses of primates to dams, ecotourism, populations seeking refuge in flooded habitats to avoid hunting or because of habitat destruction in *terra firma* forest and the incorporation of genetic data into management plans of isolated populations. The final part deals directly with conservation issues and there are chapters discussing Africa, Southeast Asia and the Neotropics.

Ours is an era characterized by great destruction of primate habitat. Global forest loss between 2000 and 2012 was estimated at 2.3 million km^2, with an increase of 2101 km^2 every year in the tropics (Hansen *et al.* 2013). But this is also an era characterized by huge new conservation efforts and a wave of restoration through tree planting, corridors, re-wilding, as well as creative mitigation of human development impacts. For these efforts to succeed, knowledge becomes a key tool to wisely invest time, effort and money. Conservation and restoration at the scale needed will be no simple task: we need to identify key habitats, which species depend on and which are just being used as a refuge of last resort. We need the knowledge from different areas of the world and all types of habitats. This volume tackles these issues for flooded habitats and, given their geographic extent, will help managers in many areas construct informed conservation plans. Most importantly, for the first time, it significantly highlights the potential importance of flooded habitats and I predict this will lead to a great deal of future research of primates and other taxa in flooded habitats.

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