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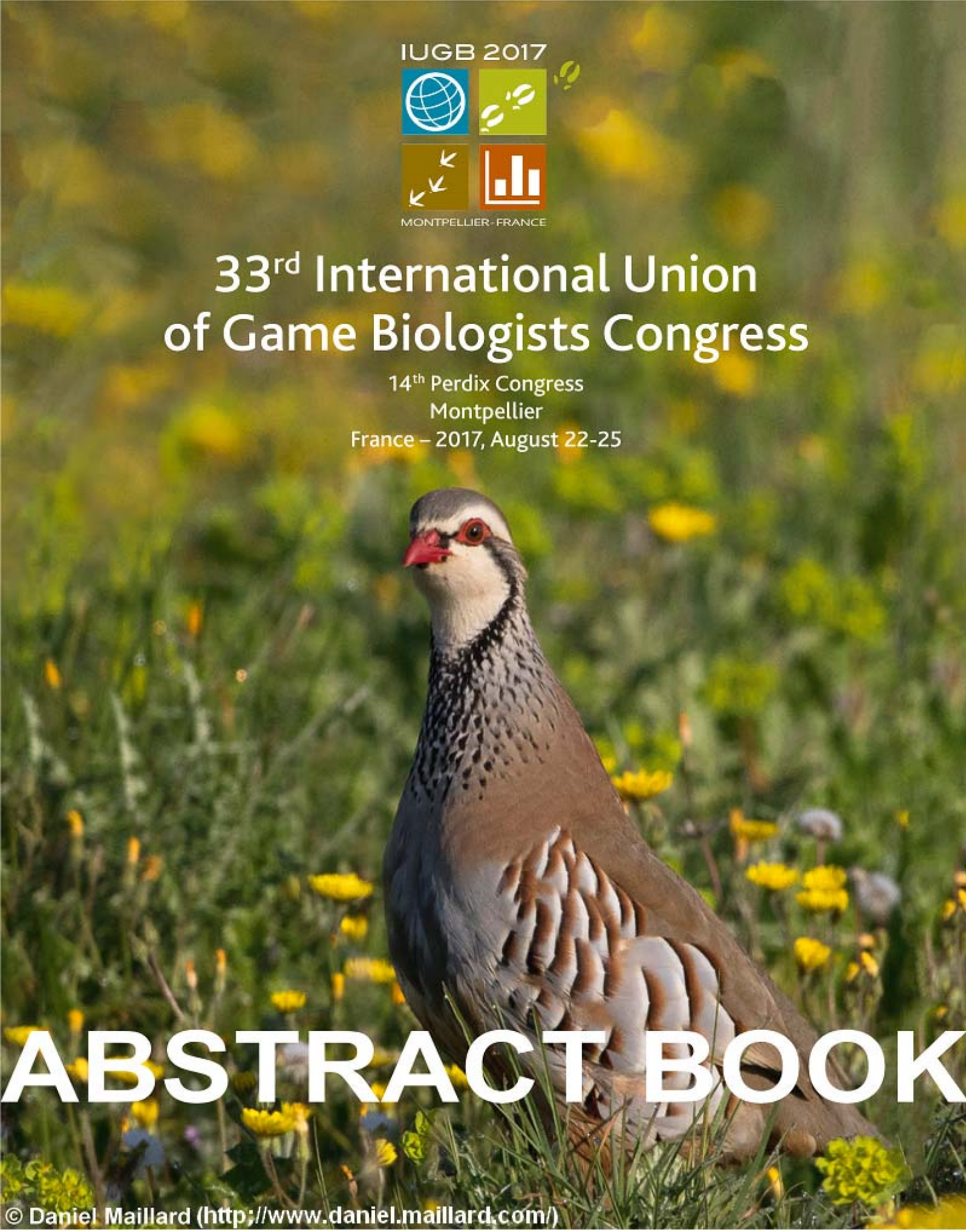

ABSTRACT BOOK

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(keynote)

From wildlife management to Planetary Health: a multidisciplinary challenge

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In numerous civilizations for many centuries, wild animals have been essential sources of proteins and raw materials. In earlier times, there were fewer humans and their impact was low compared to that of climate, diseases, predation and food shortage. Domestication, growing human population, globalization, a number of ecological perturbations including climate change, and human activities in general have dramatically accelerated the rate of species extinction and caused a cascade of events leading to the emergence of an increasing number of infectious diseases in animals and humans, and to an exponential overexploitation of natural resources threatening human's survival in the long term. Therefore, it has been proposed to call "Anthropocene" the epoch dating from the commencement of significant human impact on the Earth's geology and ecosystems. As the human impact on the planet has accelerated, the awareness for the fact that natural resources are limited has begun to grow. The concept of Planetary Health was born from the recognition that the health of human civilization relies on the health of the natural systems on which it depends [1]. Here, we argue that wildlife, and in particular wildlife management (i.e. the process which recognizes, analyzes and proposes solutions for tasks and problems when dealing with wild animals and their habitats) and wildlife population health (i.e. the discipline dealing with the health of wild animals, with a focus on ecosystem and population health) should play a key role in the efforts towards Planetary Health.

Health is the capacity of an organism or a population to adapt and self-manage under changing environmental conditions. It is a delicate balance between a host, population or ecosystem, and the stressors it is exposed to. Until relatively recently, health concerns have been largely focused on humans and their domestic animals, these being mostly relevant as a source of food as well as a potential source of disease agents for humans. During the past decades, several initiatives were taken towards more integrated health approaches, such as One Health, Conservation Medicine and EcoHealth. Planetary Health is a new discipline proposed in 2015. It recognizes that it is vital that we protect the environment in which we live and on which we depend, and that we develop sustainable systems to support human health. Planetary Health warns that while human health has progressed, the depletion of our natural systems threatens our ability to maintain these improvements (www.thelancet.com/infographics/what-is-planetary-health). However, despite these initiatives, up to now collaborations between health disciplines, nature conservation and wildlife management have been insufficient.

The relationship between wildlife disease and wildlife management is often seen as causal, with diseases impacting wildlife populations in such a way that their exploitation may be limited or their conservation threatened. Yet, this causality link is also valid in the other direction. Microorganisms with pathogenic potential are an integral part of ecosystems and co-evolutive mechanisms have promoted individuals and populations able to cope with infectious and non-infectious stressors through natural selection. Thus, disease and associated mortality are not necessarily a threat to species survival but certainly important drivers of natural selection. By contrast, where habitats and wildlife populations are strongly disturbed by humans (intensive management towards increased production for people's benefit, introduction of new microorganisms through human travel and encroachment in wildlife habitats), the systems' plasticity is strongly affected, new diseases emerge, pathogens relevant to humans and their domestic animals become maintained in the wild, and diseases can turn into a serious threat to wildlife, domestic animals and humans [2].

Wildlife disease investigations include surveillance and research with the aim to develop prevention measures in two main areas: 1) Risk of transmission of pathogens of wildlife origin to humans and domestic animals, including diseases with potential global spread through animal migration and trade (e.g. avian influenza, African swine fever, bovine tuberculosis); 2) diseases as a threat to species conservation, locally and globally (e.g. white nose syndrome in bats, chytridiomycosis in amphibians). In both areas, it is now recognized that wildlife management is a considerable disease risk factor. For example, management practices fostering unnaturally high game densities and aggregation, such as supplemental feeding and fencing, contribute to the maintenance of *Mycobacterium bovis* and *M. caprae* (the agents of bovine tuberculosis) in the wild, creating infection sources for domestic livestock and humans [3]. Population isolation (fencing, habitat fragmentation) leading to a loss of genetic diversity increases disease risk, including the maintenance of livestock pathogens such as the agents of bovine tuberculosis in wild ungulates [3] and species conservation threats such as the

facial tumor disease in Tasmanian devils [4]. Wildlife translocations are associated with a high risk of disease introduction with potentially disastrous impacts on indigenous populations [2,5].

Consequently, sound wildlife management has the potential to bring a major contribution to health in four ways: 1) Protection of functioning ecosystems: ensuring the existence of habitats in which the natural plasticity of species is not overloaded, i.e. where the full ecological potential of species and biocenosis are not exploited up to exhaustion; 2) Respectful exploitation of natural resources: ensuring the utilization of wildlife populations without disturbing or destroying the structures that arose from evolution as concerns their social structure, ethology and ecology; 3) Contribution to ecosystem recoveries: restoration and tolerance for restoration of ecosystems (e.g. reintroduction or immigration of predator species), implementation of measures to reconnect and revalue habitats to prevent genetic isolation and foster biodiversity, decrease of disease risk through increase of genetic diversity (e.g. reducing cryptorchidism occurrence in Florida panther *Puma concolor coryi* [6]), inclusion of veterinary supervision in translocation programs [5] (e.g. planning the restoration of lynx populations *Lynx* spp. in Europe [8]), and reduction of host densities and feeding bans (e.g. bovine tuberculosis in white-tailed deer *Odocoileus virginianus* in Michigan [8]); 4) Development of tools for wildlife health investigations: collection of population data in a harmonized way to better assess wildlife health, to understand the underlying causes of threatening disease situations, and to take measures towards solutions [9].

Planetary Health recognizes the essential value of ecosystems services, and that nature conservation (including an exploitation respectful of natural equilibriums, i.e. “wise use”) is no less than a health insurance. This concept was first proposed nearly 80 years ago by the American forester and founder of the wildlife management concept, Aldo Leopold [10], but has been largely ignored so far. Up to now, biocentric wildlife management (i.e. aiming primarily at species conservation with the view that living organisms have an intrinsic value) and anthropocentric wildlife management (i.e. aiming at a maximal possible exploitation of wildlife resources such as venison and trophies) have been largely opposed and dependent on people’s own values or ethics. Planetary Health warns that in the long run, human survival and the sustainable exploitation of natural resources upon which we depend is only possible if nature conservation and restoration is placed at the top of our agendas. Applied to global health, Leopold’s vision means that the health of each of us is linked to the health of all the rest [11]. In other words, independently of people’s ethical principles, we need to recognize that everything is interconnected and that ecosystem conservation is indispensable to human survival.

Consequently, we have to ask ourselves whether current management systems are in agreement with the Planetary Health concept, and whether scientific knowledge is being used for the benefit of the planet’s health or mostly for production purposes. Wildlife management is a powerful tool on the way to Planetary Health, but to achieve this goal, ecological criteria should be prioritized. Almost a century after Aldo Leopold’s ideas, the Planetary Health approach requires and offers the chance to bring scientists with similar goals and complementary skills together, to demonstrate evidence and take action for the long-term benefit of humans, animals, and of the planet as a whole.

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