

Rats in the city: implications for zoonotic disease risk in an urbanizing world

Kim R. Blasdell¹, Serge Morand^{2,3}, Susan G.W. Laurance⁴, Stephen L Doggett⁵, Amy Hahs⁶, David Perera⁷, Cadhla Firth⁸

1. Health and Biosecurity Business Unit, Commonwealth Scientific and Industrial Research Organisation, Geelong, VIC, Australia
2. Institut des Sciences de l'Evolution de Montpellier, National Center for Scientific Research, Montpellier University, Montpellier, France
3. Faculty of Veterinary Technology, Kasetsart University, Bangkok, Thailand
4. College of Science and Engineering, James Cook University, Cairns, QLD, Australia
5. Department of Medical Entomology, NSWHP-ICPMR, Westmead Hospital, Westmead, Australia
6. School of Ecosystem and Forest Sciences, The University of Melbourne, Parkville, VIC, Australia
7. The Institute of Health and Community Medicine, Universiti Malaysia Sarawak, Kota Samarahan, Sarawak, Malaysia
8. The Australian Institute of Health and Community Medicine, James Cook University, Cairns, QLD, Australia

Abstract

Urbanization is rapidly transforming much of Southeast Asia, altering the structure and function of the landscape, as well as the frequency and intensity of the interactions between people, animals, and the environment. In this study, we began to explore the impact of urbanization on zoonotic disease risk by simultaneously characterizing changes in the abundance and diversity

of reservoir hosts (rodents), ectoparasite vectors (ticks), and microbial pathogens across a gradient of urbanization in Malaysian Borneo. We found that although rodent species diversity decreased with increasing urbanization, two species appeared to thrive in anthropogenic environments: the invasive urban exploiter, *Rattus rattus* and the native urban adapter, *Sundamys muelleri*. *R. rattus* was strongly associated with the presence of built infrastructure across the gradient and dominated the urban rodent community where it was associated with high microbial diversity and multi-host zoonoses capable of environmental transmission, including *Leptospira* spp., and *Toxoplasma gondii*. In contrast, *S. muelleri* was restricted to sites with a significant vegetative component where it was found at high densities in the urban location. This species was strongly associated with the presence of ticks, including the medically important genera *Ambylomma*, *Haemaphysalis*, and *Ixodes*. Overall, our results demonstrate that the response to urbanization varies by species at all levels: host, ectoparasite, and microbe. This may lead to increased zoonotic disease risk in a subset of environments across urban and urbanizing landscapes that can be reduced through improved pest management and public health messaging.

Introduction

Urbanization is a widespread and significant process of global change that modifies the landscape rapidly, extensively, and often permanently. These environmental changes are