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Review

Biodiversity and health: Lessons and recommendations from an interdisciplinary conference to advise Southeast Asian research, society and policy

Bruno Andreas Walther [a,*], Christophe Boëte [b], Aurélie Binot [c,d], Youlet By [e], Julien Cappelle [c,f], Juan Carrique-Mas [g,h], Monidarin Chou [i], Neil Furey [j], Sothea Kim [i], Claire Lajaunie [k], Sovan Lek [l], Philippe Méral [m,n], Malyne Neang [n], Boon-Huan Tan [o], Catherine Walton [p], Serge Morand [c,q,r]

[a] Master Program in Global Health and Development, College of Public Health and Nutrition, Taipei Medical University, 250 Wu-Hsing St., Taipei 110, Taiwan, R.O.C
[b] UMR_D 190 Unité des Virus Emergents Aix-Marseille Université - Institut de Recherche pour le Développement – Ecole des Hautes Etudes en Santé Publique, 27 Bd Jean Moulin, 13005, Marseille cedex 05, France
[c] CIRAD-ES, UPR AGIRs, F-34398, Montpellier, France
[d] Kasetsart University, Faculty of Veterinary Medicine, Bangkok, Thailand
[e] Fondation Mérieux, 73 Boulevard Monivong, Phnom Penh, Cambodia
[f] Institut Pasteur du Cambodge, Epidemiology and Public Health Unit, BP, 983, Phnom Penh, Cambodia
[g] Hospital for Tropical Diseases, Oxford University Clinical Research Unit - Wellcome Trust Major Overseas Programme, 764 Vo Van Kiet, District 5, Ho Chi Minh City, Vietnam
[h] Centre for Tropical Medicine, Nuffield Department of Clinical Medicine, Oxford University, Old Road Campus Oxford, OX3 7BN, United Kingdom
[i] University of Health Sciences, 73 Boulevard Monivong, Phnom Penh, Cambodia
[j] Fauna & Flora International, PO Box 1380, No. 19, Street 360, Boeng Keng Kang 1, Phnom Penh, Cambodia, 12000
[k] UMR URMITE, U1095 INSERM - Aix-Marseille Université - Institut de Recherche pour le Développement - CNRS, 27 Bd Jean Moulin, 13385, Marseille cedex 05, France
[l] Université de Toulouse, Lab. Evolution & Diversité Biologique, UMR 5174 CNRS – Université Paul Sabatier, 118 route de Narbonne, 31062, Toulouse cedex 9, France
[m] UMR GRED (IRD – University Paul Valery Montpellier 3), 911 av. agropolis, BP, 64501 34 394 Montpellier Cedex 5, France
[n] Ecoland Research Centre - Royal University of Agriculture (RUA) Faculty of Agricultural Economics and Rural Development Dangkor district, Phnom Penh, Cambodia
[o] Saw Swee Hock School of Public Health, National University of Singapore, Singapore, Republic of Singapore
[p] Faculty of Life Sciences, University of Manchester, Manchester M13 9PL, UK
[q] CNRS, Centre d'Infectiologie Christophe Mérieux du Laos, Vientiane, Laos
[r] Department of Helminthology, Faculty of Tropical Medicine, Mahidol University, Bangkok, Thailand

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ABSTRACT

Southeast Asia is an economic, biodiverse, cultural and disease hotspot. Due to rapid socio-economic and environmental changes, the role of biodiversity and ecosystems for human health ought to be examined and communicated to decision-makers and the public. We therefore summarized the lessons and recommendations from an interdisciplinary conference convened in Cambodia in 2014 to advise Southeast Asian societies on current research efforts, future research needs, and to provide suggestions for improved education, training and science–policy interactions. First, we reviewed several examples of the important role of ecosystems as 'sentinels' in the sense that potentially harmful developments for human health become first apparent in ecosystem components. Other ecosystem services which also benefit human well-being are briefly summarized. Second, we summarized the recommendations of the conference's roundtable discussions and added recent developments in the science–policy interface. The recommendations were organized along five themes: Ethical and legal considerations; implementation of the One Health approach; education, training, and capacity building; future research priorities; and potential science–policy interactions. While the role of biodiversity for human health needs further research, especially for zoonoses and emerging diseases, many direct and indirect benefits to human health are already apparent, but have yet to filter down to the science–policy interface in order to influence legislation and enforcement. Therefore, efforts to strengthen the interface in Southeast Asia should become a high priority in order to strengthen the health and resilience of Southeast Asian societies.

* Corresponding author.
E-mail address: bawalther2009@gmail.com (B.A. Walther).

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Contents

1. Introduction

The ecosystem functions and services resulting from the presence of biodiversity have complex and sometimes contradictory relationships to human health and well-being (Chivian and Bernstein, 2008; Corvalan et al., 2005; Hough, 2014); e.g., the transmission of vector-borne and zoonotic diseases to humans is based on complex and often very different mechanisms for each disease. Therefore, loss of biodiversity may increase or decrease disease transmission, depending on the ecology of humans, pathogens and vectors (Myers et al., 2013).

Simply put, biodiversity can be both good and bad for people's health: draining a wetland may decrease the likelihood of disease transmission, but many other ecosystem benefits would also be lost. Since any human-caused change to biodiversity has both benefits and costs to human health, the role of research is to elucidate these benefits and costs and to advise stakeholders and decision-makers on solutions which maximize benefits and minimize costs.

The trade-off between development and conservation also needs to be ameliorated. Since higher-income countries generally have better human health outcomes, economic development, even on the back of ecosystem destruction, will often enhance health outcomes in the short-term (Hough, 2014). However, it is becoming increasingly clear that much economic development is not sustainable in the long-term, and that better compromises between the need for economic development, ecosystem management and human health outcomes must be found. Therefore, governance, policies and practices must take into account ecosystem approaches to health.

The implementation of these ideas and principles into the international agenda began with the Stockholm Conference (for all definitions and abbreviations, see Table S1). The resulting Stockholm Declaration stated people's fundamental right to live "in an environment of a quality that permits a life of dignity and well-being," which is thus the first international recognition of the health dimension of environmental issues. Since then, the necessity of an integrated approach to development compatible with the need to protect the environment for the benefit of human health has been repeatedly reaffirmed (Lajaunie et al., 2015).

In 2004, the World Conservation Society proposed the One World - One Health approach which originally was a list of 12 recommendations to establish a more holistic approach to prevent epidemic or epizootic diseases while maintaining ecosystem integrity for the benefit of humans and their domesticated animals (WCS, 2016) (Table S1).

Over the last few decades, Southeast Asia (SEA) has been a hotspot of economic growth. It experienced tremendous population growth (33% increase to 600 million from 1980 to 2012), doubled its gross domestic product (GDP) from 4580 to 9776 million USD between 1990 and 2013, increased livestock populations manifold, and increased the value of its agricultural exports about 10 times (FAO, 2015). The urban population doubled between 1970 and 2010 to reach 42% (Jones, 2013), and regional roads and airlines greatly increased regional connectivity (Coker et al., 2011).

SEA is also a biodiversity hotspot (Orme et al., 2005). However, the usual suspects of habitat loss, overexploitation of species, pollution (including climate change) and invasive species are taking their toll on SEA's biodiversity and ecosystems which are shrinking dramatically (Koh and Sodhi, 2010; Wilcove et al., 2013).

SEA is also a cultural and linguistic hotspot (Harmon and Loh, 2010; Moseley, 2010), and biodiversity loss often combines with cultural and linguistic diversity loss (Gorenflo et al., 2012) because these three diversities are under threat by some of the same forces (Maffi, 2005).

Finally, SEA is a hotspot for established and emerging human diseases (Coker et al., 2011; Jones et al., 2008; Morand et al., 2014; Box 1). Some of the most important emerging infectious diseases (EIDs) of the past two decades have emerged in SEA, e.g., avian influenza, Nipah virus, and SARS.

Despite these worrying trends, there is a growing research effort and an increasing realization by some of SEA's stakeholders and decision-makers that research can guide better policies which benefit both biodiversity and people; e.g., the practice of the Health Impact Assessment (HIA) was introduced by the Thailand Constitution of 2007, and universities are now offering HIA courses. The Thai National Health Act considers health issues within their complex social, cultural, and environmental frameworks in accordance with the holistic definition of health defined as a state of well-being. The Community HIA is of particular interest as it is considered a "joint learning process in the society" where active citizen involvement is considered helpful to identify the various dimensions of health. The communities may invite researchers who can provide evidence of the links between policies and health impacts; e.g., a quarry mining HIA in Mae Song Province led by a graduate student pushed the public decision-making process in favor of local people's health.

As a consequence of Thailand's constitutional HIA, the ASEAN member states commended Thailand's leadership at the regional