Multifaceted Interactions between Urban Humans and Biodiversity-related Concepts: A Developing-country Data Set (Postprint)

Authors: I understand the translation requirements. Please provide the Chinese text (including the … tags) that you would like me to translate., Minh-Hoang Nguyen

Date: 2022-11-18T00:00:00+00:00

Abstract

Urban humans and biodiversity-related concepts are interacting with each other in many negative and positive ways. The biodiversity provides a wide array of provision and cultural-ecological services to urban residents, but it is being over-exploited to the point of crisis. The crisis is largely driven by the expanding illegal wildlife trade in developing countries with a high urbanization rate and biodiversity level like Vietnam. While supply-side measures are ineffective in reducing biodiversity loss, researchers have suggested demand#2;side measures as supplements, such as social marketing campaigns and law enforcement in urban areas. Moreover, urban residents are also potential visitors to urban public parks and national parks, which helps generate finance for biodiversity preservation and conservation in those places. Understanding how urban residents' perceptions towards biodiversity and biodiversity-related behaviors can help improve the effectiveness of conservation efforts and sustainable urban development. Thus, this article presents a data set of 535 urban residents' wildlife consumption behaviors, multifaceted perceptions and interactions with biodiversity-related concepts, and nature-based recreation demand. The data set is constructed with six major categories: 1) wildlife product consumption, 2) general biodiversity perceptions, 3) biodiversity at home and neighborhood, 4) public park visitation and motivations, 5) national park visitation and motivations, and 6) socio-demographic profiles. These resources are expected to support researchers in enriching the lax literature regarding the role of urban residents in biodiversity conservation and preservation, and help policymakers to find insights for building up an "eco-surplus culture" among urban residents through effective public communication and policymaking

Full Text

Preamble

DATA PAPER

Multifaceted Interactions between Urban Humans and Biodiversity-related Concepts: A Developing-country Data Set

Minh-Hoang Nguyen1,2†

1Graduate School of Asia Pacific Studies, Ritsumeikan Asia Pacific University, Beppu, Oita 874-8577, Japan
2Centre for Interdisciplinary Social Research, Phenikaa University, Yen Nghia Ward, Ha Dong District, Hanoi 100803, Vietnam

Keywords: Biodiversity conservation; Urban resident; Wildlife trade; Vietnam

Citation: Nguyen, M.-H.: Multifaceted interactions between urban humans and biodiversity-related concepts: A developing-country data set. Data Intelligence 3(4), 578-605 (2021). doi: 10.1162/dint_a_{00110}

Received: April 14, 2021; **Revised:** September 21, 2021; **Accepted:** September 23, 2021

ABSTRACT

Urban humans and biodiversity-related concepts interact in many negative and positive ways. Biodiversity provides a wide array of provisioning and cultural-ecological services to urban residents, but it is being overexploited to the point of crisis. This crisis is largely driven by the expanding illegal wildlife trade in developing countries with high urbanization rates and biodiversity levels, such as Vietnam.

While supply-side measures have proven ineffective in reducing biodiversity loss, researchers have suggested demand-side measures as supplements, such as social marketing campaigns and law enforcement in urban areas. Moreover, urban residents are potential visitors to urban public parks and national parks, which helps generate finance for biodiversity preservation and conservation in those places. Understanding urban residents' perceptions toward biodiversity and their biodiversity-related behaviors can improve the effectiveness of conservation efforts and sustainable urban development.

Thus, this article presents a dataset of 535 urban residents' wildlife consumption behaviors, multifaceted perceptions and interactions with biodiversity-related concepts, and nature-based recreation demand. The dataset is constructed with six major categories: 1) wildlife product consumption, 2) general biodiversity perceptions, 3) biodiversity at home and neighborhood, 4) public park visitation and motivations, 5) national park visitation and motivations, and 6)

socio-demographic profiles. These resources are expected to support researchers in enriching the sparse literature regarding the role of urban residents in biodiversity conservation and preservation, and to help policymakers find insights for building an "eco-surplus culture" among urban residents through effective public communication and policymaking.

Corresponding author: Minh-Hoang Nguyen (Email: ng19m6tk@apu.ac.jp; hoang.nguyenminh@phenikaa-uni.edu.vn; ORCID: 0000-0002-7520-3844).

1. INTRODUCTION

Biodiversity loss is happening at an unprecedented rate. Since 1970, the population sizes of mammals, fish, birds, amphibians, and reptiles have declined rapidly by 68% on average [1]. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) reports that around 1 million species are threatened with extinction [2]. Among 35 biodiversity hotspots, the Indo-Burma hotspot ranks among the five most threatened places, with only 5% of natural habitat remaining and the highest human population compared to other hotspots [3]. Located in Indo-Burma, Vietnam's rate of endemic species disappearance is also alarming. In particular, the 2007 Vietnam Red List identified 882 threatened and endangered species (418 animals and 464 plants), representing a 22.33% increase (161 species) compared to the first Vietnam Red List published in 1992 [4].

The interactions between urban ecosystems and biodiversity are multiplex, as are the relationships between urban humans and biodiversity-related concepts. While urban residents' demand for wildlife products is one major cause of biodiversity loss, the associations between biodiversity-related concepts and the human urban ecosystem require further research to improve not only urban people's quality of life and education but also to facilitate biodiversity preservation and conservation. This data descriptor therefore presents a dataset of multifaceted interactions between urban residents and biodiversity-related concepts in Vietnam—a highly urbanized developing country with rich biodiversity. Specifically, the dataset is valuable for studying urban people's wildlife product consumption behaviors, perceptions, and interactions with biodiversity across different levels (individual, home, neighborhood, and public park), as well as nature-based recreation demand.

To reduce the biodiversity loss rate, the Vietnamese government has demonstrated strong commitment to biodiversity protection and conservation by implementing national strategic plans, programs, and initiatives [5]. Conservation of ecosystems, endangered, rare, and precious species and genetic resources is one of the government's main objectives. In particular, the government released Decree 32/2006/ND-CP and Decree 82/2006/ND-CP to prohibit the harvest, trade, use, and consumption of all protected species [6].

However, efforts controlling the supply side of the wildlife trade network have proven ineffective for several reasons [7, 8]: 1) slow and inadequate law enforcement and policy implementation, 2) insufficient resources for monitoring and management, such as manpower, funding, and equipment, 3) corruption among influential people, 4) conflicts between conservation initiatives and local livelihoods, and 5) increasingly organized and expanding criminal networks.

Given these challenges, many scientists have suggested paying more attention to tackling wildlife consumption demand, particularly among the middle class in urban areas. Wildlife product consumption in Vietnamese urban areas is prevalent for multiple purposes, such as traditional medicines (tiger bones, bear bile, etc.) [9, 10], wild meat [11, 12], and pet keeping [13], but legal mechanisms are still missing [12]. Social marketing campaigns have been suggested as a potential method to reduce consumption demand for wildlife products or redirect it to herbal substitutes [6, 14, 15]. Understanding how biodiversity perceptions influence wildlife product consumption behaviors can help improve the effectiveness of public communication and law implementation in urban areas.

Biodiversity-friendly environments are inextricably associated with sustainable urban concepts and human well-being [16], as they provide a wide range of provisioning and cultural ecosystem services, maintain human connection to nature, increase aesthetic appreciation and inspiration, and improve physical and mental health [17, 18, 19]. Given such benefits, international organizations and scholars call for biodiversity conservation and preservation in cities for sustainability. For example, the Intergovernmental Panel on Biodiversity and Ecosystem Services and the United Nations Habitat call for integrating biodiversity notions into human settlements [20, 21]. Opoku suggests that biodiversity conservation needs to be an integral component of built environment policies and strategies toward sustainable development [22]. Recognizing urban residents' perceptions and interactions with biodiversity is vital for gaining public acceptance and support in developing biodiverse urban environments, specifically in residential areas and public parks [23, 24].

Nature-based recreation is another concept through which biodiversity-related concepts and urban residents can be closely linked. Nature-based recreation is defined as "all forms of leisure that rely on the natural environment" [25]. As "nature" refers to any outdoor areas with greenery or natural features, urban residents' demand for nature-based recreation can be met through urban green spaces (e.g., public parks, gardens, or neighborhoods) and protected area visits [26]. Urban public parks are cohabitation places between city dwellers and nature, whereas protected areas are designated for conservation and nature-based tourism. High biodiversity levels in urban public parks and protected areas positively influence visitors' psychological well-being [19, 26, 27, 28]. In return, increasing demand for nature-based recreation might generate sustainable finance for biodiversity conservation in protected areas and preservation in urban public parks [29, 30].

Illustrative Data Analysis

To demonstrate the dataset's utility, we conducted a Bayesian analysis examining factors influencing agreement with illegal wildlife consumption prohibition. The analysis proceeded as follows:

```
# Data preparation
keeps <- c("Gender", "Age", "Education", "Income", "WildConsProhibi",
           "GoodDiversityLoss", "EconomicGrowthLoss")
data1 <- data1[keeps]
data1 <- na.omit(data1)

# Package loading
library(bayesvl)
library(cowplot)

# Model construction
model <- bayesvl()
model <- bvl_{addNode}(model, "WildConsProhibi", "binom")
model <- bvl_{addNode}(model, "Gender", "binom")
model <- bvl_{addNode}(model, "Age", "norm")
model <- bvl_{addNode}(model, "Education", "norm")
model <- bvl_{addNode}(model, "Income", "norm")
model <- bvl_{addNode}(model, "GoodDiversityLoss", "norm")
model <- bvl_{addNode}(model, "EconomicGrowthLoss", "norm")

model <- bvl_{addArc}(model, "Gender", "WildConsProhibi", "slope")
model <- bvl_{addArc}(model, "Age", "WildConsProhibi", "slope")
model <- bvl_{addArc}(model, "Education", "WildConsProhibi", "slope")
model <- bvl_{addArc}(model, "Income", "WildConsProhibi", "slope")
model <- bvl_{addArc}(model, "GoodDiversityLoss", "WildConsProhibi", "slope")
model <- bvl_{addArc}(model, "EconomicGrowthLoss", "WildConsProhibi", "slope")

# Stan code generation
model_{string} <- bvl_{model2Stan}(model)
cat(model_{string})

# Model Fit
model <- bvl_{modelFit}(model, data1, warmup = 2000, iter = 5000, chains = 4, cores = 4)
summary(model)
```

The simulated results are shown in Table 7 . When employing Bayesian analysis, diagnosing the convergence of Markov chains is fundamental. This can be performed using two basic statistics: effective sample size (n_{eff}) and Gelman shrink factor (Rhat). If the n_{eff} value is larger than 1,000 and the Rhat value equals 1, the model's Markov chains can be deemed well-convergent and the estimations reliable. Here, all parameters' n_{eff} and Rhat values meet

these criteria.

Table 7. Estimated posterior coefficients.

Parameters	Mean	Standard deviation	n_{eff}	Rhat
Constant				
Gender				
Education				
Income				
GoodDiversityLoss				
EconomicGrowthLoss				

Using diagnostic statistics alone is insufficient; visual diagnoses through trace plots, Gelman plots, and autocorrelation plots are also required. The trace plots in Figure 2 [Figure 2: see original paper] show "healthy" and stationary patterns of Markov chains, confirming convergence. In the Gelman plots, shrink factor values drop rapidly to 1 during the warm-up period (before the 2,000th iteration), while autocorrelation levels in autocorrelation plots decline to 0 after a certain lag (Figures A1 and A2). Both signals indicate that the Markov chain central limit theorem holds, making the simulated results reliable for interpretation.

The simulated results show that Gender, Education, and Income positively influenced the probability of agreeing that illegal wildlife consumption prohibition is a preventive measure of biodiversity loss (Gender = 0.78 and sGender = 0.65; Education = 0.63 and sEducation = 0.42; Income = 0.15 and sIncome = 0.25), but Age did not (Age = 0.00 and sAge = 0.03). When plotting the probability distributions of parameters, we see that almost entire distributions of Gender and Education are located on the positive side of the x-axis, indicating reliable positive associations between Gender, Education, and WildConsProhibi. For Income, a certain proportion of the distribution still lies on the negative side, making its positive association with WildConsProhibi less reliable than the other two.

Apart from socio-demographic factors, I also found positive associations between perceptions about the consequences of biodiversity loss and agreement that wildlife consumption prohibition is a preventive measure. Specifically, respondents who thought that loss of daily product variety and loss of economic growth are consequences of biodiversity loss were more likely to consider wildlife consumption prohibition a preventive measure (GoodDiversityLoss = 0.87 and sGoodDiversityLoss = 0.44; EconomicGrowthLoss = 0.98 and sEconomicGrowthLoss = 0.46). In Figures 3A and 3B, their probability distributions are almost completely located on the positive side of the x-axis, implying high reliability of these associations.

Figure 2. Trace plots.

Figure 3 [Figure 3: see original paper]. Probability distributions of posterior coefficients (A–Interval plot, B–Density plot).

The following code snippet was used for visualization:

```
# Figure 1 visualization
bvl_{bnPlot}(model)

# Figure 2 visualization
bvl_{plotTrace}(model)

# Figure A1 visualization
bvl_{plotGelmans}(model, NULL, 3, 3)

# Figure A2 visualization
bvl_{plotAcfs}(model, NULL, 3, 3)

# Figures 3A and 3B visualization
Distribution_1 <- bvl_{plotIntervals}(model,
  c("b_{{{Gender}}_{{WildConsProhibi}}}", "b_{{{Age}}_{{WildConsProhibi}}}",
    "b_{{{Education}}_{{WildConsProhibi}}}", "b_{{{Income}}_{{WildConsProhibi}}}",
    "b_{{{GoodDiversityLoss}}_{{WildConsProhibi}}}",
    "b_{{{EconomicGrowthLoss}}_{{WildConsProhibi}}}")) + theme_{bw}()

Distribution_2 <- bvl_{plotDensity}(model,
  c("b_{{{Gender}}_{{WildConsProhibi}}}", "b_{{{Age}}_{{WildConsProhibi}}}",
    "b_{{{Education}}_{{WildConsProhibi}}}", "b_{{{Income}}_{{WildConsProhibi}}}",
    "b_{{{GoodDiversityLoss}}_{{WildConsProhibi}}}",
    "b_{{{EconomicGrowthLoss}}_{{WildConsProhibi}}}")) + theme_{bw}()

plot_{grid}(Distribution_1, Distribution_2, nrow = 2, labels = c('A', 'B'))
```

4. USAGE NOTES AND CONCLUSION

The current dataset provides resources for studying important aspects of interactions between urban residents and biodiversity-related concepts, which are currently lacking in the literature. Besides a stringent quality-check process, the dataset was also employed to examine associations between agreement with illegal wildlife consumption prohibition and perceived negative impacts of biodiversity loss for further validation. The results show that respondents who perceived more negative effects of biodiversity loss on economic growth and daily product variety were more likely to agree with illegal wildlife consumption prohibition. This finding aligns with the Mindsponge mechanism, which stipulates that an individual's perceptions toward a specific matter are influenced by their subjective cost-benefit judgment toward that matter [38, 39, 40]. Due

to this consistency with theoretical assumptions, the dataset can be deemed reliable for studying the socio-psychological aspects of the relationship between urban humans and biodiversity-related concepts.

Several potential issues can be explored using this dataset. First, mitigating demand for wildlife products among urban residents is crucial for reducing biodiversity loss. Raising urban residents' awareness through social marketing campaigns is a potential measure to achieve this target [6, 7]. Using the current dataset to explore how biodiversity perceptions influence wildlife product consumption behaviors might help improve the effectiveness and efficiency of public communication campaigns and programs. Additionally, insights generated from this dataset might contribute to biodiversity conservation-related legislation and law enforcement in urban areas [12].

Second, researchers can investigate urban residents' interactions with biodiversity-related concepts across multiple green spaces: home, neighborhood, urban public park, and national park. This can enrich literature in both sustainable urban development and biodiversity conservation. For example, planting and pet-keeping behaviors might be associated with willingness to support planting projects in neighborhoods and public parks. Moreover, the frequency of visiting national parks might be predicted by urban residents' biodiversity perceptions, providing more insights for social marketing campaigns to attract visitors. An increasing influx of visitors might help generate sustainable finance for biodiversity conservation in national parks and preservation in urban public parks [29, 30].

Additionally, this dataset helps reduce the cost of doing science for researchers in developing countries with characteristics similar to Vietnam [41]: high urbanization rates and high biodiversity levels (e.g., being located in a biodiversity hotspot). Within an academic setting with high competition and limited resources, not only researchers from developing countries but also young scholars in developed countries can capitalize on this dataset to develop new hypotheses and test their assumptions regarding relationships between urban humans and biodiversity-related concepts [42]. Making the dataset open also enhances transparency and facilitates open review and dialogue among researchers [43].

In summary, the dataset was systematically designed, collected, and validated to explore interactions between urban residents and biodiversity-related concepts. Thus, researchers can use the dataset to enrich the sparse literature regarding the role of urban residents in biodiversity conservation and preservation, and policymakers can find insights for building an "eco-surplus culture" [44] among urban residents through effective public communication and policymaking.

ACKNOWLEDGEMENTS

I would like to express my gratitude to my family and friends for assisting in data collection, especially Prof. Vuong Quan Hoang (Phenikaa University) and Ms. Dam Thu Ha (Vuong & Associates). My most sincere appreciation also goes to Prof. Jones E. Thomas (Ritsumeikan Asia Pacific University), Mr. Le Tam Tri (Phenikaa University), and Mr. Khuc Van Quy (Vietkaplab) for providing comments and feedback on the questionnaire design.

CONFLICT OF INTEREST

The dataset was designed and collected for the author's dissertation research project.

DATA AVAILABILITY STATEMENT

The responses of 535 participants on multifaceted interactions between urban humans and biodiversity were saved as "Data_{535} (cleaned).csv" and deposited in the Science Data Bank repository, https://doi.org/10.11922/sciencedb.j00104.00097, under an Attribution 4.0 International (CC BY 4.0). Detailed data description, saved as "Data description.xlsx", was also included in the same repository. All information related to participants' personal contacts was excluded for confidentiality.

REFERENCES

[1] World Wildlife Fund. Living Planet Report 2020 - Bending the curve of biodiversity loss. Available at: http://environmentportal.in/content/468493/living-planet-report-2020-bending-the-curve-of-biodiversity-loss/. Accessed 24 June 2021.

[2] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Nature's dangerous decline 'unprecedented' species extinction rates 'accelerating'. Available at: https://www.unenvironment.org/news-and-stories/press-release/natures-dangerous-decline-unprecedented-species-extinction-rates. Accessed 24 June 2021.

[3] Tordoff, A.W., et al.: Indo-Burma biodiversity hotspot. Critical Ecosystem Partnership Fund. Available at: https://www.kfbg.org/en/conservation-by-site/indo-burma-biodiversity-hotspot. Accessed 24 June 2021.

[4] Ministry of Natural Resources and Environment. Vietnam fifth national report to the United Nations Convention on Biological Diversity. The Vietnamese Government, Hanoi (2014).

[5] Ministry of Natural Resources and Environment. Vietnam national biodiversity strategy to 2020, vision to 2030. The Vietnamese Government, Hanoi (2014).

[6] Shairp, R., et al.: Understanding urban demand for wild meat in Vietnam: Implications for conservation actions. PloS ONE 11(1), e0134787 (2016).

[7] Challender, D.W., MacMillan, D.C.: Poaching is more than an enforcement problem. Conservation Letters 7(5), 484–494 (2014).

[8] Van Song, N.: Wildlife trading in Vietnam: Situation, causes, and solutions. The Journal of Environment and Development 17(2), 145–165 (2008).

[9] Davis, E.O., et al.: Consumer demand and traditional medicine prescription of bear products in Vietnam. Biological Conservation 235, 119–127 (2019).

[10] Davis, E.O., et al.: An updated analysis of the consumption of tiger products in urban Vietnam. Global Ecology and Conservation 22, e00960 (2020).

[11] Olmedo, A., et al.: Who eats wild meat? Profiling consumers in Ho Chi Minh City, Vietnam. People and Nature 3(3), 700–710 (2021).

[12] Sandalj, M., Treydte, A.C., Ziegler, S.: Is wild meat luxury? Quantifying wild meat demand and availability in Hue, Vietnam. Biological Conservation 194, 105–112 (2016).

[13] Nguyen, N.H.: Bird play: Raising red-whiskered bulbuls and (re)inventing urban 'nature' in contemporary Vietnam. Contemporary Social Science 16(1), 57–70 (2021).

[14] Greenfield, S., Veríssimo, D.: To what extent is social marketing used in demand reduction campaigns for illegal wildlife products? Insights from elephant ivory and rhino horn. Social Marketing Quarterly 25(1), 152450041881354 (2018).

[15] Moorhouse, T.P., et al.: Reduce or redirect? Which social marketing interventions could influence demand for traditional medicines? Biological Conservation 242, 108391 (2020).

[16] Kowarik, I., Fischer, L.K., Kendal, D.: Biodiversity conservation and sustainable urban development. Sustainability 12(12), 1–8 (2020).

[17] Schwarz, N., et al.: Understanding biodiversity-ecosystem service relationships in urban areas: A comprehensive literature review. Ecosystem Services 27, 161–171 (2017).

[18] Fischer, L.K., et al.: Beyond green: Broad support for biodiversity in multicultural European cities. Global Environmental Change 49, 35–45 (2018).

[19] Clark, N.E., et al.: Biodiversity, cultural pathways, and human health: A framework. Trends in Ecology & Evolution 29(4), 198–204 (2014).

[20] UN Habitat. Habitat III: New Urban Agenda. Available at: https://habitat3.org/the-new-urban-agenda. Accessed 24 June 2021.

[21] IPBES. Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Available at: https://onlinelibrary.wiley.com/doi/10.1111/padr.12283. Accessed 24 June 2021.

[22] Opoku, A.: Biodiversity and the built environment: Implications for the Sustainable Development Goals (SDGs). Resources, Conservation and Recycling 141, 1–7 (2019).

[23] Ives, C.D., Kendal, D.: The role of social values in the management of ecological systems. Journal of Environmental Management 144, 67-72 (2014).

[24] Alberti, M., et al.: Integrating humans into ecology: Opportunities and challenges for studying urban ecosystems. BioScience 53, 1169–1179 (2003).

[25] Jenkins, J., Pigram, J.: Encyclopedia of leisure and outdoor recreation. Routledge: Oxfordshire (2004).

[26] Lackey, N.Q., et al.: Mental health benefits of nature-based recreation: A systematic review. Annals of Leisure Research 24, 379–393 (2021).

[27] Fuller, R.A., et al.: Psychological benefits of greenspace increase with biodiversity. Biology Letters 3(4), 390–394 (2007).

[28] Shwartz, A., et al.: Enhancing urban biodiversity and its influence on city-dwellers: An experiment. Biological Conservation 171, 82-90 (2014).

[29] Tapper, R.: Wildlife watching and tourism: A study on the benefits and risks of a fast growing tourism activity and its impacts on species. UNEP/Earthprint, Bonn (2006).

[30] Chung, M.G., Dietz, T., Liu, J.: Global relationships between biodiversity and nature-based tourism in protected areas. Ecosystem Services 34, 11–23 (2018).

[31] Khai, H.V., Yabe, M.: The demand of urban residents for the biodiversity conservation in U Minh Thuong National Park, Vietnam. Agricultural and Food Economics 2, 10 (2014).

[32] Creswell, J.W., Poth, C.N.: Qualitative inquiry and research design: Choosing among five approaches. SAGE: Los Angeles (2018).

[33] Nguyen, M.-H., et al.: A data set of students' mental health and help-seeking behaviors in a multicultural environment. Data 4, 124 (2019).

[34] Kim, Y., et al.: Straightlining: Overview of measurement, comparison of indicators, and effects in mail–web mixed-mode surveys. Social Science Computer Review 37(2), 214–233 (2019).

[35] Sexton, R., Nguyen, T., Roberts, D.L.: The use and prescription of pangolin in traditional Vietnamese medicine. Tropical Conservation Science 14, 1–13 (2021).

[36] Vuong, Q.-H., et al.: Improving Bayesian statistics understanding in the age of Big Data with the bayesvl R package. Software Impacts 4, 100016 (2020).

[37] Vuong, Q.-H., et al.: Bayesian analysis for social data: A step-by-step protocol and interpretation. MethodsX 7, 100924 (2020).

[38] Vuong, Q.-H., Napier, N.K.: Acculturation and global mindsponge: An emerging market perspective. International Journal of Intercultural Relations 49, 354–367 (2015).

[39] Nguyen, M.-H., et al.: Alice in suicideland: Exploring the suicidal ideation mechanism through the sense of connectedness and help-seeking behaviors. IJERPH 18, 3681 (2021).

[40] Vuong, Q.-H.: Global mindset as the integration of emerging socio-cultural values through mindsponge processes: A transition economy perspective. In: Kuada, J., (ed.) Global Mindsets: Exploration and Perspectives, pp. 1-9-126. Routledge, Oxfordshire (2016).

[41] Vuong, Q.-H.: The (ir)rational consideration of the cost of science in transition economies. Nature Human Behaviour 2, 5 (2018).

[42] Vuong, Q.-H.: From children's literature to sustainability science, and young scientists for a more sustainable Earth. Journal of Sustainability Education 24, 1–12 (2020).

[43] Vuong, Q.-H.: Reform retractions to make them more transparent. Nature 582, 149 (2020).

[44] Vuong, Q.-H.: The semiconducting principle of monetary and environmental values exchange. Economics and Business Letters 10, 284–290 (2021).

APPENDIX A

Figure A1. Gelman plots.

Figure A2. Autocorrelation plots.

AUTHOR BIOGRAPHY

Minh-Hoang Nguyen holds an MSc in Sustainability Science from Ritsumeikan Asia Pacific University, Beppu, Japan, where he continues his PhD track. He works as a researcher in the Centre for Interdisciplinary Social Research, Phenikaa University, Hanoi, Vietnam. He is the author of two books and has

published around 40 articles in journals and books by multiple publishers: Cell Press, De Gruyter, Elsevier, Emerald, MDPI, MIT Press, Nature Research, Oxford University Press, Springer, and Wiley. His research interest concerns psychological issues. He believes understanding human mental constructs and mechanisms is a fundamental approach for achieving sustainability across multiple disciplines.

ORCID: 0000-0002-7520-3844

Note: Figure translations are in progress. See original paper for figures.