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

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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 overexploited 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-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.

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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 is in the top five most threatened places, with only 5% of the natural habitat remaining and the highest human population compared to other hotspots [3]. Being located in the Indo-Burma, the disappearing rate of endemic species in Vietnam is also alarming. In particular, Vietnam Red List in 2007 identified 882 threatened and endangered species (418 animals and 464 plants), showing an increase of 22.33% (161 species) compared to the first published Vietnam Red List in 1992 [4].

The interactions between urban ecosystems and biodiversity are multiplex, so do the relationship between urban humans and biodiversity-related concepts. While urban residents’ demand for wildlife products is one of the major causes of biodiversity loss, the associations between biodiversity-related concepts and humans urban ecosystem need further research to not only improve urban people’s quality of life and education but also facilitate biodiversity preservation and conservation. The current data descriptor, thus, presents a data set of multifaceted interactions between urban residents and biodiversity-related concepts in Vietnam—a highly urbanized developing country with a rich biodiversity level. Specifically, the data set 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), and nature-based recreation demand.

To reduce the biodiversity loss rate, the Vietnamese government has demonstrated a great commitment to biodiversity protection and conservation by implementing national strategic plans, programs, and initiatives [5]. Conservation of ecosystems, endangered, rare, and precious species and genetics 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 harvest, trade, use, and consumption of all protected species [6]. However, efforts controlling the supply side in the wildlife trade network seem to be ineffective due to several reasons [7, 8]: 1) slow and inadequate law enforcement and policy implementation, 2) lacking resources for monitoring and management, such as manpower, funding, and equipment, 3) corruption among influential people, 4) conflicts of conservation initiatives and programs with local livelihoods, and 5) the increasingly organized and expanded criminal networks.

Given these challenges, many scientists have suggested paying more attention to tackling the wildlife consumption demand, particularly among the middle class in urban areas. The consumption of wildlife products in Vietnamese urban areas is prevalent with multiple purposes, such as traditional medicines (tiger bones, bear bile, etc.) [9, 10], wildmeat [11, 12], and petting [13], but legal mechanisms are still missing [12]. Social marketing campaigns have also been suggested as a potential method to reduce the consumption demand of 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 provision and cultural ecosystem services, maintain human’s connection to nature, increase aesthetic appreciation and inspiration, and improve physical and mental health [17, 18, 19]. Given such benefits of biodiversity, international organizations and scholars call for the conservation and preservation of biodiversity in cities for the sake of sustainability. For example, the Intergovernmental Panel on Biodiversity and Ecosystem Services and the United Nations Habitat call to integrate biodiversity notions into human settlements [20, 21]. Opoku suggests that biodiversity conservation needs to be an integral component of the built environment’s policies and strategies towards sustainable development [22]. Recognizing urban residents’ perceptions and interactions with biodiversity is vital to gain public acceptance and support in developing biodiverse urban environments, specifically in residential areas and public parks [23, 24].

Nature-based recreation is another notion in which biodiversity-related concepts and urban residents can be closely linked together. 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, the urban residents’ demand for nature-based recreation can be met through urban green spaces (e.g., public parks, gardens, or neighborhood) and protected area visitations [26]. Urban public parks are cohabitation places between city dwellers and nature, whereas protected areas are designated for conservation and nature-based tourism. The high biodiversity levels in urban public parks and protected areas positively influence the visitors’ psychological well-being [19, 26, 27, 28]. In return, the increasing demand for nature-based recreation might generate sustainable finance for biodiversity conservation in protected areas and preservation in urban public parks [29, 30]. In particular, it is reported that urban residents in Mekong Delta are willing to pay around $11 million per year for biodiversity conservation activities in the nearby protected area [31]. Comprehending how urban residents’ perceptions of biodiversity are linked to their visitation behaviors, motivations, and financial contribution can enhance monitoring, management, and regulation effectiveness in urban green spaces and protected areas.

Given the above reasons and the lack of related studies and resources in a developing country like Vietnam, data of urban residents’ biodiversity perceptions and biodiversity-related behaviors are necessary. The current data descriptor provides a detailed explanation for the data set of wildlife consumption behaviors, multifaceted perceptions and interactions with biodiversity-related concepts, and nature-based recreation demand among urban Vietnamese residents. The data set comprises 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. Such valuable resources are expected to enable studies about the human-biodiversity interactions in multiple aspects and provide insights for conservation and urban development policymaking, monitoring, management, and regulation.
2. METHODOLOGY

2.1 Survey Design and Validation

The survey was systematically designed with five major steps: (1) questionnaire design, (2) survey collection, (3) data check and validation, (4) data set generation, and (5) data analysis.

First, as there is a lack of qualitative research on biodiversity perceptions among Vietnamese urban people, an in-depth semi-structured interview was conducted to set the stage for questionnaire design. Specifically, 38 urban residents at the two largest cities (Ho Chi Minh City and Hanoi Capital City) in Vietnam were interviewed from November 15 to December 26, 2020. The interviewees were purposively chosen to diversify opinions according to their gender, age, occupations, and prior experiences with nature. When the “theoretical saturation” point was met, the interview was stopped [32]. Based on the interviewed results, the questionnaire was constructed with the 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
6. Socio-demographic profiles

The data were collected through a Web-based survey via Google Forms using a snowball sampling strategy. Google Forms was employed due to its user-friendly interfaces, confidentiality, and easy distribution [33]. The collection happened approximately two months, from June 18 to August 8, 2021. Even though the distribution was targeted at people living in Ho Chi Minh City and Hanoi Capital City, several respondents from other provinces and cities also participated in the survey. At the beginning of the questionnaire, respondents were required to read and agree with the consent form, which stipulates the research purposes, questionnaire contents, and confidentiality of participants. Two hundred random participants who completed the questionnaire were given a gift card with a value ranging from US $1 to US $10 through their email addresses. Eventually, 581 people got involved in the data collection.

Next, to ensure the data set quality, a four-step quality check was performed. First of all, a certain number of questionnaire respondents were from other provinces that were not urban, so their responses were excluded from the data set based on the residency they reported. Secondly, children whose age was less than 18-year-old were also excluded from the data set as their agreement to the consent form was not legitimate without guardians’ acceptance. Thirdly, based on the reported email addresses, duplicate responses were detected and removed afterwards.

Finally, “straightlining” and “select-all” behavior can distort the analysis results [34], so any respondents giving identical answers to a set of questions using the same response scale and selecting all answers of checkbox questions simultaneously were excluded. Although responses with solely “straightline” answers were not excluded, they were marked “warning” in the Quality Assessment column at the end of the data.
In detail, 27 responses were removed due to inappropriate residency; 13 were removed due to insufficient age; three were removed due to repeated reporting; three were removed due to their simultaneous “straightlining” and “select-all” behaviors. Eventually, 535 responses were included in the cleaned data set.

All four steps of the quality check were completed in the Microsoft Excel spreadsheet (.xls.) file downloaded from Google Form. After cleaning the data, all the responses were encoded and saved under comma-separated value format for easing later uses. During this step, any missing data were coded as “NA” (a.k.a “Not Applicable”). The data set would be validated using Bayesian analysis in the later section.

2.2 Data Sample

Most respondents were from the two largest cities in Vietnam: 347 people from Ho Chi Minh City (accounting for 64.86%) and 107 people from Hanoi Capital City (accounting for 20%). The remaining respondents (15.14%) came from other urban areas, like Hue city, Vung Tau city, and Thanh Hoa city. Among 535 responses, female participants constituted a greater proportion than male participants (58.31% of females versus 41.12% of males). The average mean age of all participants was around 33.80. The educational level of participants was relatively high, as 85.05% of them acquired an undergraduate (63.18%) or post-graduate levels (21.87%).

The occupational backgrounds of participants were highly diverse, ranging from accountant, activist, actor to retiree and employee. The income of most participants (39.24%) fell into the range from 5 million to 15 million VNĐ monthly. No-income participants consisted of 4.11% of the total number, whereas the percentage of participants acquiring more than 30 million VNĐ monthly was 7.48%. Most of the participants reported spending the majority of their lifetime living in urban areas (84.86%). Only 54 and 26 participants spent most of their lifetime in sub-urban (10.09%) and rural areas (4.86%), respectively.

2.3 Response Coding

The current section presents how the responses of six major categories were coded according to the following order: 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. Two main types of responses are categorical (including binary variables) and numerical variables. In the next sub-sections, categorical variables are described using seven kinds of information corresponding with seven columns: “Variable”, “Name”, “Explanation”, “Level”, “Code”, “Frequency”, and “Proportion”. Meanwhile, for the description of numerical variables, the last three columns are replaced with “Range”, “Mean”, and “Standard deviation”.

2.3.1 Wildlife Product Consumption

The first sub-section of the data set comprises 12 categorical variables that demonstrate the wildlife product consumption behaviors among urban residents (Table 1). The variables were generated by questions
about four ways of consuming wildlife products: bushmeat, traditional medicine, products made from animal skin/fur/leather, and uncommon pet. Variables A1 and A2 are used to present whether the respondent has ever consumed bushmeat and their consumption frequency.

The behaviors of consuming traditional medicines made from wildlife are indicated by variables A3_1 to A5. While variables A3_1 to A3_3 are whether the respondent has ever consumed animal bones, bile bear, and pangolin scale for medical treatment, the other two variables (A4 and A5) are the respondent's information sources of traditional medicine and perception of effective medicine. Animal bones, bile bear, and pangolin scale are three frequently consumed materials for traditional medicines in Vietnam [9, 10, 35].

The consumption behaviors of products made from animal skin/fur/leather are indicated by variables A6 to A8. The remaining two variables are to demonstrate the uncommon pet adoption behaviors of the respondent. Uncommon pets are animals that are not dogs or cats.

Table 1. Description of variables related to wildlife product consumption.

| Variable | Name                                | Explanation                                                                 | Level       | Code | Frequency | Proportion |
|----------|-------------------------------------|-----------------------------------------------------------------------------|-------------|------|-----------|------------|
| A1       | Bushmeat consumption                | Whether the respondent has ever consumed bushmeat                           | Yes         | 1    | 202       | 37.76%     |
| A2       | Bushmeat consumption frequency     | How often the respondent consumes bushmeat                                  | Never       | 1    | 345       | 64.49%     |
|          |                                     |                                                                             | Sometimes   | 2    | 188       | 35.14%     |
|          |                                     |                                                                             | Often       | 3    | 1         | 0.19%      |
|          |                                     |                                                                             | Very often  | 4    | 1         | 0.19%      |
| A3_1     | Animal bone consumption             | Whether the respondent has ever consumed animal bone (monkey, tiger, horse, etc.) for traditional medicine | Yes         | 1    | 77        | 14.39%     |
| A3_2     | Bile bear consumption               | Whether the respondent has ever consumed bile bear for traditional medicine | Yes         | 1    | 116       | 21.68%     |
| A3_3     | Pangolin scale consumption          | Whether the respondent has ever consumed pangolin scale for traditional medicine | Yes         | 1    | 11        | 2.06%      |
| A4       | Information source of traditional medicine | Information sources for traditional medicine | Family and friends | a    | 321       | 60.00%     |
|          |                                     |                                                                             | Newspaper   | b    | 270       | 50.47%     |
|          |                                     |                                                                             | Social media | c    | 359       | 67.10%     |
|          |                                     |                                                                             | Book        | d    | 112       | 20.93%     |
|          |                                     |                                                                             | Doctor      | e    | 31        | 5.79%      |
|          |                                     |                                                                             | Other       | f    | 7         | 1.31%      |
| A5       | Perceived effective medicine        | Perceived effective type of medicine                                        | Eastern medicine | 1    | 64        | 11.96%     |
|          |                                     |                                                                             | Same        | 2    | 219       | 40.93%     |
|          |                                     |                                                                             | Western medicine | 3    | 252       | 47.10%     |

Data Intelligence 583
Multifaceted Interactions between Urban Humans and Biodiversity-related Concepts: A Developing-country Data Set

2.3.2 General Biodiversity Perceptions

The second sub-section focuses on the urban residents’ general perceptions towards biodiversity, like the self-assessment knowledge (variable $B1$), perceived importance of biodiversity loss (variable $B2$), perceived consequences of biodiversity loss (variables $B3_1$ to $B3_{13}$), perceived preventive measures of biodiversity loss (variables $B4_1$ to $B4_9$), perceived biodiversity-affected objects (variables $B5_1$ to $B5_4$), and perceived contributors to biodiversity loss prevention (variables $B6_1$ to $B6_5$). In total, 33 variables belong to this group (Table 2).

| Variable | Name | Explanation | Level | Code | Frequency | Proportion |
|----------|------|-------------|-------|------|-----------|------------|
| $B1$     | Biodiversity knowledge | Self-assessment knowledge about biodiversity | Never heard about| 1 | 64 | 11.96% |
|          |      |             | Poor  | 2   | 189       | 35.33%    |
|          |      |             | Adequate | 3  | 243       | 45.42%    |
|          |      |             | Good   | 4   | 39        | 7.29%     |
| $B2$     | Biodiversity perception | Perception about the importance of biodiversity loss | Biodiversity loss is not real | 1 | 17 | 3.18% |
|          |      |             | Biodiversity loss is real but only a small problem | 2 | 30 | 5.61% |
|          |      |             | Biodiversity loss is real and a major environmental problem | 3 | 488 | 91.21% |

Table 2. Description of variables related to general biodiversity perceptions.
### Multifaceted Interactions between Urban Humans and Biodiversity-related Concepts: A Developing-country Data Set

| Variable | Name | Explanation | Range | Mean  | SD   |
|----------|------|-------------|-------|-------|------|
| B3_1     | Perceived impact [pollution] | Agreement with that the following consequence is a result of biodiversity loss [Environmental pollution (air pollution, water pollution, etc.)] | 1. Strongly disagree 2. Disagree 3. Agree 4. Strongly agree | 3.34  | 0.74  |
| B3_2     | Perceived impact [climate change] | Agreement with that the following consequence is a result of biodiversity loss [Climate change] | | 3.33  | 0.72  |
| B3_3     | Perceived impact [life imbalance] | Agreement with that the following consequence is a result of biodiversity loss [Loss of life balance] | | 3.17  | 0.76  |
| B3_4     | Perceived impact [good's diversity loss] | Agreement with that the following consequence is a result of biodiversity loss [Loss of daily product variety (food, medicine, etc.)] | | 2.95  | 0.84  |
| B3_5     | Perceived impact [economic growth] | Agreement with that the following consequence is a result of biodiversity loss [Negative impacts on economic growth] | | 2.85  | 0.83  |
| B3_6     | Perceived impact [green space] | Agreement with that the following consequence is a result of biodiversity loss [Loss of green space] | | 3.34  | 0.72  |
| B3_7     | Perceived impact [natural scenery] | Agreement with that the following consequence is a result of biodiversity loss [Loss of natural aesthetics] | | 3.35  | 0.72  |
| B3_8     | Perceived impact [nature-based recreation] | Agreement with that the following consequence is a result of biodiversity loss [Loss of opportunities for nature-based recreation] | | 3.02  | 0.80  |
| B3_9     | Perceived impact [knowledge loss] | Agreement with that the following consequence is a result of biodiversity loss [Loss of knowledge about nature] | | 3.15  | 0.81  |
| B3_10    | Perceived impact [life quality loss] | Agreement with that the following consequence is a result of biodiversity loss [Reduction of quality of life ] | | 3.14  | 0.76  |
| B3_11    | Perceived impact [physical health loss] | Agreement with that the following consequence is a result of biodiversity loss [Reduction of physical health] | | 3.00  | 0.81  |
| B3_12    | Perceived impact [mental health loss] | Agreement with that the following consequence is a result of biodiversity loss [Reduction of mental health] | | 3.04  | 0.78  |
| B3_13    | Perceived impact [life expectancy loss] | Agreement with that the following consequence is a result of biodiversity loss [Reduction of life expectancy] | | 2.95  | 0.82  |
Multifaceted Interactions between Urban Humans and Biodiversity-related Concepts: A Developing-country Data Set

| Variable | Name                                                                 | Explanation                                                                 | Range                       | Mean  | SD  |
|----------|----------------------------------------------------------------------|------------------------------------------------------------------------------|-----------------------------|-------|-----|
| **B4_1** | Perceived prevention method [conservation]                           | Agreement with the following measure is preventive of biodiversity loss.     | 1. Strongly disagree        | 3.36  | 0.72|
|          |                                                                      | Species conservation in protected areas                                      | 2. Disagree                 |       |     |
|          |                                                                      |                                                                              | 3. Agree                    | 3.60  | 0.67|
|          |                                                                      |                                                                              | 4. Strongly agree           |       |     |
| **B4_2** | Perceived prevention method [reduction of deforestation and exploitation] | Agreement with the following measure is preventive of biodiversity loss.     | 1. Strongly disagree        | 3.36  | 0.72|
|          |                                                                      | Reduction of deforestation and exploitation                                | 2. Disagree                 |       |     |
|          |                                                                      |                                                                              | 3. Agree                    | 3.60  | 0.67|
|          |                                                                      |                                                                              | 4. Strongly agree           |       |     |
| **B4_3** | Perceived prevention method [environmental law]                      | Agreement with the following measure is preventive of biodiversity loss.    | 1. Strongly disagree        | 3.54  | 0.65|
|          |                                                                      | Environmental law enactment                                                 | 2. Disagree                 |       |     |
|          |                                                                      |                                                                              | 3. Agree                    |       |     |
|          |                                                                      |                                                                              | 4. Strongly agree           |       |     |
| **B4_4** | Perceived prevention method [research]                              | Agreement with the following measure is preventive of biodiversity loss.     | 1. Strongly disagree        | 3.30  | 0.68|
|          |                                                                      | Scientific research                                                          | 2. Disagree                 |       |     |
|          |                                                                      |                                                                              | 3. Agree                    |       |     |
|          |                                                                      |                                                                              | 4. Strongly agree           |       |     |
| **B4_5** | Perceived prevention method [public communication]                  | Agreement with the following measure is preventive of biodiversity loss.     | 1. Strongly disagree        | 3.48  | 0.67|
|          |                                                                      | Public communication about biodiversity loss                                 | 2. Disagree                 |       |     |
|          |                                                                      |                                                                              | 3. Agree                    |       |     |
|          |                                                                      |                                                                              | 4. Strongly agree           |       |     |
| **B4_6** | Perceived prevention method [education]                             | Agreement with the following measure is preventive of biodiversity loss.     | 1. Strongly disagree        | 3.48  | 0.67|
|          |                                                                      | Education about biodiversity loss                                            | 2. Disagree                 |       |     |
|          |                                                                      |                                                                              | 3. Agree                    |       |     |
|          |                                                                      |                                                                              | 4. Strongly agree           |       |     |
| **B4_7** | Perceived prevention method [wildlife consumption prohibition]      | Agreement with the following measure is preventive of biodiversity loss.     | 1. Strongly disagree        | 3.60  | 0.67|
|          |                                                                      | Prohibition of illegal wildlife consumption                                 | 2. Disagree                 |       |     |
|          |                                                                      |                                                                              | 3. Agree                    |       |     |
|          |                                                                      |                                                                              | 4. Strongly agree           |       |     |
| **B4_8** | Perceived prevention method [environmental tax]                     | Agreement with the following measure is preventive of biodiversity loss.     | 1. Strongly disagree        | 3.24  | 0.77|
|          |                                                                      | Environmental tax                                                            | 2. Disagree                 |       |     |
|          |                                                                      |                                                                              | 3. Agree                    |       |     |
|          |                                                                      |                                                                              | 4. Strongly agree           |       |     |
| **B4_9** | Perceived prevention method [donation]                              | Agreement with the following measure is preventive of biodiversity loss.     | 1. Strongly disagree        | 3.25  | 0.73|
|          |                                                                      | Donation for biodiversity conservation                                       | 2. Disagree                 |       |     |
|          |                                                                      |                                                                              | 3. Agree                    |       |     |
|          |                                                                      |                                                                              | 4. Strongly agree           |       |     |
| **B5_1** | Affected object [my life]                                          | Agreement with the following object is affected by biodiversity loss.        | 1. Strongly disagree        | 3.06  | 0.69|
|          |                                                                      | My life                                                                     | 2. Disagree                 |       |     |
|          |                                                                      |                                                                              | 3. Agree                    | 3.03  | 0.70|
|          |                                                                      |                                                                              | 4. Strongly agree           |       |     |
| **B5_2** | Affected object [my family]                                         | Agreement with the following object is affected by biodiversity loss.        | 1. Strongly disagree        | 3.14  | 0.67|
|          |                                                                      | My family                                                                    | 2. Disagree                 |       |     |
|          |                                                                      |                                                                              | 3. Agree                    |       |     |
|          |                                                                      |                                                                              | 4. Strongly agree           |       |     |
| **B5_3** | Affected object [my neighborhood]                                   | Agreement with the following object is affected by biodiversity loss.        | 1. Strongly disagree        | 3.23  | 0.67|
|          |                                                                      | My neighborhood                                                              | 2. Disagree                 |       |     |
|          |                                                                      |                                                                              | 3. Agree                    |       |     |
|          |                                                                      |                                                                              | 4. Strongly agree           |       |     |

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Numerical variables

| Variable | Name                     | Explanation                                                                 | Range                        | Mean  | SD   |
|----------|--------------------------|-----------------------------------------------------------------------------|------------------------------|-------|------|
| B6_1     | Contributor [myself]     | Agreement with that the following subject can contribute to biodiversity loss prevention [Myself] | 1. Strongly disagree   | 3.30  | 0.62 |
|          |                          |                                                                             | 2. Disagree                  |       |      |
|          |                          |                                                                             | 3. Agree                     | 3.27  | 0.62 |
|          |                          |                                                                             | 4. Strongly agree            |       |      |
| B6_2     | Contributor [my family]  | Agreement with that the following subject can contribute to biodiversity loss prevention [My family] |                              |       |      |
| B6_3     | Contributor [my neighbors] | Agreement with that the following subject can contribute to biodiversity loss prevention [People in my neighborhood] |                              |       |      |
| B6_4     | Contributor [government] | Agreement with that the following subject can contribute to biodiversity loss prevention [Government] |                              |       |      |
| B6_5     | Contributor [international organization] | Agreement with that the following subject can contribute to biodiversity loss prevention [International organization] |                              |       |      |

2.3.3 Biodiversity at Home and Neighborhood

The third sub-section focuses on the interactions between humans and biodiversity at the respondent's home and neighborhood (Table 3). The first four variables (from C1_1 to C1_4) show the respondent's behaviors and willingness to plant varied types of plants in their houses, while the next four variables (from C2_1 to C2_4) present the respondent's behaviors and willingness of adopting varied types of pet in their houses. The respondent's feelings (e.g., comfortability and aesthetics) when being in the house are indicated by variables C3_1 to C3_4. The last three variables (C4_1, C4_2, and C4_3) are used to present the perceived availability of plants in the respondent's neighborhood, their willingness to donate to a planting project, and considered important aspects of the project, respectively.

Table 3. Description of variables related to biodiversity at home and neighborhood.

Categorical variables

| Variable | Name                       | Explanation                                                                 | Level                          | Code | Frequency | Proportion |
|----------|-----------------------------|-----------------------------------------------------------------------------|--------------------------------|------|-----------|------------|
| C1_1     | In-house planting (scale)   | Whether the respondent plants plant in their house                         | Not at all                     | 1    | 31        | 5.79%      |
|          |                             |                                                                             | Yes, but only a few            | 2    | 292       | 54.58%     |
|          |                             |                                                                             | Yes, I plant many              | 3    | 212       | 39.63%     |
| C1_2     | In-house planting (binary)  | Whether the respondent plants plant in their house                         | Yes                            | 1    | 504       | 94.21%     |
|          |                             |                                                                             | No                             | 0    | 31        | 5.79%      |
| C1_3     | Number of types of plants planted | The number of types of plants planted in the house                      | 0                              | 0    | 30        | 5.61%      |
|          |                             |                                                                             | 1                              | 1    | 17        | 3.18%      |
|          |                             |                                                                             | 2                              | 2    | 48        | 8.97%      |
|          |                             |                                                                             | 3                              | 3    | 66        | 12.34%     |
|          |                             |                                                                             | 4                              | 4    | 32        | 5.98%      |
|          |                             |                                                                             | 5                              | 5    | 50        | 9.35%      |
|          |                             |                                                                             | More than 5                    | 6    | 292       | 54.58%     |
### Multifaceted Interactions between Urban Humans and Biodiversity-related Concepts: A Developing-country Data Set

| Variable | Name | Explanation | Level | Code | Frequency | Proportion |
|----------|------|-------------|-------|------|-----------|------------|
| C1_4 | Willingness to plant more plants | Whether the respondent is willing to plant more plants | No, I wouldn’t | 1 | 38 | 7.10% |
| | | | Yes, I would plant more plants from the same type | 2 | 49 | 9.16% |
| | | | Yes, I would plant more plants from various types | 3 | 448 | 83.74% |
| C2_1 | Petting | Whether the respondent owns any pet | Yes | 1 | 254 | 47.48% |
| | | | No | 0 | 281 | 52.52% |
| C2_2 | Type of pet | Type of pet that the respondent owns | Cat | a | 142 | 26.54% |
| | | | Dog | b | 225 | 42.06% |
| | | | Fish | c | 174 | 32.52% |
| | | | Other | d | 23 | 4.30% |
| | | | No pet | e | 154 | 28.79% |
| C2_3 | Number of pets | Number of pet types that the respondent owns | 0 | 0 | 200 | 37.38% |
| | | | 1 | 1 | 183 | 34.21% |
| | | | 2 | 2 | 70 | 13.08% |
| | | | More than 2 | 3 | 62 | 11.59% |
| C2_4 | Willingness to adopt more pet | Whether the respondent is willing to adopt more pet | No, I wouldn’t | 1 | 347 | 64.86% |
| | | | Yes, I would adopt more pets from the same type | 2 | 78 | 14.58% |
| | | | Yes, I would adopt more pets from various types | 3 | 110 | 20.56% |
| C3_1 | Feeling comfortable at home (scale) | How much comfortable the respondent feels in the house | Very Uncomfortable | 1 | 25 | 4.67% |
| | | | Uncomfortable | 2 | 33 | 6.17% |
| | | | Comfortable | 3 | 258 | 48.22% |
| | | | Very comfortable | 4 | 219 | 40.93% |
| C3_2 | Feeling comfortable at home (binary) | Whether the respondent feels comfortable when being in the house | Comfortable | 1 | 477 | 89.16% |
| | | | Uncomfortable | 0 | 58 | 10.84% |
| C3_3 | Feeling aesthetic at home due to plant/animal (scale) | How much aesthetic the respondent feels the house is due to plant/animal | Very negative effect | 1 | 12 | 2.24% |
| | | | Negative effect | 2 | 12 | 2.24% |
| | | | Positive effect | 3 | 316 | 59.07% |
| | | | Very positive effect | 4 | 195 | 36.45% |
| C3_4 | Feeling aesthetic at home due to plant/animal (binary) | Whether the respondent feels the house aesthetic due to plant/animal | Positive effect | 1 | 511 | 95.51% |
| | | | Negative effect | 0 | 24 | 4.49% |
| C4_1 | Plants in the neighborhood | Whether there are any plants in the neighborhood | Not at all | 1 | 26 | 4.86% |
| | | | A few | 2 | 232 | 43.36% |
| | | | Many | 3 | 188 | 35.14% |
| | | | Abundant | 4 | 89 | 16.64% |
| C4_2 | Donation to planting project in the neighborhood | Whether the respondent is willing to financially contribute to the planting project in the neighborhood | Not at all | 1 | 5 | 0.93% |
| | | | Not really | 2 | 60 | 11.21% |
| | | | Willing | 3 | 284 | 53.08% |
| | | | Very willing | 4 | 186 | 34.77% |
## 2.3.4 Public Park Visitation and Motivations

Respondent's public park visitation and involvement in planting projects can be explored using the variables in the fourth sub-section (Table 4). At the beginning of the sub-section, the question, “is there any public park near your house?” was asked. If the respondent answered “yes”, other questions about their visitation to the public park and planting-project contribution willingness would be given. Otherwise, these questions would be skipped. In this sub-section, specific questions about the public park's biodiversity characteristics were not included to avoid respondent’s recall bias, which downgrades the answers’ reliability.

### Table 4. Description of variables related to public park visitation and motivations.

| Variable | Name | Explanation | Level       | Code | Frequency | Proportion |
|----------|------|-------------|-------------|------|-----------|------------|
| D1       | Availability of a nearby public park | Whether there is a public park near where the respondent lives | Yes | 1    | 415       | 77.57%     |
|          |      |             | No          | 0    | 120       | 22.43%     |
| D2       | Public park visitation frequency | Frequency of going to the nearby public park | Never | 1   | 21        | 3.93%      |
|          |      |             | Almost never | 2   | 38        | 7.10%      |
|          |      |             | Sometimes   | 3   | 281       | 52.52%     |
|          |      |             | Almost everyday | 4 | 55        | 10.28%     |
|          |      |             | Everyday     | 5   | 20        | 3.74%      |
| D3       | Public park visitation reasons | The respondent’s reasons to visit the nearby public park | Relaxation | a | 260       | 48.60%     |
|          |      |             | Physical activities | b | 238       | 44.49%     |
|          |      |             | Meeting with friends | c | 96        | 17.94%     |
|          |      |             | Spending time with family | d | 107       | 20.00%     |
|          |      |             | Educational activities for children | e | 101       | 18.88%     |
|          |      |             | Enjoying nature | f | 220       | 41.12%     |
|          |      |             | Community events | g | 70        | 13.08%     |
|          |      |             | Other        | h | 2         | 0.37%      |
Multifaceted Interactions between Urban Humans and Biodiversity-related Concepts: A Developing-country Data Set

| Variable | Name | Explanation | Level | Code | Frequency | Proportion |
|----------|------|-------------|-------|------|-----------|------------|
| D4       | Donation to planting project in the public park | Whether the respondent is willing to financially contribute to the planting project in the nearby public park | Not at all willing | 1 | 8 | 1.50% |
|          |      |             | Not really willing | 2 | 58 | 10.84% |
|          |      |             | Willing | 3 | 244 | 45.61% |
|          |      |             | Very willing | 4 | 105 | 19.63% |
| D5       | Favorable planting characteristics in the public park | Important aspects that should be considered in the planting project | Amount | a | 220 | 41.12% |
|          |      |             | Variety | b | 281 | 52.52% |
|          |      |             | Aesthetics | c | 326 | 60.93% |
|          |      |             | Location | d | 228 | 42.62% |
|          |      |             | Utilities (shades, etc.) | e | 284 | 53.08% |
|          |      |             | Other | f | 7 | 1.31% |

2.3.5 National Park Visitation and Motivations

The fifth sub-section is about the respondent’s national park visitation (Table 5). Besides the visitation behaviors (variable E1) and motivations (variables E2 to E4), the respondent’s willingness that might contribute to conservation finance in national parks was also measured by variable E5 (entrance fee payment willingness) and E6 (donation willingness). The questions in this sub-section were kept as general (or not context-based) as possible because urban residents in different cities had distinct impression with particular national parks, so their perceptions about national parks might be different accordingly. Moreover, recall bias also alleviates the reliability of responses to specific (or context-based) questions.

Table 5. Description of variables related to national park visitation and motivations.

| Variable | Name | Explanation | Level | Code | Frequency | Proportion |
|----------|------|-------------|-------|------|-----------|------------|
| E1       | National Park visitation frequency | Frequency of going to the national park | Never | 1 | 114 | 21.31% |
|          |      |             | Less than once a year | 2 | 259 | 48.41% |
|          |      |             | Once a year | 3 | 111 | 20.75% |
|          |      |             | Twice a year | 4 | 27 | 5.05% |
|          |      |             | More than twice a year | 5 | 24 | 4.49% |
| E2       | National park visitation reasons | The respondent’s reasons to visit the national park | Escape and relaxation | a | 300 | 56.07% |
|          |      |             | Enjoying nature | b | 342 | 63.93% |
|          |      |             | Watching wild animals | c | 290 | 54.21% |
|          |      |             | Meeting with friends | d | 107 | 20.00% |
|          |      |             | Spending time with family | e | 223 | 41.68% |
|          |      |             | Educational activities for children | f | 182 | 34.02% |
|          |      |             | Seeking new knowledge (animals, plants, etc.) | g | 244 | 45.61% |
|          |      |             | Outdoor activities (hiking, trekking, etc.) | h | 233 | 43.55% |
|          |      |             | Other | i | 7 | 1.31% |
### Multifaceted Interactions between Urban Humans and Biodiversity-related Concepts: A Developing-country Data Set

#### Categorical variables

| Variable | Name | Explanation | Level | Code | Frequency | Proportion |
|----------|------|-------------|-------|------|-----------|------------|
| E3       | Willingness to visit a national park (scale) | Whether the respondent is willing to visit a national park in the next 12 months | No, I don’t even think about it | 1 | 30 | 5.61% |
|          |      |             | No, but maybe later | 2 | 36 | 6.73% |
|          |      |             | Yes, but I’m still not sure | 3 | 232 | 43.36% |
|          |      |             | Yes, certainly | 4 | 237 | 44.30% |
| E4       | Willingness to visit a national park (binary) | Whether the respondent is willing to visit a national park in the next 12 months | Yes | 1 | 469 | 87.66% |
|          |      |             | No | 0 | 66 | 12.34% |
| E5       | Entrance fee payment willingness | Whether the respondent is willing to pay for the national park’s entrance fee | Yes | 1 | 522 | 97.57% |
|          |      |             | No | 0 | 13 | 2.43% |
| E6       | Conservation project donation willingness | Whether the respondent is willing to donate to the national park’s conservation activities | Yes | 1 | 508 | 94.95% |
|          |      |             | No | 0 | 27 | 5.05% |

#### 2.3.6 Socio-demographic Profile

The last sub-section consists of variables about the socio-demographic characteristics of the respondent, such as gender (variable $F1$), age (variables $F2$ and $F3$), occupation (variable $F4$), educational level (variable $F5$), and income (variables $F6$ and $F7$). Apart from basic information, the nearby landscape (variable $F8$), environmental information source (variable $F9$), most frequently lived area (variable $F10$), and current residency (variable $F11$) are also included in the sub-section (Table 6).

**Table 6.** Description of variables related to respondents’ socio-demographic profiles.

| Variable | Name | Explanation | Level | Code | Frequency | Proportion |
|----------|------|-------------|-------|------|-----------|------------|
| $F1$     | Gender | Gender | Female | 0 | 312 | 57.08% |
|          |       |         | Male | 1 | 220 | 42.92% |
| $F3$     | Age group | The age group in which the respondent belongs to | 18–22 | 1 | 120 | 13.95% |
|          |       |         | 23–30 | 2 | 132 | 21.36% |
|          |       |         | 31–40 | 3 | 140 | 25.75% |
|          |       |         | 41–50 | 4 | 87 | 17.37% |
|          |       |         | 51–60 | 5 | 36 | 7.58% |
|          |       |         | More than 60 | 6 | 20 | 3.99% |
| $F4$     | Occupation | The current occupation of the respondent | NA | NA | NA | NA |
| $F5$     | Education | The highest educational level of the respondent | Primary school | 1 | 1 | 0.2% |
|          |       |         | Secondary school | 2 | 9 | 1.8% |
|          |       |         | High school | 3 | 70 | 13.77% |
|          |       |         | Undergraduate | 4 | 338 | 61.68% |
|          |       |         | Post-graduate | 5 | 117 | 22.55% |
### Categorical variables

| Variable | Name                                      | Explanation                                                                 | Level                      | Code | Frequency | Proportion |
|----------|-------------------------------------------|-----------------------------------------------------------------------------|----------------------------|------|-----------|------------|
| F7       | Income group                              | The income group in which the respondent belongs to                         | No income                  | 1    | 22        | 4.39%      |
|          |                                           |                                                                             | Less than 5 million VND    | 2    | 53        | 10.58%     |
|          |                                           |                                                                             | 10–15 million VND           | 3    | 99        | 15.37%     |
|          |                                           |                                                                             | 5–10 million VND            | 4    | 107       | 20.16%     |
|          |                                           |                                                                             | 15–20 VND                  | 5    | 40        | 7.78%      |
|          |                                           |                                                                             | 20–30 million VND           | 6    | 44        | 9.38%      |
|          |                                           |                                                                             | More than 30 million VND   | 7    | 40        | 7.78%      |
| F8       | Nearby landscape                          | The landscapes that the respondent has ever lived nearby                     | Forest                     | a    | 121       | 23.15%     |
|          |                                           |                                                                             | Ocean                      | b    | 133       | 24.35%     |
|          |                                           |                                                                             | River                      | c    | 201       | 36.73%     |
|          |                                           |                                                                             | Cropland                   | d    | 205       | 37.72%     |
|          |                                           |                                                                             | Pond                       | e    | 203       | 37.92%     |
|          |                                           |                                                                             | Other                      | f    | 143       | 28.54%     |
|          |                                           |                                                                             | Not at all                 | g    | 6         | 0%         |
| F9       | Environmental information source          | The sources from which the respondent receives environment-related information | Newspaper                  | a    | 382       | 71.86%     |
|          |                                           |                                                                             | Online newspaper           | b    | 380       | 71.46%     |
|          |                                           |                                                                             | Social Media               | c    | 464       | 87.03%     |
|          |                                           |                                                                             | Lecture                    | d    | 228       | 43.91%     |
|          |                                           |                                                                             | Word of mouth              | e    | 278       | 52.50%     |
|          |                                           |                                                                             | Books                      | f    | 253       | 47.90%     |
|          |                                           |                                                                             | Textbooks                  | g    | 228       | 43.51%     |
|          |                                           |                                                                             | Documentary movies         | h    | 339       | 64.27%     |
|          |                                           |                                                                             | Observations               | i    | 292       | 56.09%     |
|          |                                           |                                                                             | Local government           | j    | 99        | 19.56%     |
|          |                                           |                                                                             | Others                     | k    | 3         | 0.6%       |
| F10      | Area with most living time                | The area in which the respondent has spent a majority of their lifetime     | Urban                      | a    | 454       | 85.63%     |
|          |                                           |                                                                             | Sub-urban                  | b    | 54        | 10.38%     |
|          |                                           |                                                                             | Rural                      | c    | 26        | 3.79%      |
| F11      | Current residency                         | The current city in which the respondent is living                          | NA                         | NA   | NA        | NA         |

### Numerical variable

| Variable | Name            | Explanation                                | Range       | Mean    | SD    |
|----------|-----------------|--------------------------------------------|-------------|---------|-------|
| F2       | Age             | The reported age of the respondent         | 18-71       | 33.80   | 12.18 |
| F5       | Income          | The reported income of the respondent      | 0-100,000,000 | 13,708,971 | 16,646,862 |
3. EXEMPLARY DATA ANALYSIS

This section presents Bayesian linear analysis’s results to validate the data set. I constructed the model using four socio-demographic factors (Gender, Age, Education, and Income) and two perceptions about perceived impacts of biodiversity loss (GoodDiversityLoss and EconomicGrowthLoss) as predictor variables. The Gender, Age, Education, and Income variables were illustrated by F1, F2, F5, and F7 variables in the data set. B3_4 and B3_5 variables correspondingly present the agreement level with that the loss results of daily product diversity and negative impacts on economic growth are consequences of biodiversity loss. Meanwhile, the respondents’ agreement with prohibiting illegal wildlife consumption as a preventive measure was selected as the outcome variable, which variable WildConsProhibi exhibits. The variable was generated by modifying variable B4_7 from numerical data to dichotomous data, with “strongly disagree” and “disagree” being 0 and “agree” and “strongly agree” being 1. Eventually, the constructed model and its logical network can be presented as follows (Figure 1):

\[ WildConsProhibi \sim \alpha + Gender + Age + Education + Income + GoodDiversityLoss + EconomicGrowthLoss \]

![Logical network of the simulated model.](http://direct.mit.edu/dint/article-pdf/3/4/578/1968604/dint_a_00110.pdf)
The bayesvl R package was utilized to perform the data analysis due to its user-friendly operation, eye-catching graphics, and integration of the Monte Carlo Markov Chain (MCMC) technique [36, 37]. All the parameters’ prior distributions were set at normal distribution (0,10), or “uninformative” distribution. The simulation was operated on R Studio (version 4.1.0) using four Markov chains and 5,000 iterations, 2,000 of which were for the warm-up process. Before constructing and fitting the model in R, the following code snippet was employed to prepare necessary resources:

```r
# Data preparation
data1<-read.csv("C:/Users/.../Data_535 (cleaned).csv", header = TRUE, stringsAsFactors = TRUE)
data1$WildConsProhibi<-data1$B4_7
data1$Gender<-data1$F1
data1$Age<-data1$F2
data1$Education<-data1$F5
data1$Income<-data1$F7
data1$GoodDiversityLoss<-data1$B3_4
data1$EconomicGrowthLoss<-data1$B3_5

require(dplyr)
data1$WildConsProhibi <-
  case_when(
    data1$WildConsProhibi %in% c("1","2") ~ 0,
    data1$WildConsProhibi %in% c("3","4") ~ 1
  )

keeps<-c("Gender","Age","Education","Income","WildConsProhibi","GoodDiversityLoss","EconomicGrowth Loss")
data1<-data1[keeps]
data1<-na.omit(data1)

# Package loading
library(bayesvl)
library(cowplot)
```
Then, we started to construct and fit the model:

```r
# 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 one of the fundamental steps. The diagnosis can be performed using two basic statistics: effective number 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 are reliable. Here, all the parameters' n_eff and Rhat values meet the basic criteria.

| Parameters               | Mean (μ) | Standard deviation (σ) | n_eff | Rhat |
|--------------------------|----------|------------------------|-------|------|
| Constant                 | -4.36    | 2.11                   | 6241  | 1    |
| Gender                   | 0.78     | 0.65                   | 7921  | 1    |
| Age                      | 0.00     | 0.03                   | 8647  | 1    |
| Education                | 0.63     | 0.42                   | 7153  | 1    |
| Income                   | 0.15     | 0.25                   | 6942  | 1    |
| GoodDiversityLoss        | 0.87     | 0.44                   | 7121  | 1    |
| EconomicGrowthLoss       | 0.98     | 0.46                   | 7152  | 1    |
Using the diagnostic statistics solely is not sufficient, but visual diagnoses through trace plots, Gelman plots, and autocorrelation plots are also required. The trace plots in Figure 2 show “healthy” and stationary patterns of Markov chains, so the convergence can be confirmed. In the Gelman plots, the shrink factor values drop rapidly to 1 during the warm-up period (before the 2,000th iterations), while the autocorrelation levels in autocorrelation plots also decline to 0 after a certain lag (Figures A1 and A2). Both signals indicated by Gelman and autocorrelation plots imply that the Markov chain central limit theorem is held, so the simulated results are reliable for interpretation.

![Trace plots](attachment:trace_plots.png)

**Figure 2. Trace plots.**

The simulated results show that Gender, Education, and Income positively influenced the probability to agree that illegal wildlife consumption prohibition is a preventive measure of biodiversity loss ($\mu_{\text{Gender}} = 0.78$ and $\sigma_{\text{Gender}} = 0.65$; $\mu_{\text{Education}} = 0.63$ and $\sigma_{\text{Education}} = 0.42$; $\mu_{\text{Income}} = 0.15$ and $\sigma_{\text{Income}} = 0.25$), but Age did not ($\mu_{\text{Age}} = 0.00$ and $\mu_{\text{Age}} = 0.03$). When plotting the probability distributions of parameters, we could see that almost entire distributions of Gender and Education are located on the positive side of the x-axis, indicating reliable positive associations among Gender, Education, and WildConsProhibi.
As for *Income*, the certain proportion of the distribution still lies on the negative side, so its positive association with *WildConsProhibi* was 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 the agreement that wildlife consumption prohibition is a preventive measure. Specifically, respondents thinking that the loss of daily product variety and loss of economic growth were more likely to consider wildlife consumption prohibition a preventive measure ($\mu_{\text{GoodDiversityLoss}} = 0.87$ and $\sigma_{\text{GoodDiversityLoss}} = 0.44$; $\mu_{\text{EconomicGrowthLoss}} = 0.98$ and $\sigma_{\text{EconomicGrowthLoss}} = 0.46$). In Figures 3A and 3B, their probability distributions are almost completely located on the positive side of the $x$-axis, implying the high reliability of the associations.

![Figure 3](http://direct.mit.edu/dint/article-pdf/3/4/578/1968604/dint_a_00110.pdf)

**Figure 3.** Probability distributions of posterior coefficients (A–Interval plot, B–Density plot).
For plotting the above figures, the following code snippet was used:

```r
# 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 data set provides resources for studying important aspects of the interactions between urban residents and biodiversity-related concepts, which are currently lacking in the literature.

Besides the stringent quality-check process, the data set was also employed to examine the associations between the agreement with illegal wildlife consumption and perceived negative impacts of biodiversity loss for further validation. The results show that respondents who perceived more negative effects of biodiversity on economic growth and their daily used product diversity would be more likely to agree with illegal wildlife consumption prohibition. This finding is aligned with the Mindsponge mechanism, which stipulates that an individual's perceptions towards a specific matter are influenced by their subjective cost-benefit judgement towards that matter [38, 39, 40]. Due to the consistency with the theoretical assumption, the data set can be deemed reliable to study the socio-psychological aspects of the relationship between urban humans and biodiversity-related concepts.

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

Secondly, based on the current data set, researchers can also investigate the interactions of urban residents with biodiversity-related concepts in multiple green spaces at home, neighborhood, urban public park, and national park. This can help enrich the literature in both sustainable urban development and biodiversity conservation. For example, planting and pet keeping behaviors might be associated with the willingness to support planting projects in the neighborhood and public parks. Moreover, the frequency of visiting national parks might be predicted by the biodiversity perceptions of urban residents, which provides more insights for social marketing campaigns to attract more visitors. The increasing influx of visitors might help generate sustainable finance for biodiversity conservation in national parks and preservation in urban public parks [29, 30].

Additionally, the current data set helps reduce the cost of doing science for researchers in developing countries with similar characteristics to Vietnam [41]: high urbanization rate and high level of biodiversity (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 data set to develop new hypotheses and test their assumptions regarding the relationships between urban humans and biodiversity-related concepts [42]. Making the data set open also enhances transparency and facilitates open review and dialogue among researchers [43].

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

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CONFLICT OF INTEREST

The data set was designed and collected for the author’s dissertation research project.
Multifaceted Interactions between Urban Humans and Biodiversity-related Concepts: A Developing-country Data Set

DATA AVAILABILITY STATEMENT

The responses of 535 participants on the multifaceted interactions between urban humans and biodiversity were saved as “Data_535 (cleaned).csv” and deposited in 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, which was saved as “Data description.xlsx”, was also included in the same repository. All information related to participants’ personal contacts was excluded for the sake of confidentiality.

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APPENDIX A

Figure A1. Gelman plots.
Multifaceted Interactions between Urban Humans and Biodiversity-related Concepts: A Developing-country Data Set

Figure A2. Autocorrelation plots.
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