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Research Article/ Review

Land use changes in Vietnam: Implications for sustainable urban development

Firstname Middle Surname 1\*

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**Abstract:** The abstract should succinctly summarize the essential elements of the research, clearly articulating the purpose, methodology, key findings, and significance of the study. The abstract must not exceed 200 words and should be self-contained, enabling readers to quickly understand the scope and relevance of the research. Begin with a concise statement of the research objectives or hypotheses. Briefly describe the methods and approaches employed, highlighting any innovative techniques or interdisciplinary strategies used. Summarize the key results clearly and precisely, indicating the main contributions to knowledge within sustainable urbanism, urban resilience, environmental sustainability, or related fields. Conclude with a brief statement of the broader implications or potential applications of the findings. Avoid citations, references, or undefined abbreviations in the abstract. The language should be professional, clear, and accessible, aimed at an international readership encompassing academics, policymakers, and practitioners from diverse disciplines related to resilient urban planning and sustainable design.

**Keywords:** Include 5-6 keywords that accurately reflect the central themes and content of the article, aiding discoverability and indexing. Keywords should be concise, specific, and relevant to sustainable urbanism, urban resilience, environmental sustainability, socio-ecological systems, spatial planning, and related areas.

Highlights:

* Provide 3-5 bullet points clearly summarizing the primary contributions and key insights of the research. Highlights should succinctly emphasize the importance, novelty, and impact of your work within the fields of resilient urbanism and sustainable design. Each bullet should be concise, informative, and easily comprehensible to a broad audience.
* Up to 85 characters.
* Up to 85 characters.

1. Introduction

The introduction section should clearly establish the context, relevance, and significance of the research topic within sustainable urbanism and resilient design. Begin by briefly outlining the current state of knowledge and identifying existing research gaps or challenges that the study aims to address. Clearly state the primary objectives, research questions, or hypotheses guiding your research. Provide an overview of the methodological approach, highlighting any unique or innovative aspects. Briefly summarize the structure and organization of the article to guide readers through the content, emphasizing the relevance and expected contribution of the research to the broader discourse on sustainable urbanism, urban resilience, and related interdisciplinary fields.



**Figure 1.** The location map of City city in AAA province and the YYYYY region

2. Literature Review

The literature review should critically examine relevant existing literature, establishing a coherent context for the research. Begin by clearly defining the scope and boundaries of your review, emphasizing key themes, theories, and previous findings in sustainable urbanism, urban resilience, and related areas. Organize your review thematically or chronologically, ensuring a logical flow of ideas. Identify gaps, inconsistencies, or emerging trends that justify your research focus. Use clear, concise language to synthesize information, and ensure all citations conform strictly to the APA 7th edition citation format. Accurate and consistent citation of sources enhances credibility and allows readers to follow up on referenced studies effectively.

3. Materials and Methods

To achieve the mentioned research purpose, it is first necessary to recognize sustainable planning as an overarching goal, including ecological, economic, social, and cultural sustainability. To achieve that goal, there is a need to identify land use changes and the landscape structure of the research area; furthermore, characteristics of economic, social, and cultural nature need to be clarified.

**3.1. Subtitle**

To achieve the mentioned research purpose, it is first necessary to recognize sustainable planning as an overarching goal, including ecological, economic, social, and cultural sustainability. To achieve that goal, there is a need to identify land use changes and the landscape structure of the research area; furthermore, characteristics of economic, social, and cultural nature need to be clarified.

**Table 1.** tile of table format should be

|  |  |  |
| --- | --- | --- |
| **No.** | **Layers** | **Type** |
| 1 | Urban area | Bbbbbb |
| 2 | Water network | Water surface |
| 3 | Aquaculture |
| 4 | Landscape | Forest |
| 5 | Rice-growing land |
| 6 | Grass-growing land |
| 7 | Other agricultural lands |
| 8 | Wetland |
| 9 | Vacant land |

The data for a water network in the city was extracted from the Landsat 5TM image of the years 1990 and 2006 and the Landsat 8 OLI image of the year 2020. The Landsat images of these years were used to calculate the MNDWI (modified normalized difference water index). The water surface was identified as MNDWI > -0,09. The post-classification results were converted to vector form and corrected the confusion of rice paddies with other land types. The MNDWI formula for Landsat image sources is shown below:

Of which:

is a band with a wavelength of 0.52-0.60 µm (band 2) for Landsat 5 TM and 0.53-0.59 µm (band 3) for Landsat 8 OLI;

is a band with a wavelength of 1.55-1.75 µm (band 5) for Landsat 5 TM and 1.57-1.65 µm (band 6) for Landsat 8 OLI.

The change assessment matrix was used to evaluate the volatility of land cover/green space in City in the period 1998–2020. Table 2 shows the structure of the volatility matrix, in which the columns represent the area reduced by conversion to other land cover types, while the rows represent the area increased by other land use types converted over a period. The cells aligned diagonally represent the unchanged portion of land cover types during the period.

**Table 2.** Structure of change matrix (Unit: ha)

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Types** | **Code** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **Changes decrease** |
| Construction land | 1 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |  |
| Rice-growing land | 2 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| Agricultural land | 3 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 |
| Grass-growing land | 4 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 |
| Vacant land | 5 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 |
| Forest | 6 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 |
| Wetland | 7 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 |
| Water surface | 8 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
| Aquaculture | 9 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 |
| **Changes increase** |  | | | | | | | | | |

**3.2. Economic, social and cultural characteristics**

The economic and socio-cultural characteristics of City were collected and analyzed based on multi-source data from relevant agencies of local government, Southern Institute of Construction Planning (SISP), and general planning data of City City in 2019. Also, other data sources were collected through field surveys and in-depth interviews.

(1) Field survey

Based on the land use map combined with the general planning map of City City (2019), we conducted a field survey to examine and establish the overall view of each planned area; at the same time, we also reassessed the physical and environmental conditions of these areas. We surveyed three areas from north to south including: the rice growing area northeast of the city, the city center, and the fruit growing area southeast of the city and islets. The waterway survey was used to understand the real landscape of Tien River, City River, Dinh Trung River, and the vast water network of the fruit growing area in the southeast. The survey was conducted at two different times: the rainy season and the dry season, with the purpose of understanding flood levels and the livelihood of rural residents when water levels rise.

(2) In-depth interviews

The subjects of in-depth interviews were SISP’s urban planning specialists and staff in the urban management department of City City (Table 3). Each interview session lasted 30 minutes, with questions relating to agricultural landscape, waterfront city design, urban flood control and ecosystem conservation. The interviews also focused on the general planning vision of City City (2019) to understand the goal of urban sustainability development. Moreover, some lecturers in the field of sociology at AAA University were interviewed to further understand how farmers are aware of flood and “live on the water”. The research also explores changes in people’s socio-economic life under previous and current conditions through interviews with the local that includes one local commune-level administrator.

**Table 3.** Demographic information participating in interview

|  |  |  |
| --- | --- | --- |
| ***Interview subject*** | | ***Number of subjects*** |
| ***Specialists*** | *SISP* | *2 (2M)* |
|  | *Staff in the urban management department of City city* | *2 (1M, 1F)* |
|  | *Lecturers of AAA University* | *2 (1M, 1F)* |
| ***Local people***  ***(15 wards/communes)*** | *Local-level administrators (e.g., chairman/ vice chairman of wards or communes)* | *15 (12M,3F)* |
| *Local residents* | *15 (9M, 6F)* |

4. Results

* 1. **Changes in land use of City in the period 1990-2020**

4.1.1. *Expansion of urban land in the period 1990-2020*

The urban area of City has undergone a marked development closely associated with the areas near the water network surrounding the city, especially the expansion of construction lands in the eastern center (Figures 2 and 3). Figure 4 shows the situation of land use/land cover in City in 1990, which showed scattered construction lands and a small urban cluster in the eastern center. From 1990 to 2006, urbanization began to appear, characterized by the expansion of construction land with an average increase of 47.5 ha per year; 94% of the expanded land was converted from other agricultural lands (Table 4). The period 2006–2020 showed an average increase of 43,5 ha per year; 20% of the expanded land was converted from rice-growing lands, while 75% came from other agricultural lands (Table 5). In terms of space, the urban area developed strongly in the eastern center and formed a line along the hydrological network.

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| *(a)* | *(b)* | *(c)* |

**Figure 4.** Land use/land cover status in City in 1990 (a), 2006 (b), and 2020 (c)

**Table 4.** Land use/land cover change matrix in City in the period 1990-2006

Unit: ha

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Types** | **Construction land** | **Rice-growing land** | **Other agricultural lands** | **Grass-growing land** | **Vacant land** | **Forest** | **Wetland** | **Water surface** | **Aquaculture** | **Changes decrease** |
| **Construction land** | 0.00 | 0.63 | 2.16 | 0.00 | 0.27 | 0.00 | 0.09 | 0.54 | 0.54 | 4.23 |
| **Rice-growing land** | 18.18 | 0.00 | 157.05 | 0.54 | 2.34 | 0.27 | 1.89 | 1.80 | 0.99 | 183.06 |
| **Other agricultural lands** | 714.42 | 2483.10 | 0.00 | 5.94 | 13.14 | 3.96 | 20.61 | 81.18 | 23.22 | 3345.57 |
| **Grass-growing land** | 0.00 | 0.99 | 0.54 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.53 |
| **Vacant land** | 0.00 | 1.62 | 3.24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 4.95 |
| **Forest** | 0.36 | 4.05 | 5.76 | 0.00 | 0.00 | 0.00 | 0.00 | 0.18 | 0.00 | 10.35 |
| **Wetland** | 1.08 | 27.18 | 8.91 | 0.00 | 0.00 | 0.00 | 0.00 | 0.18 | 0.27 | 37.62 |
| **Water surface** | 25.56 | 67.86 | 150.48 | 0.00 | 1.98 | 1.17 | 6.03 | 0.00 | 49.50 | 302.58 |
| **Aquaculture** | 0.63 | 0.81 | 1.80 | 0.00 | 0.00 | 0.00 | 0.09 | 4.86 | 0.00 | 8.19 |
| **Changes increase** | 760.23 | 2586.24 | 329.94 | 6.48 | 17.73 | 5.40 | 28.71 | 88.83 | 74.52 | 3898.08 |
| **Pure changes** | 756.00 | 2403.18 | -3015.63 | 4.95 | 12.78 | -4.95 | -8.91 | -213.75 | 66.33 |  |

**Table 5.** Land use/land cover change matrix in City in the period 2006-2020

*4.1.2. Changes in landscape layers in the period 1990-2020*

Landscape layers surrounding construction lands in City City include such land use types as forests, rice-growing lands, grass-growing lands, other agricultural lands, wetlands, and vacant lands. In 1990, the majority of land in City was other agricultural land. However, from 1990 on, City experienced a significant transformation and restructuring of the city’s land use (Figure 5).

The period 1990–2006 marked a strong transformation from other agricultural lands to rice-growing lands. The transformation increased the area of concentrated rice production lands, with an average increase of 161 ha per year, mainly distributed in the northern region and belts in the center of City city. Meanwhile, other agricultural lands tended to be gradually converted to construction lands (21%), and rice-growing lands (74%), with an average decrease of 209 ha in the period 1990–2006. In this period, forests and wetlands also tended to decrease in area, but not significantly (Figure 5, Table 4).

The period 2006–2020 marked a sharp decrease in the area of rice-growing lands in the city center. The area was mainly converted to other agricultural lands (89%), as well as other land use types, for example, construction lands and aquaculture. Other landscape layers experienced insignificant changes as well (Figure 5, Table 5).

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| *(a)* | *(b)* | *(c)* |

**Figure 5.** Status of urban lands, landscape, and water network in City in 1990 (a), 2006 (b), and 2020 (c)

**Figure 1.** This is a figure. Schemes follow the same formatting.

**Table 1.** This is a table. Tables should be placed in the main text near to the first time they are cited.

|  |  |  |
| --- | --- | --- |
| **Title 1** | **Title 2** | **Title 3** |
| entry 1 | data | data |
| entry 2 | data | data 1 |

1 Tables may have a footer.

**4.3. Formatting of Mathematical Components**

This is example 1 of an equation:

|  |  |
| --- | --- |
| a = 1, | (1) |

the text following an equation need not be a new paragraph. Please punctuate equations as regular text.

This is example 2 of an equation:

|  |  |
| --- | --- |
| a = b + c + d + e + f + g + h + i + j + k + l + m + n + o + p + q + r + s + t + u + v + w + x + y + z | (2) |

the text following an equation need not be a new paragraph. Please punctuate equations as regular text.

5. Discussion

Authors should discuss the results and how they can be interpreted from the perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

6. Conclusions

This section is not mandatory but can be added to the manuscript if the discussion is unusually long or complex.

**Supplementary Materials:** The following supporting information can be downloaded at: www. https://www.eurogeojournal.eu//xxx/s1, Figure S1: title; Table S1: title; Video S1: title.

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**Data Availability Statement:** We encourage all authors to share their research data. In this section, please provide details regarding where data supporting reported results can be found, including links to publicly archived datasets analyzed or generated during the study. Where no new data were created, or where data is unavailable due to privacy or ethical restrictions, a statement is still required.

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**Appendix A**

The appendix is an optional section that can contain details and data supplemental to the main text—for example, explanations of experimental details that would disrupt the flow of the main text but nonetheless remain crucial to understanding and reproducing the research shown; figures of replicates for experiments of which representative data is shown in the main text can be added here if brief, or as Supplementary data. Mathematical proofs of results not central to the paper can be added as an appendix.

**Appendix B**

All appendix sections must be cited in the main text. In the appendices, Figures, Tables, etc. should be labeled starting with “A”—e.g., Figure A1, Figure A2, etc.

References

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References must be in alphabetical order (including citations in tables and legends) and listed individually at the end of the manuscript. We recommend preparing the references with a bibliography software package, such as EndNote, by using Citation Apps or Plug in such as Endnote/ Mendeley/ ReferenceManager or Zotero to avoid typing mistakes and duplicated references. Include the digital object identifier (DOI) for all references where available.

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Examples:

Anselin, L. (2010). Local Indicators of Spatial Association-LISA. *Geographical Analysis*, *27*(2), 93–115. <https://doi.org/10.1111/j.1538-4632.1995.tb00338.x>

Bartzokas-Tsiompras, A., & Konstantinidou, E. (2023). Visual analytics of graffiti spatial patterns across 30 European city centres. *Environment and Planning B: Urban Analytics and City Science*, *50*(2), 564–568. <https://doi.org/10.1177/23998083221149426>

Dovey, K., & Pafka, E. (2020). What is walkability? The urban DMA. *Urban Studies*, *57*(1), 93–108. <https://doi.org/10.1177/0042098018819727>

Giles-Corti, B., Vernez-Moudon, A., Reis, R., Turrell, G., Dannenberg, A. L., Badland, H., Foster, S., Lowe, M., Sallis, J. F., Stevenson, M., & Owen, N. (2016). City planning and population health: A global challenge. *The Lancet*, *388*(10062), 2912–2924. <https://doi.org/10.1016/S0140-6736(16)30066-6>

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OECD. (2018). *Working Together for Local Integration of Migrants and Refugees*. OECD. <https://doi.org/10.1787/9789264085350-en>

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