

Urban sustainability assessment in Geneva: relevance of the local neighbourhood unit

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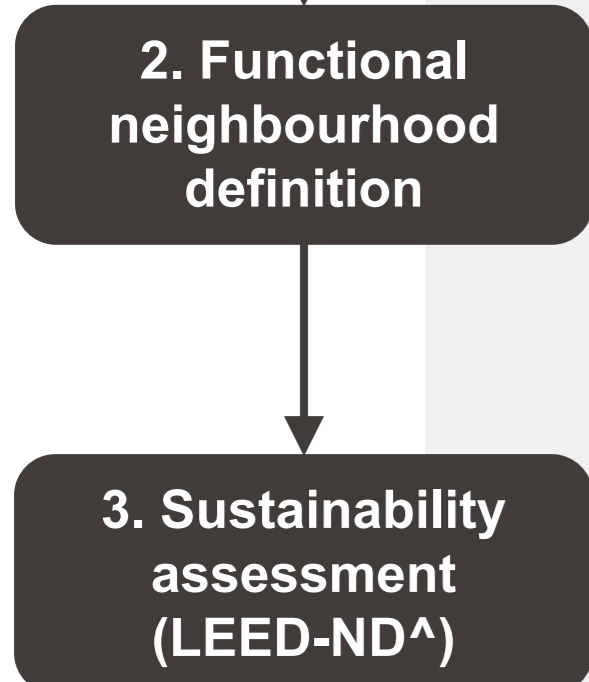
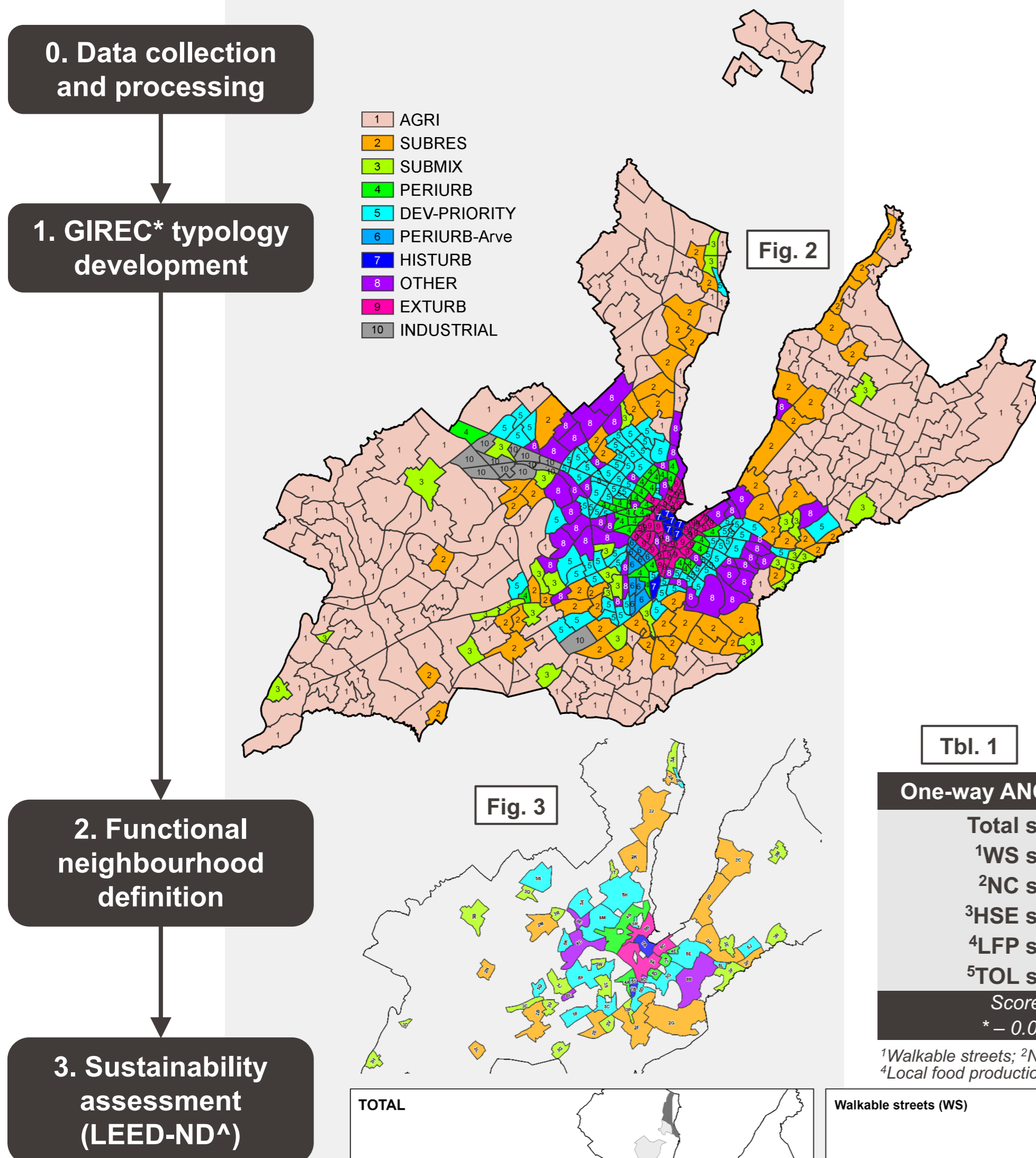
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ABSTRACT

With more and more effort directed to the development and design of sustainable urban systems today, well-designed sustainability assessment tools are indispensable in the pursuit and tracking of urban sustainability goals. Within an urban system, its physical characteristics are heterogeneously expressed across space and distinct neighbourhoods shaped by specific local features are created as a result. Hence, spatially-explicit expression of sustainability across the urban system is expected and should not be ignored. Here, we present an empirical study that explicitly accounts for the spatial heterogeneity of local-scale urban form features and the significance of a neighbourhood in the canton of Geneva, Switzerland. We first (1) established a typology of urban form features, then (2) defined local-scale functional neighbourhood boundaries using well established criteria across the study area. Finally, (3) an assessment of the sustainability of the resulting neighbourhoods was performed, revealing significant differences between the different neighbourhood types across various components of urban sustainability. These results highlight the relevance, and argue for the importance, of incorporating local-scale approaches for more effective urban sustainability assessment to support urban planning and policy making in the transition towards sustainability. (Manuscript submitted for publication)

METHODOLOGY



KEY FINDINGS

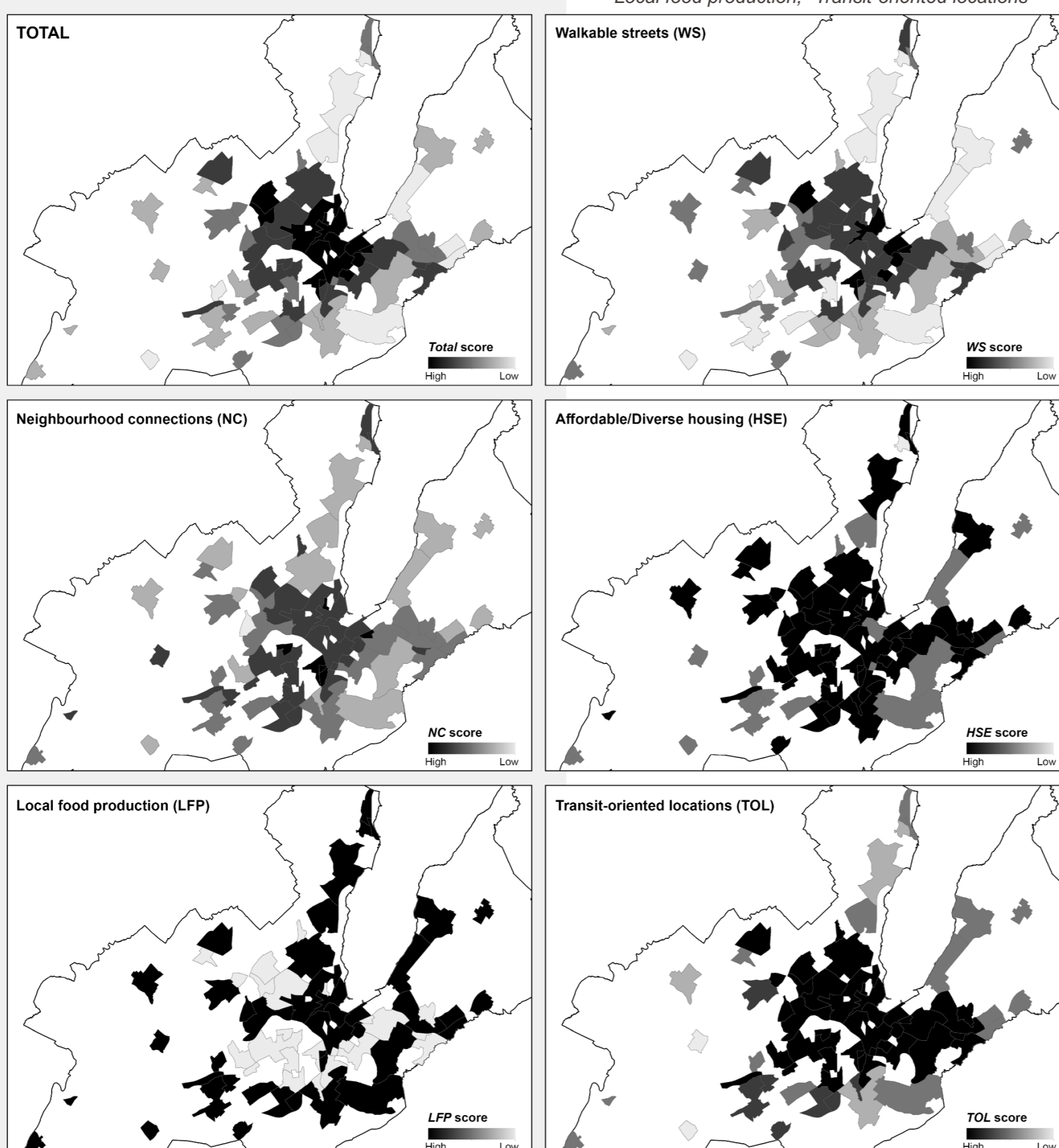
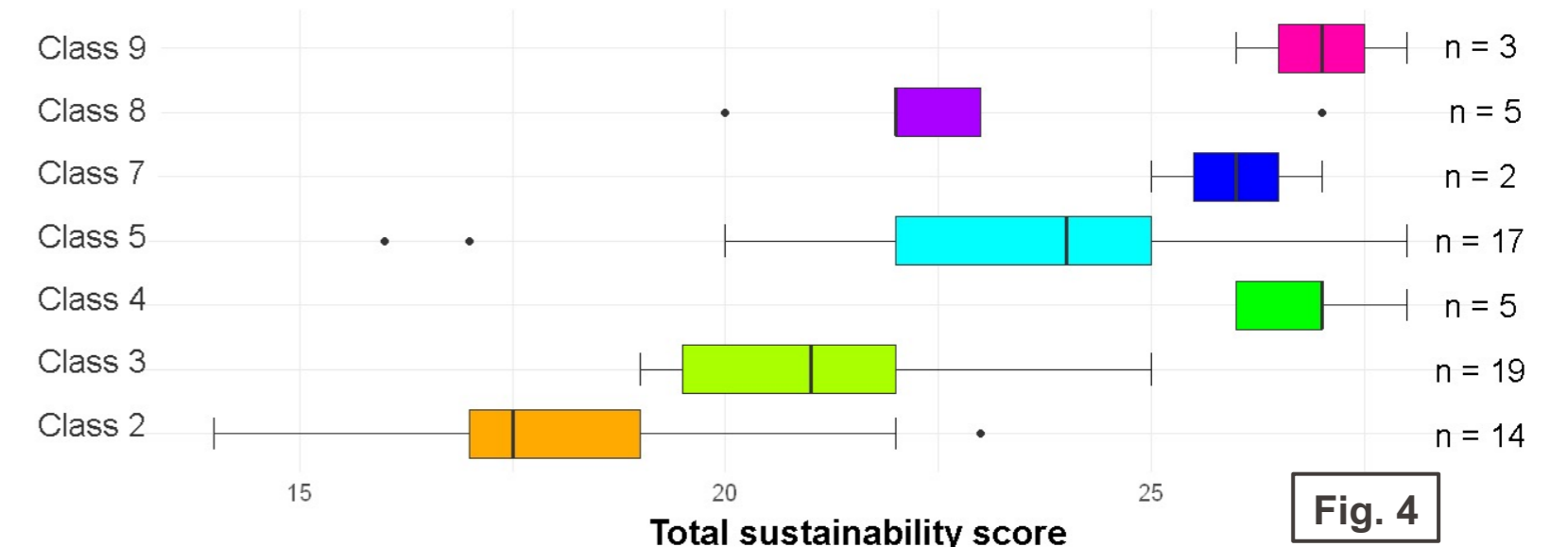
- Considering the physical urban form of Geneva, GIREC units could be clustered and categorised into **ten different classes** (Fig. 2):
 - Class 1** (AGRI) — Agriculture or forest-dominated areas
 - Class 2** (SUBRES) — Suburban residential areas
 - Class 3** (SUBMIX) — Suburban mixed-use residential areas
 - Class 4** (PERIURB) — Peripheral urban core
 - Class 5** (DEV-PRIORITY) — Priority areas for future development
 - Class 6** (PERIURB-Arve) — Peripheral urban core along the river Arve
 - Class 7** (HISTURB) — Historical urban core
 - Class 8** (OTHER) — Other mixed-use areas
 - Class 9** (EXTURB) — Extended urban core
 - Class 10** (INDUSTRIAL) — Mixed-use industrial areas
- 65 functional neighbourhoods** (Fig. 3) were established across Geneva according to the GIREC typology and other theoretical neighbourhood design principles (e.g. Duany and Plater-Zyberk 1994).
 - GIREC units from classes 1, 6, and 10 were not compatible with our definition of functional neighbourhoods and thus excluded.
- Sustainability assessment of the neighbourhoods showed that **neighbourhood sustainability differed across the typology classes** (Fig. 4).
- The total sustainability score and five subcategory scores (mapped in Fig. 5) showed statistically significant differences between their group means across the seven considered classes (ANOVA results in Tbl. 1). In Geneva,
 - Suburban residential (Class 2) areas** were the most important ones to distinguish; their sustainability scores consistently differed from that of other neighbourhoods.
 - Different sub-areas of urban sustainability are **spatially expressed in different ways** (Fig. 5) across the canton, emphasising the role of specific local features and contexts.

Tbl. 1

One-way ANOVA of sustainability scores across classes			
Total score	F = 27.622, p-value = 2.671e-05	***	
¹ WS score	F = 15.651, p-value = 1.385e-10	***	
² NC score	F = 3.3933, p-value = 0.006157	***	
³ HSE score	F = 2.5957, p-value = 0.0269	*	
⁴ LFP score	F = 3.2015, p-value = 0.008767	**	
⁵ TOL score	F = 7.4725, p-value = 5.903e-06	***	

Score is significantly different across classes at:
 * - 0.05; ** - 0.01; *** - 0.001 level of significance

¹Walkable streets; ²Neighbourhood connections; ³Affordable and diverse housing; ⁴Local food production; ⁵Transit-oriented locations



CONCLUSIONS

- Our findings provide empirical evidence supporting the need for spatially-explicit, local-scale perspectives in urban sustainability assessment and research.
- We demonstrated the **feasibility** and **value** of assessing local sustainability based on a typology of physical urban form.
- For Geneva, the loss of information when the spatial heterogeneity of local urban form is not accounted for could **hinder effective decision-making** for urban planning, and potentially lead to the **adoption of less effective, generalised solutions** that are not tailored to the specific sustainability challenges facing Geneva.

FURTHER RESEARCH

- Neighbourhood perceptions and liveability are currently being assessed via local-scale participatory approaches*.
- Together, our eventual findings could contribute to global sustainability and SDG 11 by emphasising the role of the local neighbourhood in sustainable urban development; and by facilitating the operationalisation of sustainability assessment.

REFERENCES

- Pang M, Binder C, and Golay F (2021). *Urban sustainability assessment in Geneva: relevance of the local neighbourhood unit*. Manuscript submitted for publication.
- Duany AM and Plater-Zyberk E (1994). *The Neighborhood, the District and the Corridor*. In: Katz P (ed.) *The New Urbanism: Toward an Architecture of Community*. New York: McGraw Hill, pp. 17–20.
- + **Map-based survey on neighbourhood perceptions and liveability across Geneva**: www.tinyurl.com/ge-quartiers (still active and accepting responses)
- * *Groupe interdépartementale de représentation cartographique*: a statistical unit unique to canton GE (<https://ge.ch/sitg/fiche/7716>).
- ^ *Leadership in Energy & Environmental Design for Neighbourhood Development* (<https://www.usgbc.org/leed/rating-systems/neighborhood-development>)