Transforming Ethiopian Botanical Gardens into Socio-Ecological Systems for Sustainable Land Use and Climate Resilience

Getahun Hassen[1*], Getahun Haile[2], Haile Ketema[2], Mitiku Muanenda[3]
[1] Dilla University, Dept. of Geography and Environmental Studies, Ethiopia
[2] Dilla University, Dept. of Natural Resource Management, Ethiopia
[3] Dilla University, Dept. of Horticulture Ethiopia

Introduction:

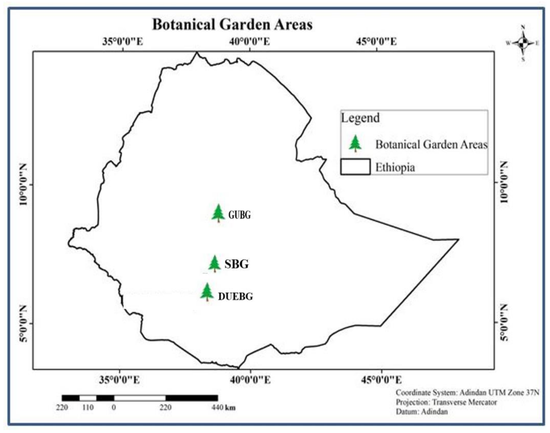
- Botanical gardens support biodiversity conservation, environmental education, and sustainable development.
- In Ethiopia, they link conservation, cultural heritage, and community engagement.
- Their effectiveness is influenced by multiple factors and varies across institutions.

Objectives:

1. Assess performance across governance, infrastructure, research, education, health and culture.
2. Identify predictors of institutional success.
3. Identify resilience-enhancing strategies

Methods:

- Sequential mixed-methods approach.
- Semi-structured interviews with 15 stakeholders.
- Surveys with 300 visitors, staff, and residents.
- Likert scale (1 = poor, 5 = excellent).
- Regression to identify key predictors.



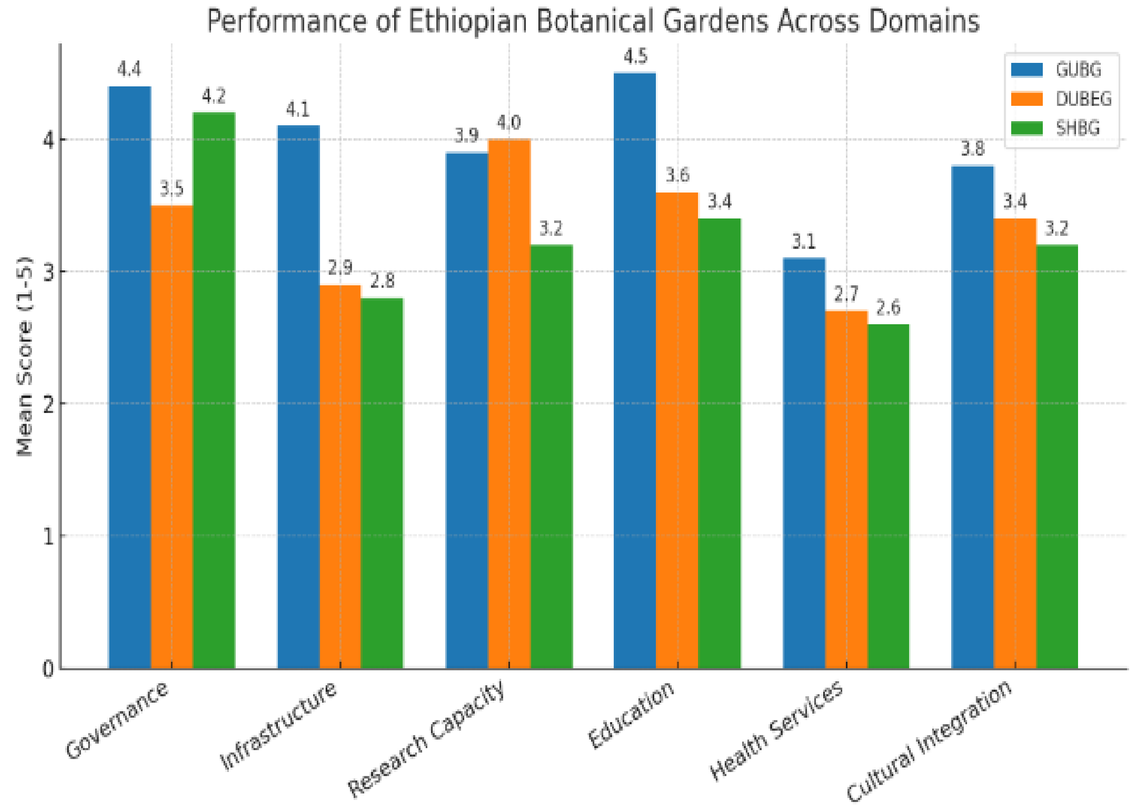
Results:

- Gullele BG: High performance (4.08) in governance, infrastructure, education.
- Dilla Univ. BG: Moderate, strong in research (4.0).
- Shashemene BG: Strong governance (4.2), weak health and infrastructure.
- Common weaknesses: health (2.7), infrastructure (2.9).
- Predictors: Infrastructure adequacy (β=0.32), governance transparency (β=0.24).

Table 1. Performance Scores of Ethiopian Botanical Gardens Across Six Domains

Domain	(GUBG)	(DUBEG)	(SHBG)
Governance	**4.4 ± 0.3**	3.5 ± 0.4	**4.2 ± 0.4**
Infrastructure	**4.1 ± 0.2**	2.9 ± 0.7	2.8 ± 0.6
Research Capacity	3.9 ± 0.4	**4.0 ± 0.5**	3.2 ± 0.5
Education	**4.5 ± 0.4**	3.6 ± 0.6	3.4 ± 0.5
Health Services	3.1 ± 0.5	2.7 ± 0.6	2.6 ± 0.5
Cultural Integration	3.8 ± 0.5	3.4 ± 0.6	3.2 ± 0.6
Overall Mean	4.08 (High Performance)	3.35 (Moderate Performance)	3.23(Moderate Performance)

Keywords: *Biodiversity policy | Participatory governance | Institutional innovation | Indigenous knowledge | Environmental education | Sustainable landscapes*



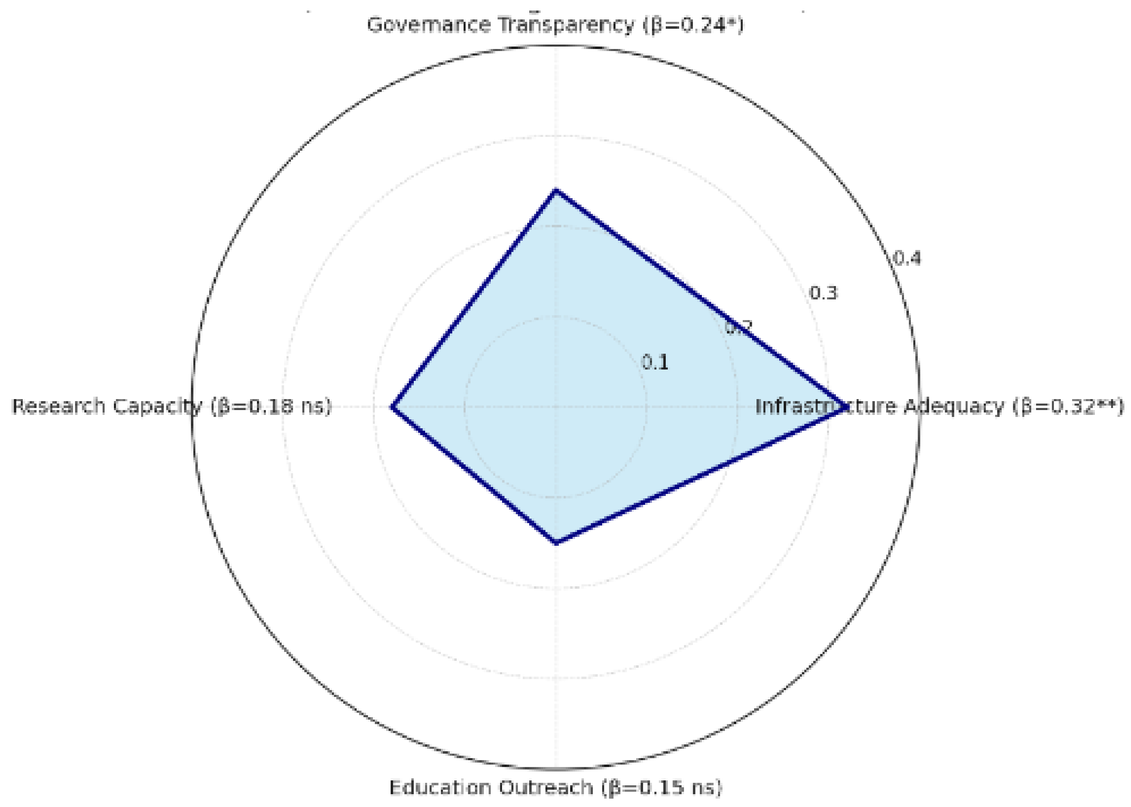


Fig 3: Predictors of Botanical Garden Efficiency (Regression Result)

Conclusion

- ☐ Ethiopian botanical gardens have potential as socio-ecological systems.
- ☐ Gullele performs strongly; Dilla University and Shashemene face infrastructure and service gaps.
- ☐ Success depends on good governance and strong infrastructure.
- ☐ Indigenous knowledge adds cultural and community value.
- ☐ Alignment with national biodiversity and climate strategies is essential.
- ☐ Gardens can become socio-ecological systems for land use, resilience, and community empowerment.

Recommendations:

- Policymakers and stakeholders should invest in and develop Ethiopian BG to enhance their role as socio-ecological systems.
- Gaps in infrastructure and health services must be addressed.
- Adaptive policy frameworks needed.
- Integration of Indigenous knowledge with biodiversity and climate policies.
- Lessons relevant for sub-Saharan Africa.
- Align efforts with Africa's Agenda 2063 sustainability goal

Acknowledgement:

-We acknowledge Dilla University, Leipzig University, DAAD, and the Conference Organizing Team.

-Contact: getahunhassen5@gmail.com OR getahunhassen@du.edu.et