Placing a value on residents' preferences for improved urban green spaces and the services they provide in Addis Ababa, Ethiopia

Dawit W. Mulatu, Jessica Alvsilver and Juha Siikamäki

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Introduction

- Sustainable Development Goal (SDG) 11 intends to “make cities and human settlements inclusive, safe, resilient and sustainable”.

- Healthy urban ecosystems are the foundation for sustainable cities. Improvement of urban green spaces and the services they provide can promote urban sustainability.

- Conserving and restoring ecosystems in urban areas can reduce the ecological footprints of cities while enhancing resilience, health, and quality of life for their inhabitants.

- However, it is difficult to put a number on the benefits of urban green space. There has not been enough research on what people in developing countries want in urban green spaces and how much they are willing to pay for these benefits.

Cont..

- In Ethiopia, urbanization has recently started increasing, especially in Addis Ababa, the capitol and by far the largest city in Ethiopia.

- The current growth trajectory of Addis Ababa is unsustainable due to extensive urban poverty, inadequate housing, severe overcrowding and congestion, and undeveloped physical infrastructure.

- These factors have placed green areas under extreme pressure; consumed the natural and scenic beauty of the landscape; and altered the attractiveness of the city, thereby threatening the ability of urban green areas to perform their basic ecological, social and economic functions.

- Thus, this paper contributes to sustainable urbanization by asking about the value that residents place on potential improvements to urban green spaces in Addis Ababa, Ethiopia.

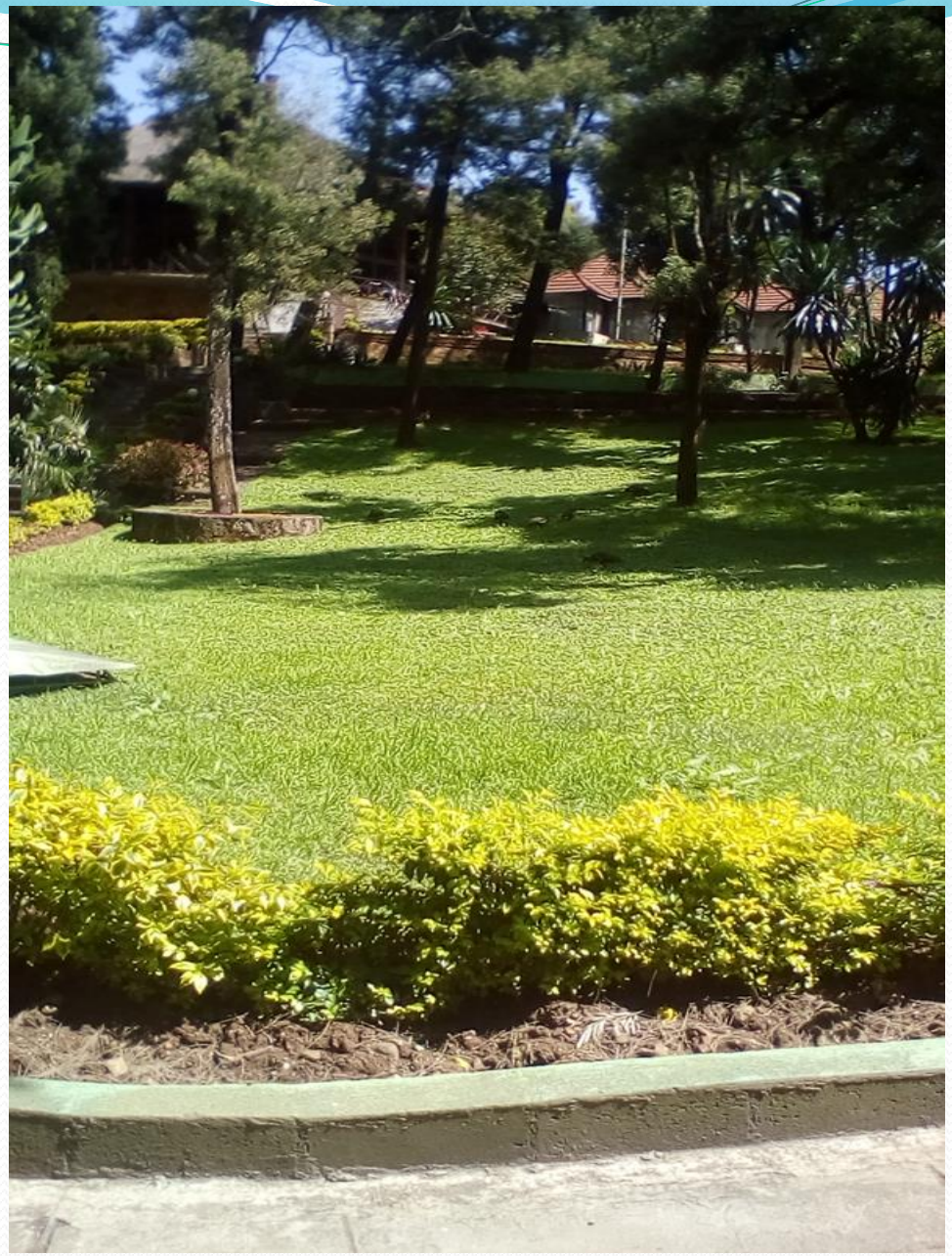
- To place a value on the benefits provided by urban green spaces, we presented residents with scenarios about urban amenities and nature restoration programs.

Addis Ababa

- The city is the diplomatic centre of Africa and international politics. ~>3million

- The new structure plan of the city has identified 41% of the total land use (around 22,000 hectares) for green area development.

- Improved urban green infrastructure services ensure sustainability of the cities and urban areas.



- The unsustainable urban growth rate of Addis Ababa has placed green areas under extreme pressure.
- Threatening the ability of urban green areas to perform their basic ecological, social and economic functions.

- Addis Ababa is a fast growing urban center that is surrounded with problems affecting most cities in developing nations

- Undeveloped physical infrastructure

- Inadequate housing,

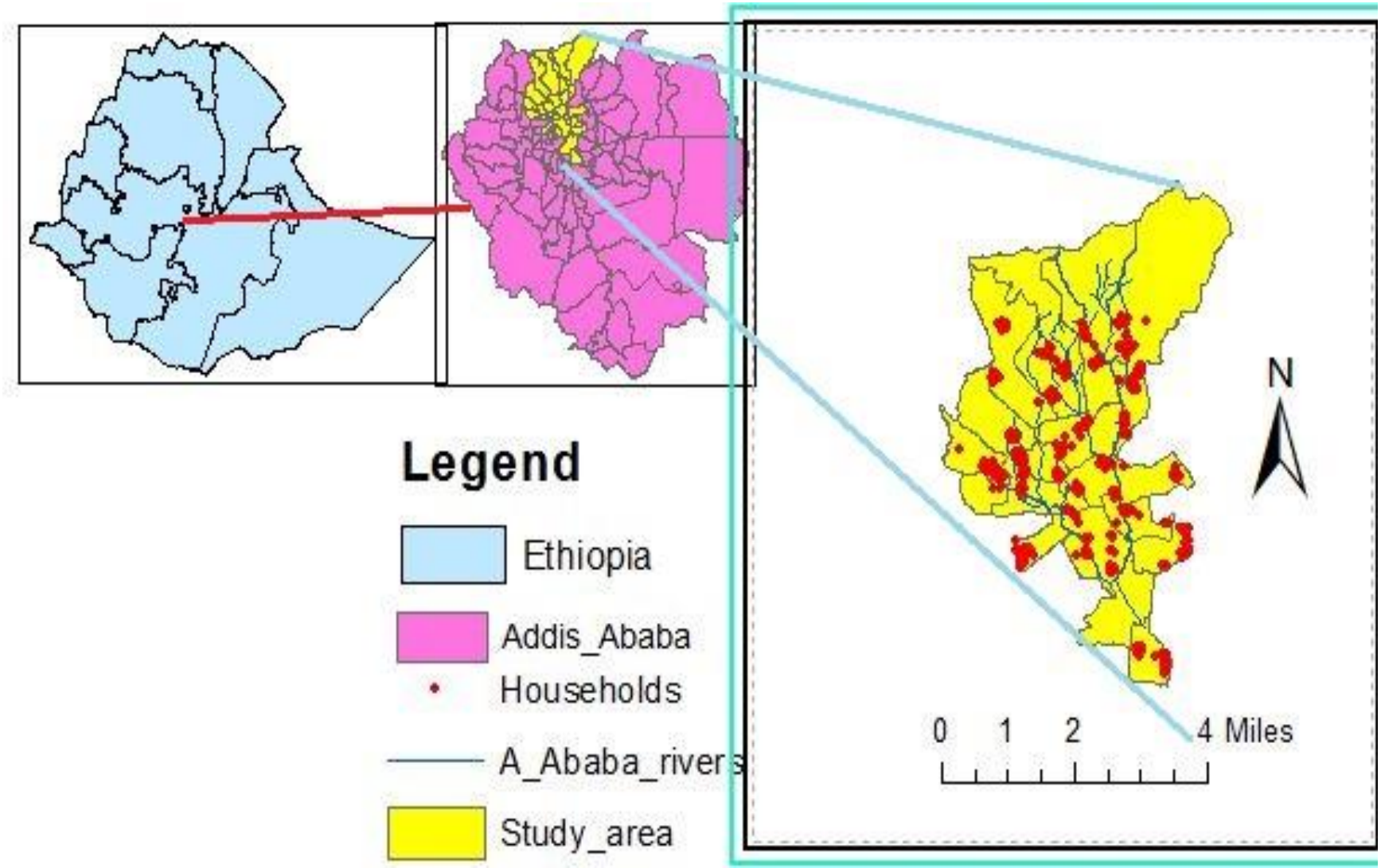
- Extensive urban poverty
- Severe overcrowding and congestion

Methods

- We identified two CE program scenarios:
  - Urban green areas and economic space development program as **“parks, paths and plots” program**
  - Nature restoration and conservation program,
- Indicating recreation, cognitive, economic space development along with cost/payment attribute for the design of the choice experiment.
- We conducted Urban household survey

Survey Approach

- Covering -Five Sub-cities in Addis Ababa
- Woreda (districts or lower Administrative level in Addis Ababa) =21
- Bante Yiketu, Kechene, Kurtume, and Kebena Rivers and Riversides [BKKK] in Addis Ababa, with their tributaries
- The five districts constituted 700 Enumeration Areas
- Out of the 700 EAs, 237 EAs were identified around and within the buffer areas of these major river lines.
- Randomly Selected Enumeration Area=40
- Randomly selected 16 household per enumeration area for interview
- Sample Surveyed Household=640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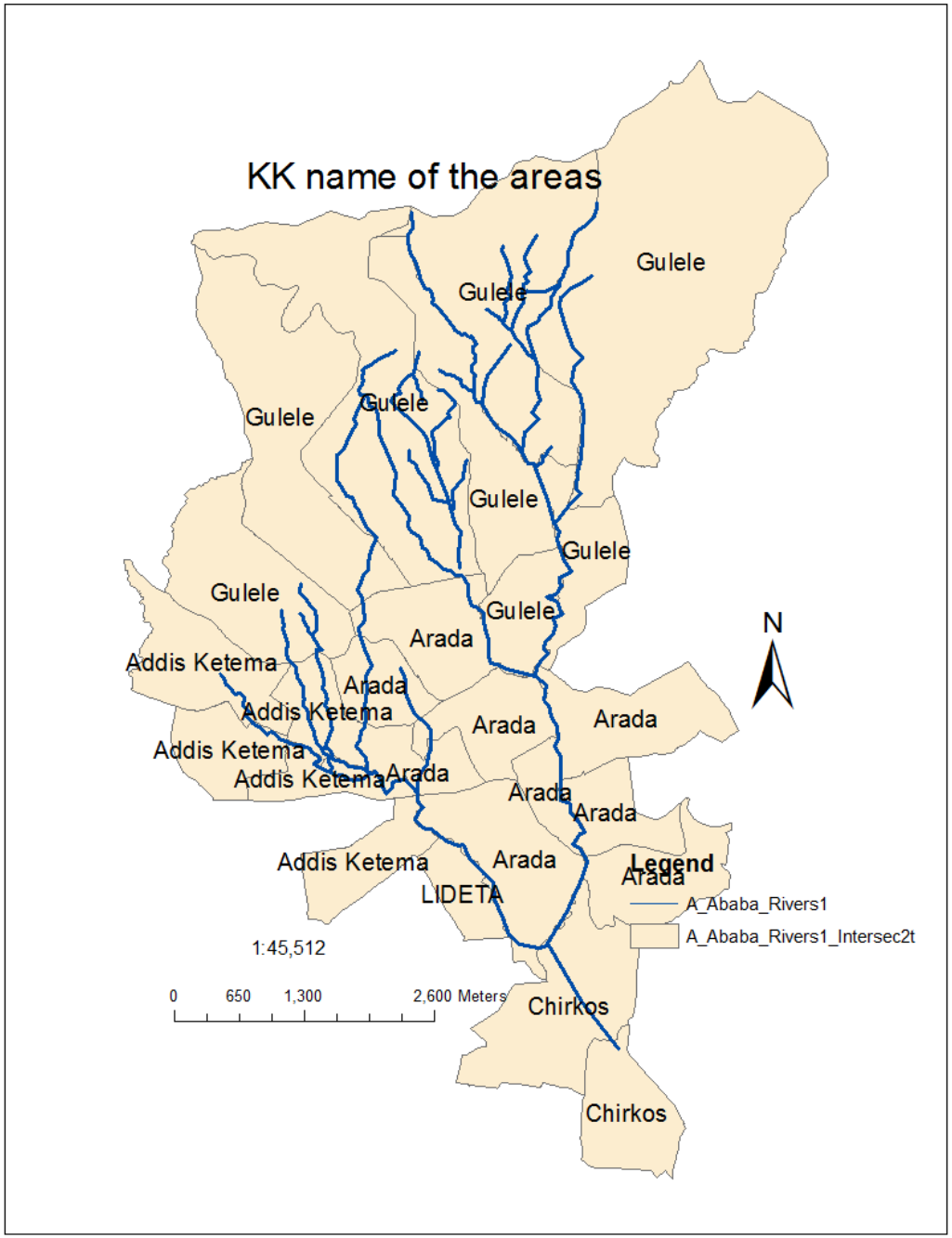
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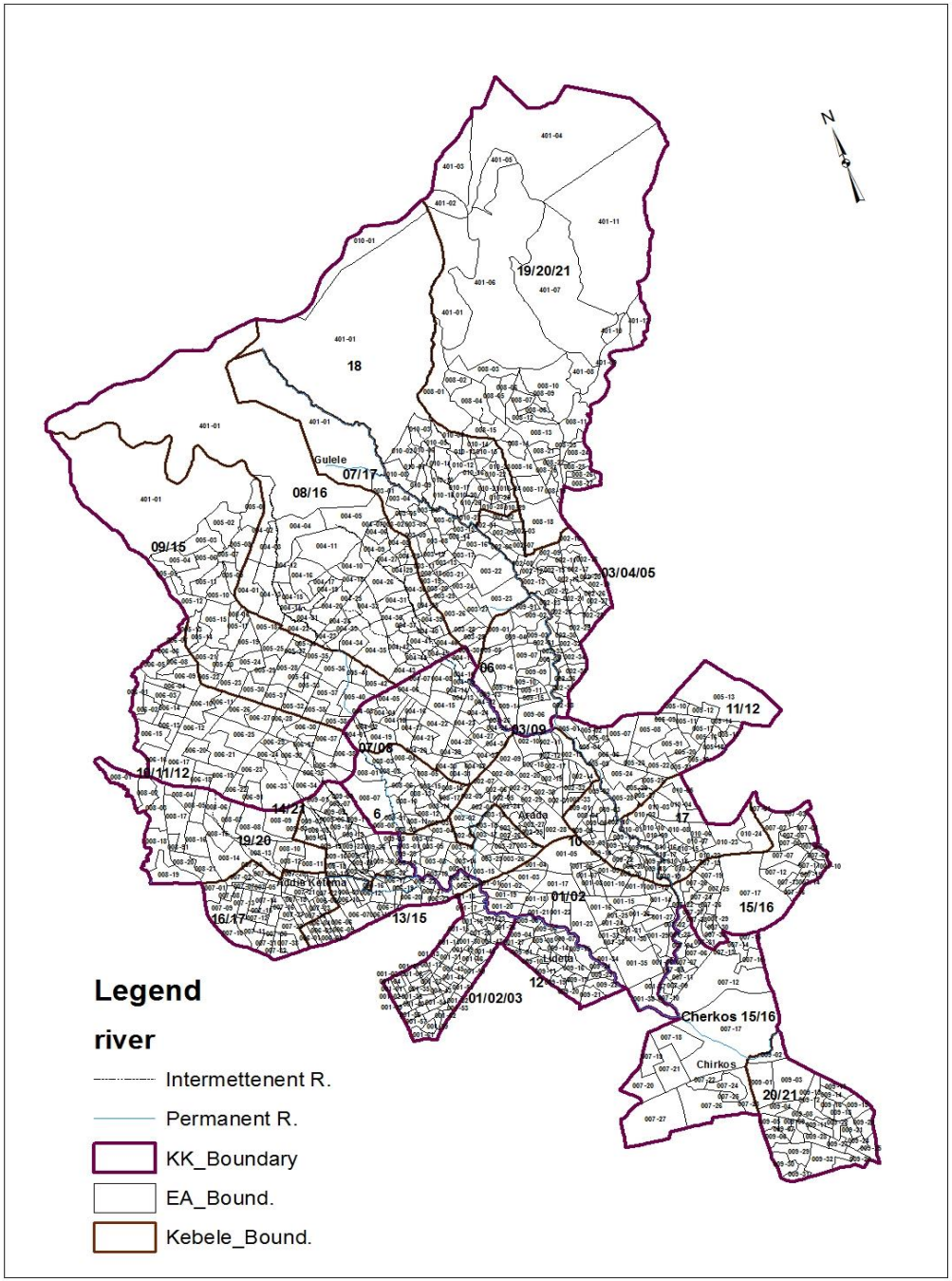
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KK_Boundary
EA_Bound.
Kebele_Bound.

Example of Enumeration Area Map at Gullele Sub-city Sub-district -3




Program I. “parks, paths and plots” program

- Establishing large multi-use park(LMUP) park intended for broader use: Create access for and improvements to areas of urban green spaces for the city **(Presence of the LMUP per district)**
- Neighborhood parks : Located near to home (resident) and having a playing facilities for children, youth and families **(Expected proximity of a park to your home per minute)**
- Availability and access to green routes **(Green route per Km)**
- Urban agriculture practices **(Economic space for urban agricultural practices per Ha)**
- Monetary Attribute **(WTP)**

Sample Choice Card (Program-I)

Urban green amenities attributes	Pictures to be added	Choice 1	Choice 2	Status-quo
Availability of Large Multi-use parks (LMUP) in your district		Two LMUP	One LMUP	No Program
Access to Neighborhood or nearby parks (NHP)		30 Min Walk from home	20 Min Walk from home	
Availability and access to Green Routes for walk and cycling route (per Kilo meter (Km)		5 Km	12 Km	
Accessible land for urban irrigated agriculture practices: (per- Ha)		1100 Ha (About 26%)	450 Ha (About 10%)	
Monetary attribute (Ethiopian Birr per month)		75 Birr	25 Birr	
Choice 1	Choice 2	Status-quo		

CE –Design

- To design the final CE for urban green areas and economic space development program,
- The combination of all attributes and their levels resulted in a full factorial was 216 ($2*3^{3}*4$) different alternatives.
- Given the attributes and their levels, a total of 16 choice sets were constructed using D-efficiency, with the D-error is sufficiently low.
- These choice sets were randomly assigned into two groups where each household had to make eight choices.

Program II: Nature Restoration program

- Similarly for nature restoration and conservation program, two attributes indicating:
  - **Forest conservation and restoration**
  - **Rivers and streams rehabilitation**
  - **Monetary Attribute (WTP)**
- The combination of all attributes and their levels resulted in a full factorial was 36 (3^2*4) different alternatives.
- Given the attributes and their levels presented in, a total of 8 choice sets were constructed using D-efficiency with the D-error is sufficiently low.
- The choice sets consisting of only the main effects and independent of two-factor interactions.
- These choice sets were randomly assigned into two groups where each household had to make four choices.

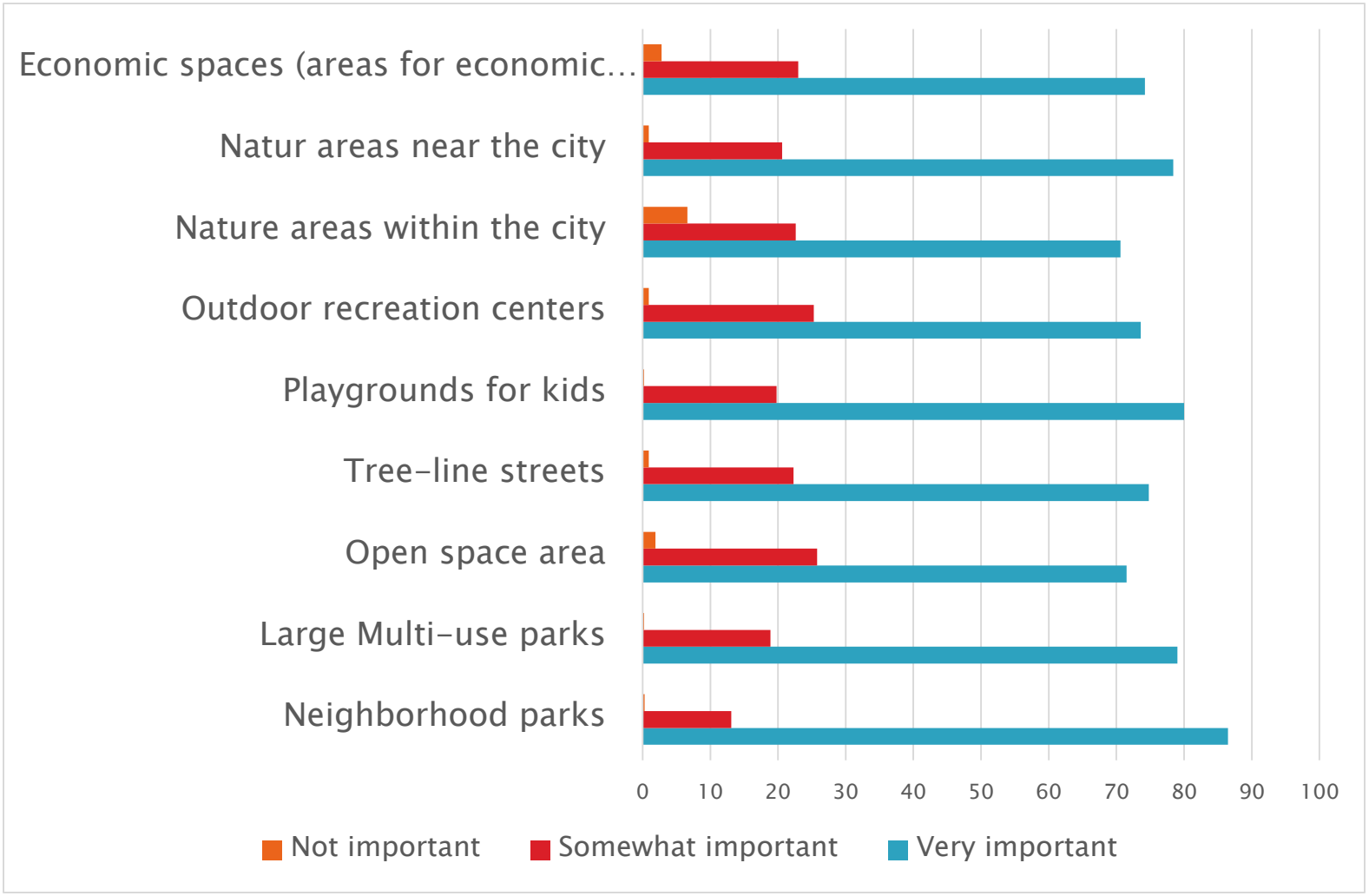
Sample Choice Card (Program-II)

Urban green amenities attributes	Pictures to be added	Choice 1	Choice 2	Status-quo
Forest conservation and restoration		**5% 285 Ha**	**10% 600 Ha**	**No Program**
River restoration		**20% 800 Ha**	**10% 420 Ha**	
Monetary attribute (Ethiopian Birr per month)		**20 Birr**	**10 Birr**	
Choice 1 ☐	**Choice 2** ☐	**Status-quo** ☐		

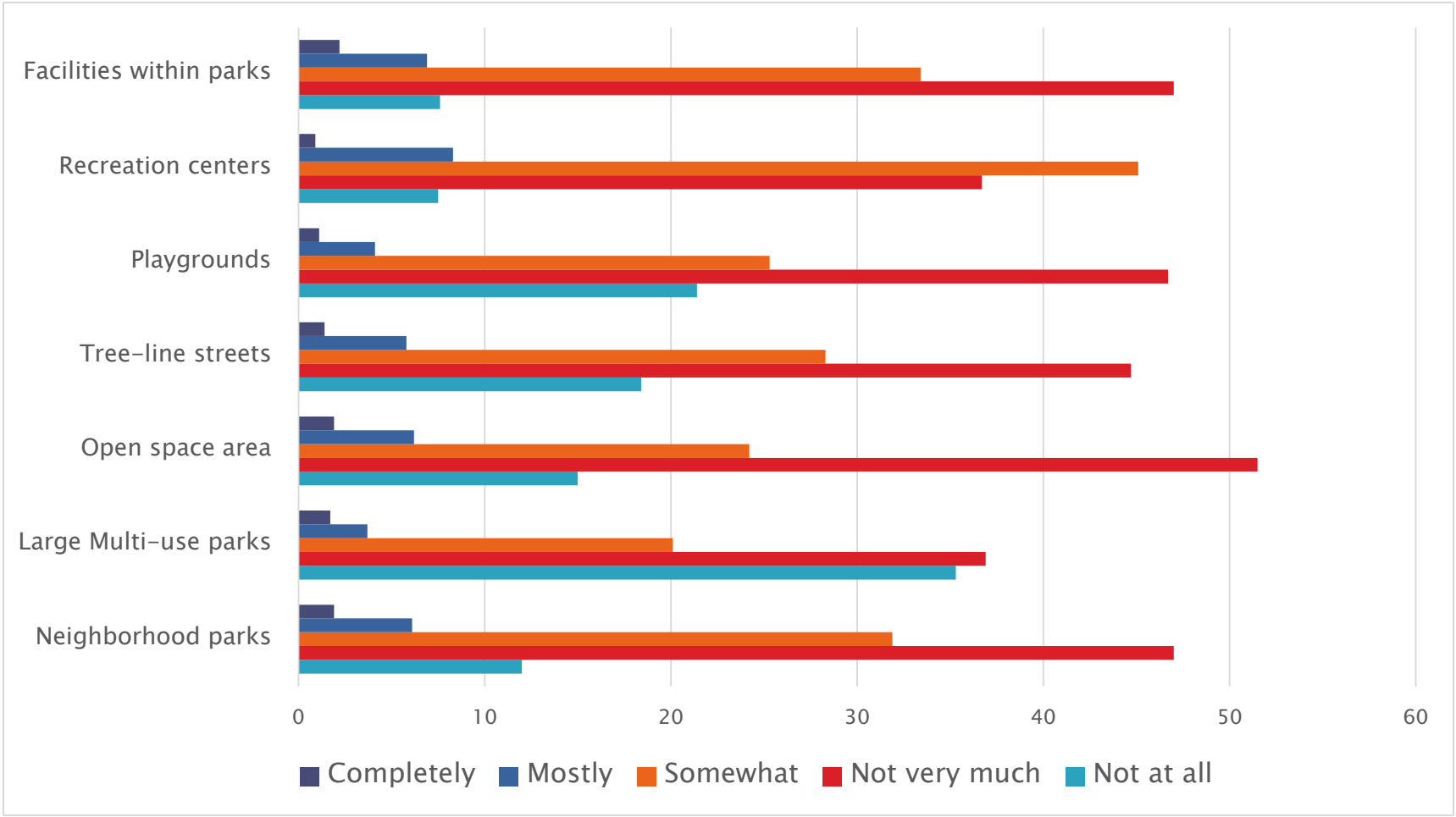
Results

No	Description	Percentage	
1	Head of the household		
	Male	57.3	
	Female	42.6	
2	Marital status		
	Married	49.5	
	Divorced or widowed	34.5	
	Never Married	10.3	
	Married but not living together	4.8	
3	Respondents		
	Head or spouse of the household	72	
	Not head but decision maker of the house	28	
4	Education level		
	Formal education	76.8	
	Informal education (they can read and write)	7.8	
	Illiterate	15.4	
5	Toilet facility		
	Flush toilet	6.6	
	Pit-latrine, private	26.6	
	Pit-latrine, shared	66.4	
6	Houses with main construction materials are wood, mud and cement	90.4	
7	Households that have made renovation work to their house	60	
8	Access to piped water	91	
9	Access to private electricity meter	80	
		Mean	**SD**
10	Family size	4.67	2.11
11	Household member under 18 years old	1.21	1.21
12	Household member over 65 years old	0.33	0.56
13	Separate rooms per household	2.72	1.62

Importance of parks and green areas program in the city



Overall satisfaction of the respondents with the adequacy of green infrastructures in the city



Empirical Results : Hausman Test for IIA assumption

Conditional Logit model for	Choice dropped	Chi.Sq (5) (χ^2)	P-value
Urban green areas and economic space development program	Choice 1	46.71	0.000
	Choice 2	13.38	0.037
	Status-quo	-11.29	
Nature restoration program	**Choice dropped**	**Chi.Sq (3) (χ^2)**	**P-value**
	Choice 1	108.91	0.000
	Choice 2	76.87	0.000
	Status-quo	241.11	0.000

Mixed logit and GLM models estimate for urban green areas and economic space development program

Variables	Mixed logit Model (S.er., P-value) (M1)	Generalized Multinomial Logit (GMNL) Model (S.er., P-value) (M2)
	Mean Parameters	Mean Parameters
ASC	-4.237***	-4.125***
	(0.170, 0.000)	(0.155, 0.000)
Availability of Large multi-use parks (LMUP)	0.474***	1.239***
	(0.053, 0.000)	(0.237, 0.000)
Access to Neighborhood parks (NHP)	-0.029***	-0.085***
	(0.0044, 0.000)	(0.015, 0.000)
Access to Green Route (GR)	0.047***	0.116***
	(0.0064, 0.000)	(0.024, 0.000)
Economic spaces for urban agriculture practices (	0.00062***	0.088***
UAP)	(0.00011, 0.000)	(0.018, 0.000)
Payment/cost	-0.0259***	-0.0268***
	(0.00011, 0.000)	(0.00012, 0.000)
	Standard deviation (SD)	Standard deviation (SD)
Availability of Large multi-use parks (LMUP)	-0.893***	1.674***
	(0.059, 0.000)	(0.261, 0.000)
Access to Neighborhood parks (NHP)	0.068***	0.121***
	(0.005, 0.007)	(0.021, 0.007)
Access to Green Route (GR)	0.065***	0.068***
	(0.011,0.000)	(0.026,0.000)
Economic spaces for urban agriculture practices	-0.0018***	0.1154***
	(0.0001, 0.000)	(0.017, 0.000)
tau	-	-1.952***
		(0.190, 0.000)
Wald Chi2 (4)	-	994.96
Number of respondents	640	640
Number of Obs.	15360	15360

Marginal willingness to pay (Ethiopian Birr/Month) for "parks, paths and plots" program

	Mixed logit Model M1			Generalized Multinomial Logit (GMNL) Model M2		
Program attributes	Ethiopian Birr/Month	Equivalent $ value/month	Equivalent $ value/year	Ethiopian Birr/Month	Equivalent $ value/month	Equivalent $ value/year
Availability of Large multi-use parks (LMUP)/district	18.09*** (2.08; 0.000)	0.80	9.60	46.13*** (8.77; 0.000)	2.02	24.27
Access to Neighborhood parks (NHP)/minute	-1.14*** (0.017; 0.000)	-0.051	-0.61	-3.17*** (0.565; 0.000)	-0.13	-1.56
Access to Green Route (GR)/Km	1.84*** (0.263; 0.001)	0.080	0.96	4.32*** (0.895; 0.001)	0.18	2.27
Economic spaces for urban agriculture practices (UAP)	0.97*** (2.08; 0.000)	0.042	0.51	3.29*** (0.700; 0.000)	0.14	1.68

- About 64 Ethiopian Birr (ETB) per month (about USD 2.28) for availability of a large multi-use park close to their homestead.
- 6.8 ETB per kilometer per month for access to green route.
- For development of spaces for urban agriculture practices, they would pay up to 4.4 ETB per month per percentage improvement.

Mixed logit and GLM model estimates for Nature restoration program

Variables	Mixed logit (S.er., P-value) M1	Generalized Multinomial Logit (GMNL) Model M2
	Mean Parameters	Mean Parameters
ASC	-2.874*** (0.190, 0.000)	-3.01*** (0.178, 0.000)
Forest conservation	0.068*** (0.061,0.000)	0.272** (0.119,0.022)
River-rehabilitation	0.062*** (0.056, 0.000)	0.226** (0.098, 0.021)
Payment/cost	-0.019*** (0.002, 0.000)	-0.020*** (0.002, 0.000)
	Standard Deviation (SD)	Standard Deviation (SD)
Forest conservation	0.084*** (0.008, 0.000)	0.213** (0.018, 0.018)
River-rehabilitation	0.069*** (0.008, 0.000)	0.147** (0.065, 0.024)
tau	-	2.14*** (0.393, 0.000)
Number of respondents	640	640
Number of Obs.	7680	7680
LR Chi2 (2)	103.35	-
Wald Chi2 (4)	-	310.73

Marginal willingness to pay (Ethiopian Birr/Month) for nature restoration

	Mixed logit Model M1			Generalized Multinomial Logit (GMNL) Model M2		
Program attributes	**Ethiopian Birr/Month**	**Equivalent $ value/month**	**Equivalent $ value/year**	**Ethiopian Birr/Month**	**Equivalent $ value/month**	**Equivalent $ value/year**
River-rehabilitation (for a percentage improvement)	**3.23*** (0.412; 0.000)**	**0.14**	**1.68**	**7.64*** (1.185; 0.000)**	**0.33**	**3.96**
Forest conservation (for a percentage improvement)	**3.51*** (0.438; 0.000)**	**0.15**	**1.80**	**7.29*** (1.153; 0.206)**	**0.31**	**3.72**

Residents are willing to pay for urban nature restoration programs, up to 7.64 ETB per month for each percent improvement of urban forest cover.

They prefer urban forest conservation to rivers and streams rehabilitation.

Conclusion

- This study contributes to the limited research in urban ecosystem services valuation using choice experiment approach in developing countries.
- We identified two program scenarios: the urban green areas and economic space development program and the nature restoration and conservation program for the design of the choice experiments.
- Urban ecosystems and the services they provide have substantial impact on human well-being in cities.
- Urban resident have a variety of preferences for improved urban green spaces, including nearby parks, more forest cover, and urban agriculture.
- Evaluating these preferences is essential to prioritizing among alternatives in urban planning, in order to build green cities.
- The findings highlighted that valuation of urban green spaces and nature areas and considering resident's preferences for improved urban ecosystem services are vital to support planning and management efforts on green spaces and urban nature areas.

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