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Review and challenges in the economic valuation of green spaces

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Appendix

Table A1. Examples of studies on the valuation of green spaces

Studies	Location	Type of green spaces	Economic evaluation method	Estimated value
Menkhaus & Lober (1996)	Monteverde Cloud Forest Reserve, Costa Rica	Tropical Rainforest Reserve	Travel Cost Method (TCM)	Average value per visit: US$1,150 per U.S. ecotourist
Mulwa & al. (2018)	Maasai Mara National Park, Kenya	National Park	Individual Travel Cost Method (ITCM)	Consumer surplus: US$115 per visitor per day - Annual recreational value: US$73.076 million - Optimal conservation fee: US$ 86.90 per day
Soe Zin & al. (2019)	Myanmar	Popa Mountain National Park	Travel Cost Method	National visitors spend an average of between $20 and $24 per visit, with a total annual recreational value estimated at between US$16.1 and US$19.6 million (or $916 to $1111 per hectare).

Jaung & Carrasco (2020)	Singapore	Urban protected area (Bukit Timah) and urban recreational park (Jurong Lake Gardens)	Travel Cost Method	Annual recreational benefits are estimated at between S$6.95 and S$9.07 million for Bukit Timah, and between S$54.70 and S$66.81 million for Jurong Lake Gardens.
Menendez-Carbo & al. (2020)	Guayaquil, Ecuador	Urban Park (Malecón 2000)	Individual Travel Cost Method (ITCM)	- Consumer surplus: US$15.72 per person per visit
Mukanjari & al. (2021)	Kruger National Park, South Africa	National Park	Contingent Valuation Method (CVM)	International tourists' WTP: US$216 to US$255 per trip - Aggregate annual WTP: US$79 million to US$94 million - Potential revenue increase: 57% to 61% (US$38 million to US$40 million) per year
Correll & al. (1978)	Boulder, Colorado, USA	Greenbelts	Hedonic Pricing Method	Properties adjacent to greenbelts had an average value of $54,379, while those 3,200 feet away averaged $47,044, indicating a premium of approximately 15.6% for proximity to greenbelts. Additionally, property values decreased by $4.20 for each foot of distance from the greenbelt.

Bolitzer & Netusil (2000)	Portland, Oregon, USA	Open spaces	Hedonic Pricing Method	Proximity to open spaces increases property values by 16-20% for homes located within 1,500 feet of parks or natural areas.
Mahan & al. (2000)	Portland, Oregon, USA	Urban Wetlands	Hedonic Pricing Method	Increasing the size of the nearest wetland by one acre increased a property's value by $24.39. Decreasing the distance to the nearest wetland by 1,000 feet increased a property's value by $436.17. Home values were not significantly influenced by wetland type.
Tyrväinen & Miettinen (2000)	Salo, Finland	Urban Forests	Hedonic Pricing Method	A one-kilometer increase in distance from the nearest forested area leads to an average 5.9% decrease in dwelling market price. Dwellings with a forest view are on average 4.9% more expensive than those without.
Mooney & Eisgruber (2001)	Western Oregon, USA	Treed Riparian Buffers	Hedonic Pricing Method	The study found that while stream frontage increases the value of the mean property by approximately 7%, the presence of a 50-foot treed riparian buffer decreases the sale price by about 3%, likely due to diminished views.
Des Rosiers & al. (2002)	Quebec Urban Community, Canada	Landscaping Features	Hedonic Pricing Method	- High percentage of lawn cover, flower arrangements, and rock plants: Each additional percentage point of cover increases property value by 0.2%. - Presence of a hedge: Adds 3.6% to 3.9% to property value. - Landscaped patio: Adds 12.4% to property value. - Landscaped curbs: Add 4.4% to property value.

Thorsnes (2002)	Grand Rapids, Michigan, USA	Forest Preserve	Hedonic Pricing Method	Vacant residential building lots adjacent to a forest preserve sold at premiums ranging from $5,800 to $8,400, representing 19% to 35% of the lot price.
Morancho (2003)	Castellón, Spain	Urban Green Areas	Hedonic Pricing Method	Proximity to urban green areas increases housing prices. Specifically, a 1% decrease in the distance to the nearest green area results in a 0.14% increase in housing price. Additionally, having a view of a park or public garden can increase property values by approximately 4.4%.
Payton & al. (2008)	Indianapolis/ Marion County, Indiana, USA	Urban forest (tree canopy cover)	Spatial hedonic pricing model	The study found that increased vegetation greenness around a property has a positive and significant effect on housing prices. Specifically, a 10% increase in the NDVI measure of greenness was associated with a 1.4% increase in housing price, holding other factors constant.
Voicu & Been (2008)	New York City, US	Community gardens	Hedonic Regression Model	Community gardens have been found to positively impact neighboring property values, with increases reaching up to 9.4 percentage points within five years of a garden's opening, particularly in economically disadvantaged neighborhoods. This appreciation in property values can result in additional tax revenues of approximately $500,000 per garden over a 20-year period.

Tapsuwan & al. (2009)	Perth, Western Australia	Urban wetlands	Hedonic Property Price Approach	Proximity to wetlands significantly increased property prices. For a property 943 meters away from the nearest wetland (average distance in the study), reducing the distance by 1 meter increased the property price by approximately AU$42.40. Additionally, having an extra wetland within 1.5 km increased the sales price by about AU$6,976. For a 20-hectare wetland, the total sales premium to surrounding properties was estimated at around AU$140 million.
Donovan & Butry (2010)	Portland, Oregon, USA	Street trees	Hedonic Pricing Model	Street trees increased the average sale price of a house by $8,870 and reduced time on market by 1.7 days.
Jim & Chen (2010)	Hong Kong	Neighbourhood parks	Hedonic Pricing Method	Proximity to neighbourhood parks increased property prices by 16.88%, with 14.93% attributed to availability and 1.95% to park view.
Herath & al. (2015)	Vienna, Austria	Urban greenbelt	Hedonic Price Method	Proximity to the greenbelt positively influences apartment prices. A 1% increase in distance from the greenbelt is associated with a decline in property price of approximately 0.13% to 0.26%, indicating a negative rent gradient.
Franco & Macdonald (2018)	Lisbon, Portugal	Tree canopy coverage	Hedonic Pricing Method	A 1 km² increase in tree canopy coverage is associated with a 0.20% increase in dwelling prices, approximately €400 per dwelling.

Black & Richards (2020)	New York, USA	Elevated urban promenade (High Line)	Hedonic Pricing Method	Properties in the immediate vicinity of the High Line saw their value increase by 35.3%
Bottero & al. (2022)	Brisbane, Australia	Urban parks	Spatial Hedonic Pricing Model	The conversion of Victoria Park from a private golf course to public parkland is projected to increase property prices by an average of 3% for properties located within 750 meters of the park.
Bonnieux & Le Goffe (1997)	Cotentin, Lower-Normandy, France	Traditional agricultural and natural landscapes	Contingent Valuation Method	The willingness to pay (WTP) for landscape restoration was estimated at €29 per household annually, highlighting public preference for preserving and restoring traditional landscapes.
Adams & al. (2008)	Morro do Diabo State Park, São Paulo State, Brazil	State Park (Atlantic Rainforest)	Contingent Valuation Method	- Aggregate WTP: US$2,113,548 per year (R$7,080,385/year) - Per hectare WTP: US$60.39/ha/year (R$202.30/ha/year)
He & al. (2017)	Southern Quebec, Canada	Wetlands	Contingent Valuation and Choice Experiment Methods	Households' annual willingness to pay for wetland preservation and restoration is approximately CAD 447 to CAD 465, indicating a total annual value of about CAD 1.49 to 1.55 billion for 400,000 hectares of wetlands, or roughly CAD 3,725 to CAD 3,866 per hectare

Roberts & al. (2017)	Tambopata National Reserve, Peru	National Reserve	Contingent Valuation Method	- Average WTP: US$15 per tourist for a conservation fee - 66% of tourists willing to pay US$10 or more - Potential annual revenue: US$318,000 for park management (based on 2015 visitation data)
Neckel & al. (2020)	Passo Fundo, Brazil	Urban parks (Gare Urban Park)	Contingent Valuation Method	- Mean WTP: R$30.68 - Median WTP: R$16.00 - Aggregate value for maintenance and preservation: R$959,024 to R$1,838,928 annually
Albaladejo-García & al. (2021)	Murcia, Spain	Allotment gardens in degraded peri-urban agroecosystems	Contingent Valuation Method	Households are willing to pay an average of €17.2 per month to own an allotment garden plot, and the value of the project to the population as a whole is estimated at €5.4 per household per month
Amaya & al. (2021)	Yanachaga–Chemillén National Park, Peru	National Park	Contingent Valuation Method and Choice Experiment	- Average WTP: US$0.695 (2.3197 soles) per household annually - Aggregate WTP: Approximately US$6.255 million annually (considering 9 million households in Peru)
Gelo & Turpie (2021)	Kampala, Uganda	New urban park	Contingent Valuation Method	Residents of Kampala were willing to pay an average of $4,728 per household as an entrance fee to use the park.

Birol & al. (2006)	Cheimaditida Wetland, Greece	Wetland ecosystem	Choice Experiment Method	Mean willingness to pay per household for wetland management scenarios: €107.56 for low-impact, €116.49 for medium-impact, and €134.46 for high-impact improvements. Aggregate annual benefits: €335.9 million for low-impact, €363.7 million for medium-impact, and €419.8 million for high-impact scenarios.
Do & Bennett (2009)	Tram Chim National Park, Mekong River Delta, Vietnam	Wetland ecosystem	Choice Modelling	The proposed wetland conservation program has an estimated net social benefit ranging from USD 0.52 million to USD 1.84 million, indicating that its implementation would enhance social welfare
Juutinen & al. (2011)	Oulanka National Park, Finland	National Park	Choice Experiment Method	Visitors' willingness to pay per visit: €10.33 for the current scenario; €18 for an enhanced scenario; potential welfare loss of up to €38 for a degraded scenario.
Kenter & al. (2011)	Solomon Islands	Tropical forests	Participatory Deliberative Choice Experiment	Initial willingness to pay (WTP) for various ecosystem services was approximately 30% of household income. After deliberative interventions, participants were unwilling to trade off key ecosystem services, indicating these services became 'priceless' to them.

Lantz & al. (2013)	Credit River Watershed, Ontario, Canada	Urban/peri-urban wetlands	Discrete Choice Method	Households are willing to pay between $50 and several hundred dollars annually for the conservation of existing wetlands
Dias & Belcher (2015)	Saskatchewan, Canada	Prairie wetlands	Choice Experiment Method	Households are willing to make a one-time payment of CAD 64.73 for increasing riparian area from 5 to 10 meters, CAD 57.56 for an increase in wildlife population, and CAD 104.68 for a decrease in the frequency of boil water advisories.
Kim & al. (2016)	South Korea	Urban living zone forests (street trees, residential parks, small school forests)	Choice Experiment	Metropolitan residents are willing to pay between $56.68 and $76.59 for each 1 m² increase in urban forest, indicating a high value placed on mitigating summer heat island effects
Zhao & Wen (2019)	Beijing, China	Urban forest	Choice Experiment Method	Residents' marginal willingness to pay (WTP) for urban forest attributes: RMB 29.42 for biodiversity, indicating a preference for higher greenery coverage and richer biodiversity.

Bhat & al. (2020)	Dachigam National Park, Jammu and Kashmir, India	National Park	Choice Experiment Method	Visitors are willing to pay an additional ₹302.07 for enhancing the population of endangered species, ₹121.91 for improving the park area, and ₹171.64 for increasing research and education opportunities.
Netusil & al. (2022)	Portland, Oregon, USA	Green roofs	Choice Experiment Survey	Total willingness to pay estimates for a 1-year green roof program range from approximately $202 to $442 per household, translating to $54.4 to $116.8 million for the city of Portland, depending on program characteristics
Xu & He (2022)	Nansha Wetland, China	Coastal wetland park	Choice Experiment Method and Travel Cost Interval Analysis	The total recreational value is estimated at 90.49 million CNY (approximately 13.77 million USD), with per capita non-use value at 116.97 CNY (17.80 USD) and use value at 313.95 CNY (47.79 USD).

Nie & al. (2023)	Beibu Gulf, Guangxi, China	Mangrove wetland	Modified Choice Experiment Model	In 2021, the total value of mangrove wetland ecosystem services in the Beibu Gulf region was estimated at 1.181 billion yuan. Public willingness to pay per capita for enhancing specific ecosystem services was: 53.89 yuan for biodiversity improvement, 47.00 yuan for increased mangrove coverage, 35.46 yuan for water quality enhancement, and 17.29 yuan for landscape appreciation.

Source: authors