

Do Views of Water Bodies Affect Water Consumption?

Author: Robbie Maris; ID: 1504676

Introduction

Freshwater scarcity is a prominent issue globally and we are fast approaching the freshwater consumption planetary boundary (Kummu et al., 2016). Understanding household water consumption behaviour is critical for designing effective water management policy. Here, we analyse whether views of water bodies affect household water consumption in Tauranga (TGA).

Background

There is a large body of literature that shows associations between household characteristics (demographics) and water demand (for a review, see Worthington & Hoffman, 2008). However, one “household characteristic” that may influence water consumption but has received relatively little attention is the views of nearby water bodies. Many researchers have used viewshed analysis to estimate views of water bodies, often to show the effects on property value (e.g. Shultz & Schmitz, 2008). Views of water affect perceptions of landscape character (Brabyn, 2009) and we propose that views of water may also affect the perceptions of water scarcity and the value of water. This may affect water consumption.

Methods

Our methodology consists of three main steps (Fig. 1): (1) using GIS to estimate views of water bodies for TGA properties, (2) compiling these estimates with socio-demographic and consumption data, and (3) estimating the effects of views on water consumption.



Figure 1. Overview of Methods

GIS and Econometric Methods

We estimate views of lakes and the coast for properties in TGA using LINZ's Property Parcels, NZ Coastline and NZ Lake Polygons layers alongside a 24 m global DEM. We clip the property, coastline and lakes layers to the TGA territorial authority. We randomly plot points along the lake boundaries, the coastline and just off the coastline (in case properties have views just beyond the shore). We estimate viewsheds for these points. Using a spatial join, we identify properties whose centres lie within the viewshed for lakes and the coast, respectively (1 = yes, 0 = no). We combine our views results with property and water consumption data from the TGA City council and Statistical Area 1 (SA1) demographic information. We then estimate the effects of views of water bodies on water consumption in a fixed effects semi-log regression model.

Results

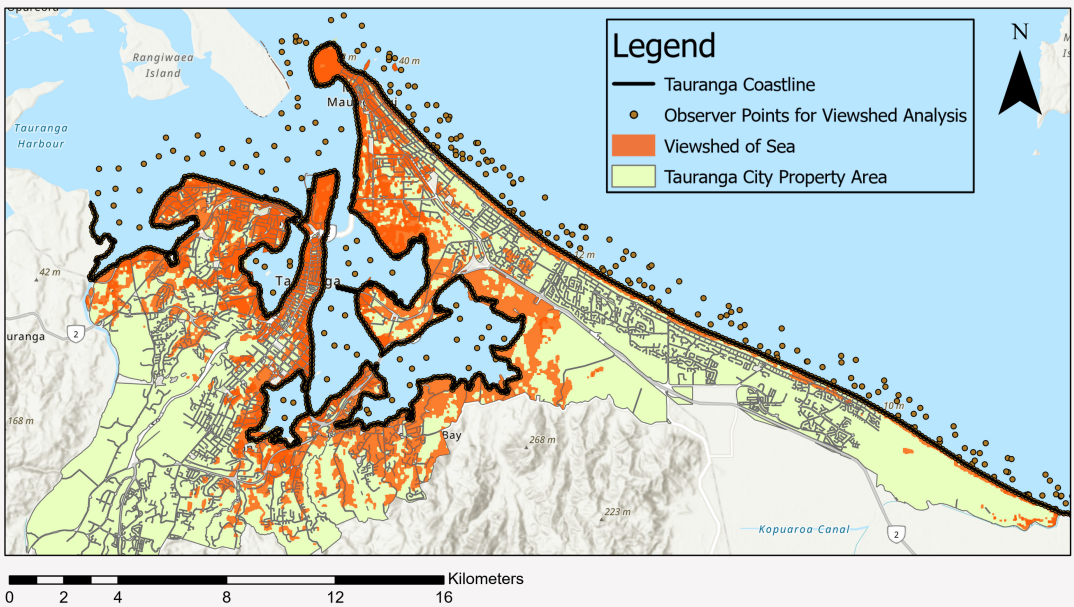


Figure 2. Map of Viewshed of Coast for Tauranga Properties

Table 1. Econometric results for the effects of views on water consumption

	(1) Lake	(4) Coast
Log (Daily Water Use)		
View of water	0.0442*** (0.0125)	-0.0435*** (0.0137)
Full Controls	YES	YES
Observations	155,843	155,843
R-squared	0.085	0.085

Note: Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; Coefficients need to be log-transformed

Results Cont.

We present our initial viewshed results for views of the coast in Fig. 2. For brevity, we do not show the viewshed for lakes. 31.7% of properties had views of lakes and 30.4% had views of the coast. The high proportion of properties with lake views arises because of the many small lakes in the Tauranga area. When we run our fixed-effects models (controlling for SA1 socio-demographics, seasonality and property-level factors), views of lakes increase water consumption by 4.5% and views of the coast decrease consumption by 4.3%. These results hold under several robustness and validity checks.

Discussion

In line with various literature, we propose explanations for our results. We suggest that people living near lakes may believe there is more freshwater than there actually is (availability bias). In believing this, these individuals would have a lower perception of water scarcity and thus consume more water than an equivalent person who doesn't live near a lake. On the other hand, we suggest that views of beautiful bodies of water may increase the intrinsic value people associate with water and reduce water consumption. In TGA, the coastline is internationally renowned for its beauty. Conversely, the lakes are smaller and arguably less appealing. Hence, we suggest these beauty effects could be driving our results for the coast. However, we can't rule out other explanations and future work should investigate these mechanisms further. Future work might also consider different regions and using a higher resolution DEM. Our results indicate that exposure to water bodies could undermine council water conservation campaigns. Water authorities may want to specifically target people living near lakes with their conservation campaigns and interventions.

References

- Brabyn, L. (2009). Classifying Landscape Character. *Landscape Research*, 34(3), 299–321. <https://doi.org/10.1080/01426390802371202>
- Kummu, M., Guillaume, J. H. A., de Moel, H., Eisner, S., Flörke, M., Porkka, M., Siebert, S., Veldkamp, T. I. E., & Ward, P. J. (2016). The world's road to water scarcity: Shortage and stress in the 20th century and pathways towards sustainability. *Scientific Reports*, 6(1), 38495. <https://doi.org/10.1038/srep38495>
- Shultz, S., & Schmitz, N. (2008). Viewshed Analyses to Measure the Impact of Lake Views on Urban Residential Properties. *Appraisal Journal*, 76(3), 224–232.
- Worthington, A. C., & Hoffman, M. (2008). An Empirical Survey of Residential Water Demand Modelling. *Journal of Economic Surveys*, 22(5), 842–871. <https://doi.org/10.1111/j.1467-6419.2008.00551.x>