**Using anonymized mobile data to quantify human-wildlife interactions in protected areas**

Abstract

**1. Introduction**

Cities are rapidly expanding, creating new challenges for managing urban greenspaces. More than half of the global population currently live in cities and that number is projected to increase to almost 90% by the end of the century (citations). As these cities increase in size and area, greenspaces, such as parks, remnant natural areas, and protected reserves, face new stressors from human activity. Direct human use of green spaces can negatively impact urban wildlife including trampling, introduction of exotics, and pollution (citations). However, urban green spaces are important for city residents as a place for exercise, recreation, socialization, and supporting mental well-being (citations). Thus, managing these spaces is a delicate balancing act between utility for people and conservation of biodiversity.

One of the main limitations in effectively managing urban greenspace is the uncertainty around how and when people use these areas. Although some parks use a reservation-based system with controlled points of entry, other urban greenspaces are more open with many access points. Trails are meant to facilitate human movement and reduce disturbance to biodiversity, but residents will still venture off-trail or erode new paths of easily navigable terrain, i.e., desire lines (citations). Determining areas of high disturbance (i.e., high traffic), potential off-trail use, and overlap with sensitive species, can all be achieved through understanding human mobility in greenspaces. However, capturing human mobility at a resolution fine enough for management, such as less than 100 x 100 m, is challenging. Previous methods for quantifying human activity include record keeping visitors at entrance points or camera traps to track the number of visitors. However, this data neglects any spatial component of what visitors do past the control point. Using social media can be effective to track actions and activity from geotags of images, but this data can be biased towards individual behaviours and points of interest (Wilkins et al. 2021). With the widespread adoption of mobile smart phones, using anonymized mobility data can be an effective tool in determining use of urban green spaces.

* 1. Challenges with anonymized mobile data

Using location data from mobile smart phones (hereafter mobility data) is not without limitations. Rightly so, mobility data is often anonymized by aggregating activity patterns to coarse resolutions to prevent harassment, crime, or injustice (de Montjoye et al. 2013; UN Global Pulse). This prevents tracking individual behaviours, activity by demographics, or fine resolution of activity patterns (e.g., < 10 m).