The Effects of the Covid-19 Pandemic on Human Behavior and Wildlife Populations along the Gradient of Urbanization

Olivia Nguyen[1], Heather Bateman[2], Dan Childers[3], Jeffrey Haight[1], Sharon Hall[1],
Nicola Koper[4], Kelli Larson[3,5], and Jesse Lewis[2]

[1]School of Life Sciences , [2]College of Integrative Sciences and Arts , [3]School of Sustainability , [4]Natural Resources Institute , [5]School of Geographical Sciences and Urban Planning

INTRODUCTION

- Humans can greatly affect wildlife populations and behavior through structural and behavioral disturbances, which are particularly pronounced along the gradient of urbanization.

- For example, in wildland areas, human development is largely absent and human presence may be low or relatively high due to human recreation.

- In contrast, in urban and suburban areas, human development is high and often associated with high levels of human presence.

- Importantly, although anthropogenic structural characteristics are relatively static along the gradient of urbanization for a given period, the presence of humans in recreational settings can be dynamic on daily and seasonal scales.

- The onset of the Covid-19 pandemic created a unique opportunity to evaluate how a rapid change in human behavior can affect wildlife populations and behavior along the urbanization gradient.

RESEARCH OBJECTIVES

The overall objective of our study is to use a before-after-control-impact (BACI) study design to understand how sudden changes in human behavior can affect wildlife behavior and populations along the gradient of urbanization. Specifically, we will:

1. Evaluate how human behavior (Fig. 1) changed due to the Covid-19 pandemic along the gradient of urbanization.

2. Analyze wildlife species' response (Fig. 2) to changing human behaviors by evaluating wildlife occupancy and daily activity patterns.

Fig 1. Humans walking in suburban area

Fig 2. Coyote along human trail

METHODS

- Fifty remote wildlife cameras were placed across the gradient of urbanization within the Phoenix-Valley (Fig. 3).

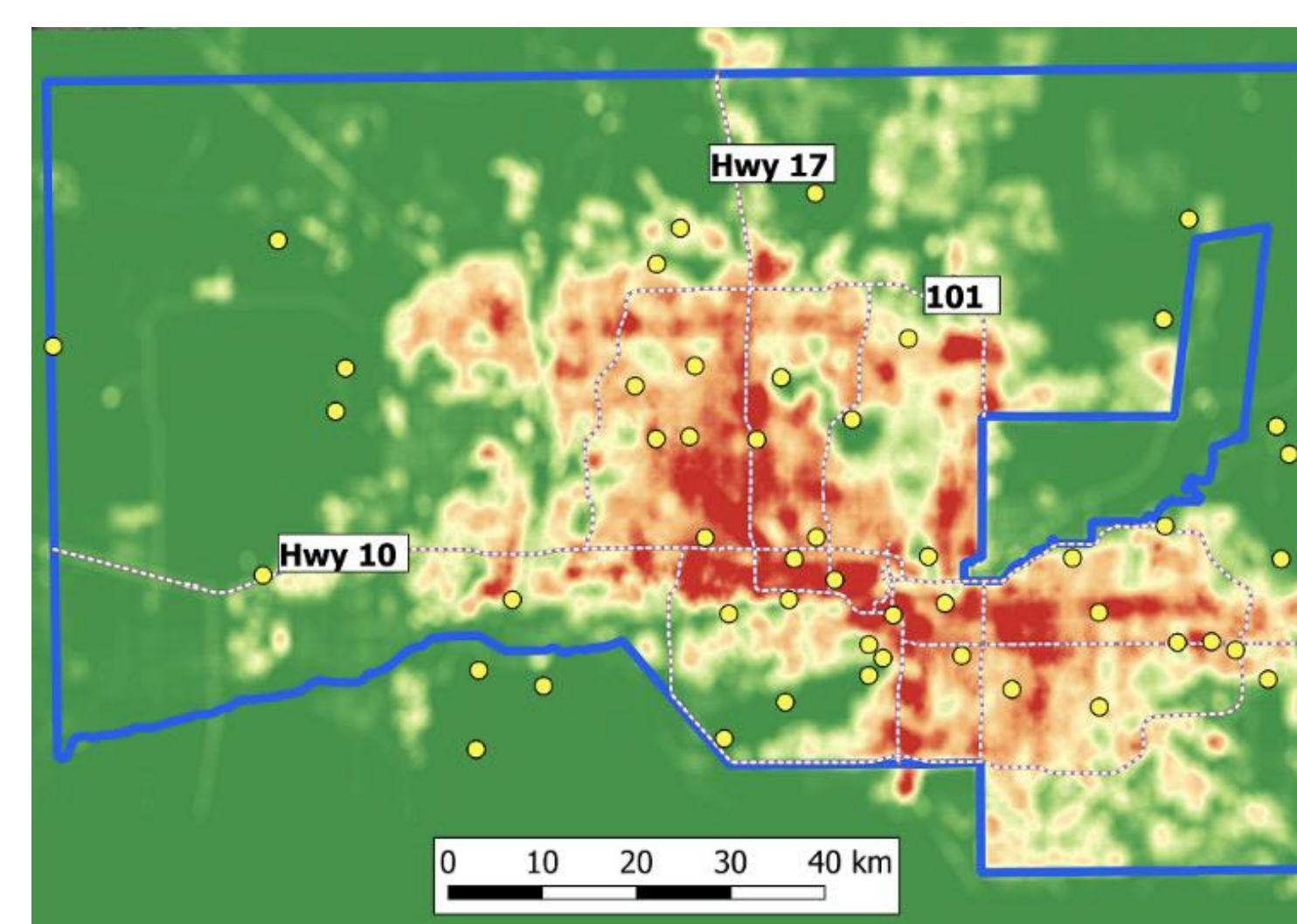**Fig 4.** Bushnell remote wildlife camera

Fig 3. Remote wildlife cameras (yellow dots) were placed across the gradient of urbanization, ranging from high (red) to low (green). The CAP LTER study area is outlined in blue, and roads are shown with the dashed lines.

- Wildlife camera data captured along the gradient of urbanization will be utilized to evaluate a suite of wildlife species (e.g., bobcat, coyote, gray fox, & javelina) with varying sensitivities and daily activity patterns.

- We will then use a BACI study design to help us understand how wildlife responded to changes in human behavior before and after the onset of the Covid-19 pandemic (Table 1).

Table 1. The BACI study design

	Before	After (spring)	After (summer)
	January - March 15	April - June	July - September
2019 (Control)	Pre	No Treatment	No Treatment
2020 (Impact)	Pre	Start of Covid-19 Pandemic	Covid-19 Pandemic

- The "before" period will consist of the months prior to the onset of the Covid-19 pandemic, January through March 15.

- The "after" period will begin following a transition period when initial Coivd-19 related protocols initiated and will be split into two seasons: spring and summer.

- We will compare the same periods of 2020 (the impact year) to the same periods the year prior in 2019 (the control year).

- Occupancy modeling and daily activity pattern analysis will be utilized to study wildlife's response to human behavior.

HYPOTHESES AND PREDICTIONS

- We predict that human activity in wildland areas will be higher in the spring and summer of 2020 compared to 2019 (Fig. 5) and will be lower in urban areas.
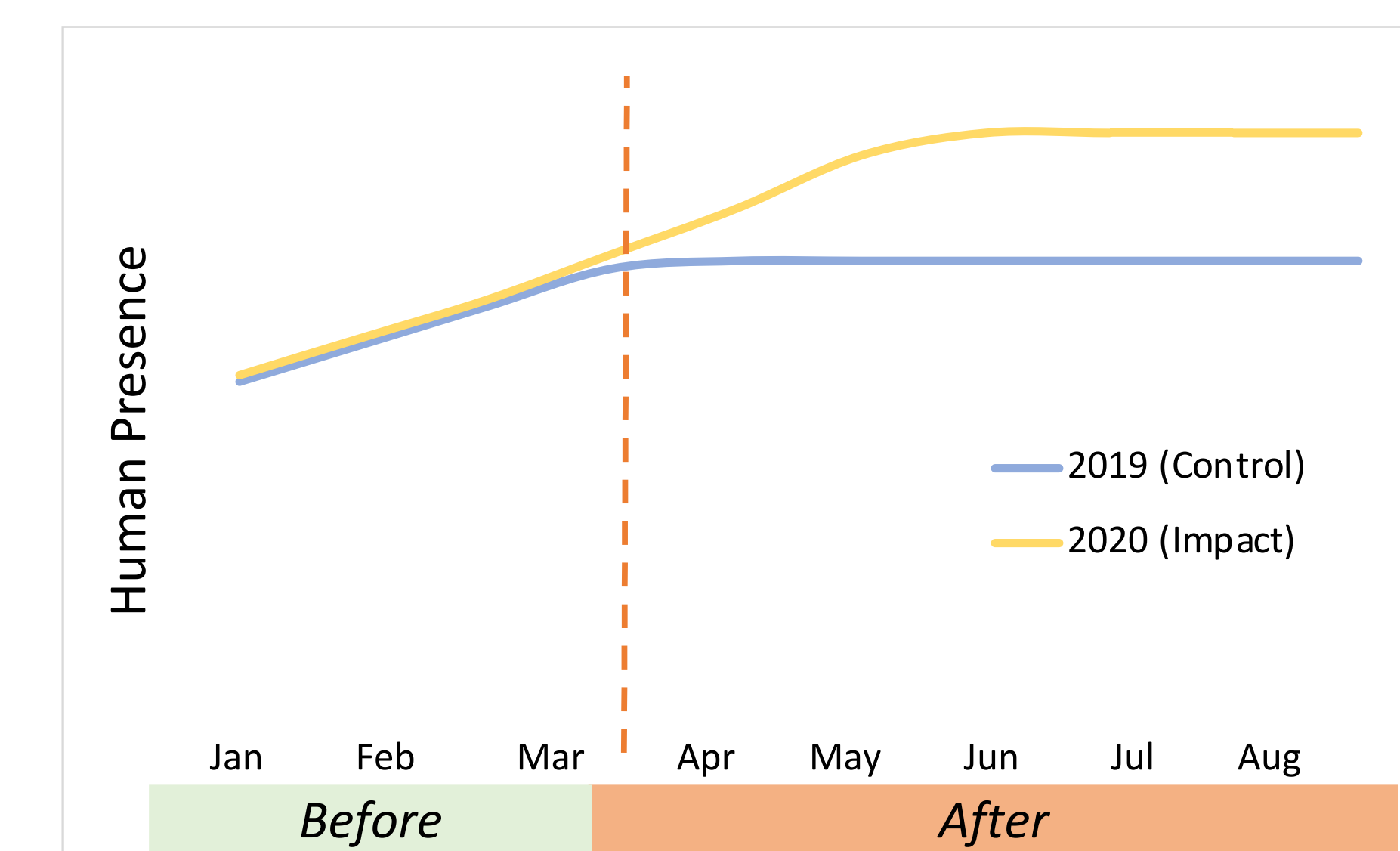

Fig 5. Prediction of human activity in wildland areas

- We expect that in wildland areas where human activity increased, wildlife species will decrease their area of area. Consequently, we expect that in urban areas where human activity decreased, wildlife species will increase their use of area.

- We also expect that in wildland areas where human activity increased, wildlife will decrease diurnal activity and increase crepuscular activity (Fig. 6). In contrast, we expect that in urban areas where human activity decreased, wildlife will increase overall daily activity.
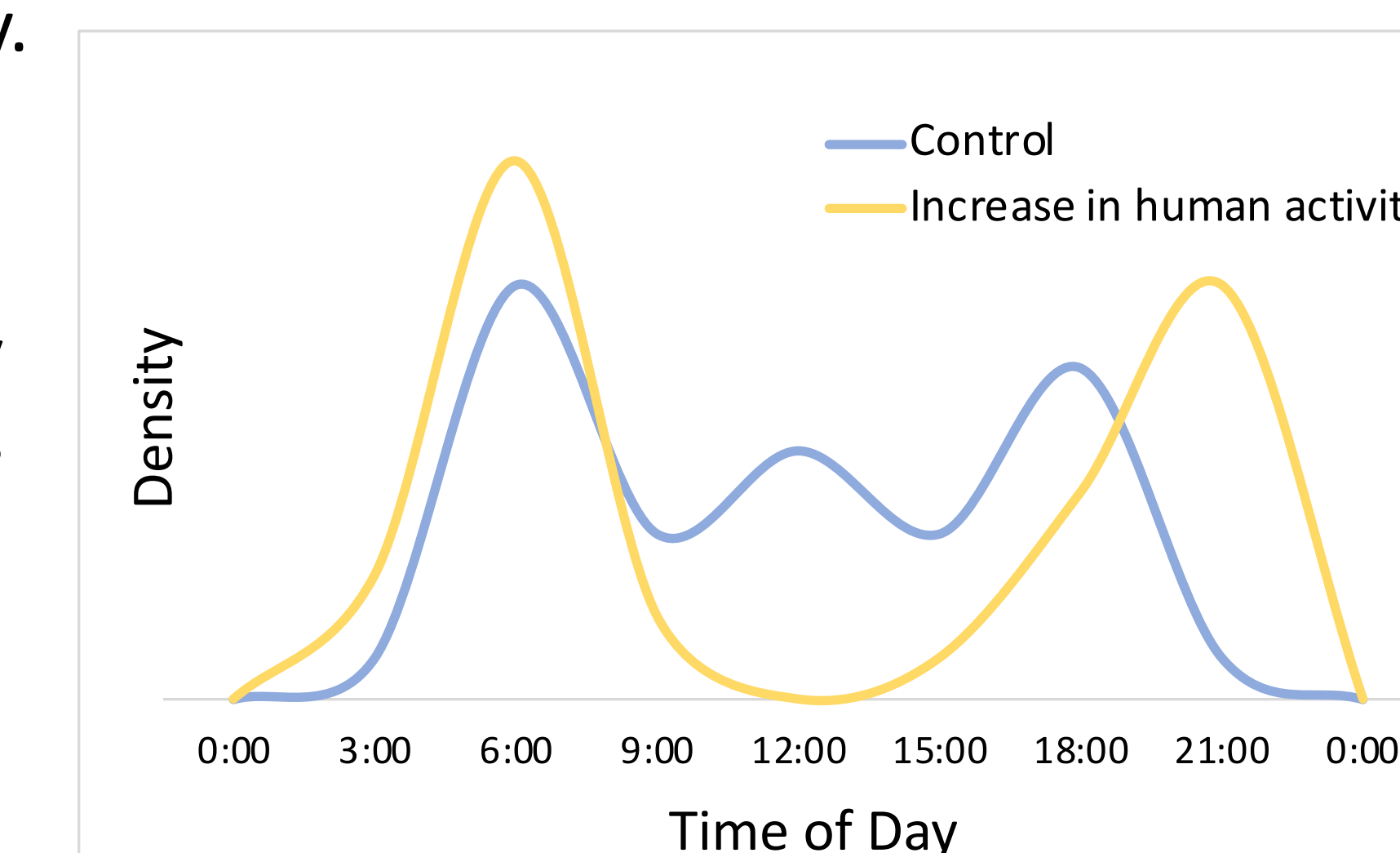

Fig 6. Prediction of wildlife daily activity changes to human activity in wildland areas.

NEXT STEPS

1) Complete human activity analysis.
2) Conduct wildlife occupancy modeling and wildlife daily activity patterns analysis.
3) Compare human and wildlife analyses under the BACI study design.

ACKNOWLEDGEMENTS