

Introduction

pests/disease. With Portland, Oregon being widely noted as the greenest city in the United States, it is is but will not be disrupted by the high activity atmosphere of a large on the ecological needs of a honeybee. The factors that we found most necessary to identify vegetation availability, duration of sunlight, distance from parks/gardens/wetlands and dis an optimal location to introduce apiaries to help increase the honey bee population and in turn, benefit the local ecosystems. There are many factors to consider when choosing an optimal apiary sight based caused by In recent years, the honeybee population in America has experience water source. brought on by a myriad of factors which include: habitat destruction, climate change and an explosion in the rate of the phenomena, colony collapse disorder. Colony collapse disorder These factors assure the bees not only have access to key city. d a dramatic decline. resources for and distance from their This has been are: survival,

Methods

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that might otherwise influence the measure of vegetation (Huete, September 13th 2016 for this model because of the importance of t through Late Autumn and Winter. Research suggests that local plant richness, density and productivity SAVI (Soil Enhanced Vegetation Index) (15%): The SAVI model accounts for "soil substrate variations" (Moreira, 2015). correlated with longer pollinator residence time and a greater probability 2016 for this model because of the importance of floral resource availability for hive survival 1988).We used Landsat 8 imagery from of plant-pollinator encounters are

Sun exposure is also important when considering the energy expenditure of bees during the cold season. **Streams (25%):** The accessibility of fresh water is vital to hive survival since bees depend on accessibility on evaporative cooling to thermoregulate their hive on hot days, to dilute stored honey and for the production of jelly for feeding the larval brood (Kovac, 2010). Hillshade (15%): The Hillshade layer was calculated for both an hour af on September 13^{th} Shade can dramatically influence the duration of bee a bee activity and the collection of pollen. ter Sunrise and an hour Before Sunset

pollination supply (Davis, 2017) the benefit of pollinators in these ecosystems is irrefutable. Neighborhood Vulnerability (5%): When considering any economic investment we should consider areas that are often subject to a lack of investment. Wealthier areas of Portland are also more likely to have parks and green spaces. The neighborhood vulnerability index assigns each census tract a composite risk score wh accounts for a variety of economic and social risk factors (Bates, 2013). Biodiversity may also play a significarole in psychological wellbeing, having positive health and social implications. (Bellamy, 2017) jelly for feeding the larval brood (Kovac, 2010). **Community Gardens (25%):** There has been a steadily growing interest in urban food gardens and farms, many of the crops grown depend on pollination services that may be limited in urban areas due to low pollinator diversity and distribution of floral resources (Davis, 2017) By locating an apiary within range of these gardens we could see an improvement in crop yields, urban landscape resilience and food security. **Parks & Wetlands (15%):** "Mutualistic plant-pollinator interactions play a key role in biodiversity conservation and ecosystem functioning... generating robustness and resilience to disturbances" (Moreira, 2015) Not only have urban parks, forest preserves and wetlands been associated with an abundance of Methods isus tract a composite risk score which

to the closest source. this allowed us to This calculate the was used for

Euclidian Distance: Calculates (for each cell) the Euclidian distance to th parks/wetlands, community gardens and streams.
Kernel Density: Calculates the magnitude per unit area of the input data, density of vegetation in a given area and produce smoother, more continue. visualization Snor data allowing for easier

bees can vary significantly from 45m to 13km. **Fuzzy Membership**: Some phenomena that cannot be classified into strictly defined classes, the range of bees and their interaction with the surrounding habitat is not bound by discrete spatial boundaries, the range of to the possibility that they belong to a defined set. Fuzzification converts the original values of the phenomenon

(environmental vs. social), the final output gave us applied with very little impact to the final output. between layers (parks/wetlands & SAVI) and because certain variables assigned fuzzy membership to the given sets which represent suitability. Reclassify: Allowed us to assign a common classification scheme Weighted Overlay: Allowed us to assign weights to each of the input variables, since there is some overlap a range of 5values. to each X arious weighting schemes were ere more important for consideration of the input variables based on their

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Figure 19



Op timal Apiary Model





Results

have. This addition of more apiaries in the Portland area could surprising as the borders of the city are less developed and provide a greater density of vegetation and less constant human disturbance, be a ideal city for starting multiple apiaries. There in neighborhoods that may be considered are very few beekeeping be used as a way to educate beekeeping are wealthy neighborhoods. Could the areas that have shown as optimal for research. One example of this being that many of Suitability" vulnerable while also improving local ecosystems? they do raise questions for potential future mainly around the borders. Based on our final overlay, Portland has shown to Although the derived results are not which are ideal conditions for a honeybee colonies. No Suitability" and only one major area of "Low is just one of many potential impacts The most suitable areas in areas that fall under the category of This result is not unexpected, the city are populations that the



Portland Maps Open Data Portland State Oregon Spatial Data Libra ry. 2016 Oregon State University & the State of Orego

University I drive data

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