Influences of Urban Land-Use on the Frequency of Scorpion Stings in the Phoenix Metropolitan Area

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Summary

Between 3000-4000 people report being stung by scorpions each year in the Phoenix metropolitan area, but the frequency of stings is not distributed evenly across the city: certain areas consistently report higher numbers of scorpion stings. I overlaid the number of scorpion stings per ZIP Code onto a GIS coverage of land use in Phoenix. I then compared the types and amounts of land use among ZIP Codes that differed in the number of scorpion stings. The number and geographic location of scorpion stings in the metro area was reflected in the presence and abundance of some forms of urban land use. Density of single-family homes and proximity to undeveloped open space were good predictors of the frequency of scorpion stings. These results suggest that undeveloped areas may act as sources for urban scorpions. It is hoped that these results may shape future development in Phoenix to minimize human-scorpion contacts.

Introduction

Scorpions are predatory arthropods with approximately 1500 species distributed worldwide. An estimated 5000 people around the world die each year from scorpion stings, making scorpions the third-ranked type of animal-induced deaths behind snakebites and beestings.

Between 3000-4000 people in the Phoenix metro area report being stung by scorpions each year. With a human population of ~2.7 million and an annual population growth rate of ~22%, Phoenix is the second-fastest growing city in the U.S. and is consequently experiencing rapid rates of urban development. As a result, more people are being brought into contact with scorpions.

I am conducting a study that is examining to what degree different forms of urban land use influence the frequency of scorpion stings. I am addressing the following questions:

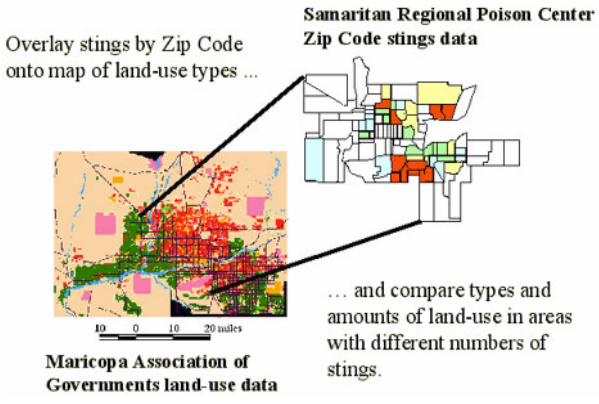

Figure 1. Map of urban land use in the Phoenix metropolitan area. Stings are grouped for presentation purposes. (Click on figure to

- Are all parts of the Phoenix metropolitan area equally susceptible to scorpion stings?
- Are there particular types of land use that are associated with different numbers of stings?

It is hoped that answers to these questions will be used to influence future development so as to minimize human-scorpion contacts.

Methods

3 Geographic Information System layers:

- 1) Maricopa Association of Governments land-use designations;
- 2) ZIP Code boundaries;
- 3) number of stings by ZIP Code, average of 1996-1997 (provided by Samaritan Regional Poison Center).

Analyses:

- 1) determine to what degree the amount of different land-use types, human population size, and ZIP Code area influence the number of stings within a ZIP Code (regression analyses);
- 2) compare average distances from large areas of undeveloped open space and urban fringe to ZIP Codes with > 1 sting vs. ZIP Codes with 0 stings (t-tests).

Results

Not all areas of the Phoenix metropolitan area are equally susceptible to scorpion stings. The heterogeneous distribution of stings is related to some forms of urban land use.
Factors positively related to the number of scorpion stings:

- proximity to undeveloped open space (t=2.89, P=0.0070)
- amount of low-density housing (r2=0.73, P=0.0007)

Factors unrelated to the number of scorpion stings:

- amounts of other types of land use
- proximity to urban fringe (t=0.51, P=0.98)
- human population size (r2=-0.17, P=0.31)
- ZIP Code area (r2=0.06, P=0.70)

The issue of why certain portions of the Phoenix

enlarge.)

metro area experience more stings than do others is a multifaceted problem. Effects from the type and amount of certain forms of land use may be tempered by socioeconomic factors. Nevertheless, these results may be useful to land-use planners and developers in deciding where are how future urban development in the Phoenix area should occur.

Using higher-density housing (> 6 dwellings per acre) may lower the risk of being stung because proportionately fewer people would be in contact with the ground (e.g. those in apartments above the first floor), which is the ultimate source of scorpions.

Future plans

- Land-classification data will be included in analyses when it becomes available as a GIS coverage (1999?).
- MAG data on residential completions will be added.
- I will incorporate data on the location of scorpions obtained from PO10 (Pilot Long-term Arthropod Monitoring) to determine whether actual scorpion densities correspond to numbers of reported scorpion stings.
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