



Surveying Harford County Beekeepers to determine the effect of land use in over-wintering hive survival

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Introduction

Pollination by insects is necessary for seventy-five percent of all crops used for worldwide human consumption (Potts, 2010). Honey bee pollination services are valued to be greater than fourteen million dollars in the US agriculture industry (Hayes, 2008). Honey bees play a key role in modern agriculture, but in recent years the global honey bee populations have been in a decline. Pollination of crops is dependent on both wild and domestic honey bee colonies. Colony success is being threatened by a phenomenon called colony collapse disorder (CCD), which appears to make bee colonies more susceptible to a variety of stressors like parasites and pesticides. Habitat loss is a dominant factor in the decline of hive populations (VanEngelsdorp, 2008). Recent studies comparing hive survival and land use, have shown results that different land uses may affect the hive population in different ways. One study supports that the abundance of pollinators was lower in residential areas than natural areas like forest and meadows (Hostette, 2001). Other studies show that more natural land uses nearby resulted in a greater abundance of pollinators (VanEngelsdorp, 2008). The purpose of this study was to survey beekeepers in the Harford County to ascertain the land uses being utilized by beekeepers to determine the effect on *Apis mellifera*, western honey bees, in Harford County, Maryland. In the survey it was expected to find that the presence of natural land uses like agriculture and forest near the bee hives caused little annual percent hive loss. Land uses that are more developed and humanly impacted like transportation, commercial and institutional land, hive loss will be greater. The survey was expected to reveal a relation between land uses and annual percent hive loss with more natural land uses having less loss.

Methods

To determine the effect of land use on the beehive populations in Harford County a survey was conducted. The survey asked the following questions to the members of the Susquehanna Beekeepers Association:

| | |
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| 1. Number of years of beekeeping | 5. How many hives did you have alive in September 2016? |
| 1. Address of the honey bee hives | 6. How many hives are alive now? |
| 3. Which description best fits your apiary location? | 7. What is your average annual percentage loss of bee colonies per year? |
| 4. Surrounding land use | 8. What do you consider the primary cause of colony mortality in your operation? |

The online survey tool, SurveyMonkey® was used to obtain data from local beekeepers. The survey was emailed to the board of the Susquehanna Beekeepers Association and to all members of the email list of the Susquehanna Beekeeper Association. The surveys replies were analyzed and interpreted for trends in the data. Geographic Information System (GIS) software was used to plot hives in the Susquehanna beekeeper's region. Locations were compared to surrounding land use data layers to examine if land use had an impact on overwintering of the neighboring *Apis mellifera* colonies. Analysis was completed using P-test to determine if there was a correlation between hive loss and land use.

Research Question

To what extent does surrounding land use affect the over-winter survival rate of *Apis mellifera* colonies in Harford County?

Graphs

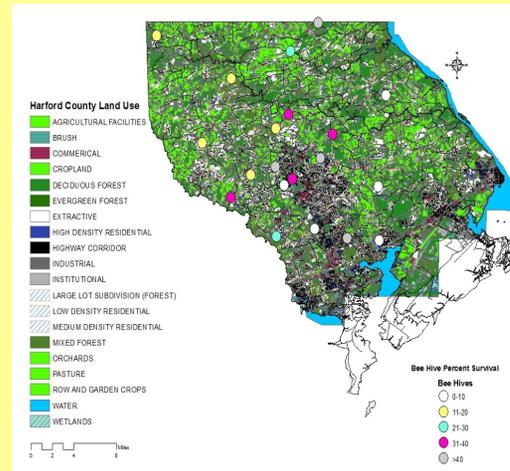


Figure 1: GIS map of Harford county land use graphing the percent hive loss of Susquehanna beehives

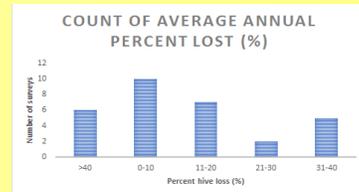


Figure 3: Bar Graph showing average annual percent loss of honey bee hives. Most people lost between 0-10% of their hive, therefore the land use didn't have much effect on their hive survival.

Average land use

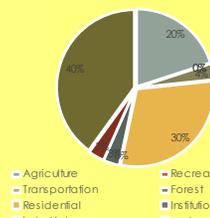


Figure 4: Pie Graph showing average land uses demonstrated from the Susquehanna beekeeper surveys

Average Annual percent over-wintering hive loss

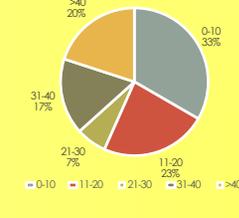


Figure 5: Pie Graph showing average annual percent over-wintering hive loss demonstrated from the Susquehanna beekeeper surveys

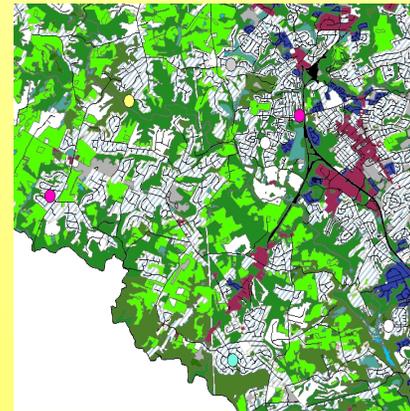


Figure 2: GIS map of land use in a region of Harford county with the beehives annual hive loss

Conclusions

The results from this experiment does not support the hypothesis that when land surrounding the *Apis mellifera* colonies is natural then the percent hive loss will be less. The results from the surveys found that the surrounding land use with the average smallest percent hive loss was residential land. The land use with the average highest percent hive loss was a combination of agriculture and residential land. The correlation of percent hive loss and land use is tied to Colony Collapse disorder (CCD) that makes the hives more susceptible to environmental factors. A study describes that apiaries affected by CCD contained weaker and a greater abundance of dead colonies and colonies affected by CCD were more likely to neighbor each other (VanEngelsdorp, 2008). Another study explains that the driving factor behind colony collapse is habitat fragmentation (Potts, 2010). The combined effect of colony collapse disorder and habitat fragmentation has caused the high percent annual loss of bees in the different land uses.

Further Implementation

Growing evidence points to more natural land-uses leading to a larger annual percent hive loss overwintering. Further studies can be conducted to distinguish the cause of this phenomenon. A study of agricultural crops relation to nearby hive loss can be conducted to determine if the crop is the reason behind the hive loss. This study would valuable because the land use with the highest percent hive loss was a combination of agriculture and residential and this study can pinpoint the reasoning behind this.

Literature Cited

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Data Analysis

The results of this study show that when land surrounding the *Apis mellifera* colonies is more natural then the percent over-wintering hive loss was greater. The data from the surveys showed that residential land, an unnatural developed land, more often was associated with only 0-10% hive loss, there were 6 surveys that had 0-10% hive loss and a residential surrounding land use. Where only 2 surveys had a 0-10% hive loss with an agriculture surrounding land use. The surrounding land use associated most with greater than 40% hive loss is a combination of both agriculture and residential land. There was 4 out of the 6 surveys with a greater than 40% hive loss that had surrounding land use of agriculture and residential. A majority of all the surveys had an agriculture or residential surrounding land use. Out of the 30 surveys collected 6 of them had an agricultural surrounding land use, 9 of the surveys had a residential land use and the land use combination of agriculture and residential land made up 12 surveys.