GODDARD SPACE FLIGHT CENTER

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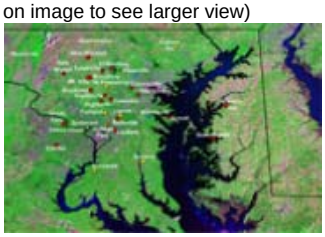
Links to data collected at scale hive locations

National Scale hive locations (click on image to see larger view)

Regional Scale hive locations (click on image to see larger view)



HONEY BEE NET OBJECTIVES

Our objectives are to address the following questions.

How will plant-pollinator interactions respond to climate and land cover/land use changes?

Ecologists are concerned that crucial plant-pollinator relationships could be disrupted as a result of climate and land use changes, to the detriment of both partners and the organisms that depend upon them (including us humans - see National Academies report on this). Colonies of honey bees in central Maryland are currently being used to monitor changes in the timing of this plant-pollinator interaction – the spring honey bee nectar flow - by the simple, yet careful, daily weighing of hives to track incremental changes. The Maryland data indicate that the peak nectar flow now occurs nearly 4 weeks earlier than in 1970's. This advancement of the nectar flow is due to climate change and the warming effect of urbanization in the Washington-Baltimore corridor. Independent observations confirm that nectar sources are blooming earlier. How these changes will impact the region's ecosystems and agriculture needs to be carefully assessed.

Can modern ecosystem and climate models, based on extensive satellite observations, help us understand these changes?

Satellites provide good large-scale coverage of vegetation change with respect to climate, but cannot observe pollination directly. Scale hive records tell us when nectar flows occur, and hence when the plant-pollinator interaction is in "high gear". Links need to be developed in order to relate these times and locations to satellite observations and ecosystem models. We find that there are a few historical records of the timing of nectar flow across the continent that scientists can use to document changes due to climate, but there are currently far too few to perform studies at even the regional scale. We think that using scale hives to track nectar flow is a very sensitive technique that can be used to monitor changes in the crucial plant-pollinator interaction, and that the hive monitoring network has the potential to be greatly expanded. This timing and flow information can then be linked to detailed ecological models and data from satellite sensors that monitor vegetation parameters such as phenology. Without the primary information about the timing of nectar flows, predicting how they may change would be extremely difficult, even with the best satellite observations and ecosystem/climate models.

How far north will the Africanized Honey Bee (AHB), an invasive species, establish permanent residence in North America, and how will climate change affect this?

Current predictions of the spread of the AHB in the US (Harrison et al., 2006) are based primarily on winter temperature limits as observed in South America. Variations in honey bee forage are missing, but may be crucial for understanding over-wintering. Our hypothesis is that the predictions can be improved through the use of the extensive high resolution (1 km) vegetation and surface climate information developed from satellite sensors and ecosystem models, especially when these data are 'tuned' by incorporating scale hive information. This builds on the successful use of satellite data to depict the areas which may be impacted by the spread of invasive plant species, such as salt cedar, or tamarisk (Morisette et al., 2006).

HoneyBeeNet - A first step toward a national network

In Maryland and Delaware, over 25 beekeepers have volunteered to collect scale hive records in 2007 in order to document the current status of the regional nectar flows. Fourteen volunteers have obtained their own scales to monitor their hives. This network will grow with time, beekeepers from over 15 states have expressed interest for the 2008 season. There are over 100,000 beekeepers in the US, and the average distribution is about 1 hive per 2 square kilometers. Many science centers maintain an observation colony of honey bees, and a "mother" colony for its maintenance. Hives can be rented (millions are rented annually for

pollination), and/or maintained by local volunteers, and can be easily placed on scales to produce valuable and highly informative data on the timing of the local nectar flows. This “Honey Bee Net” web interface, for collection and sharing of such records by volunteers, is designed to enable easy comparison with satellite and other climate records, and provide a useful insight into how climate change and land use/land cover changes affect nectar flows.

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Curator: Jaime Nickeson
NASA Official: Wayne Esaias
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