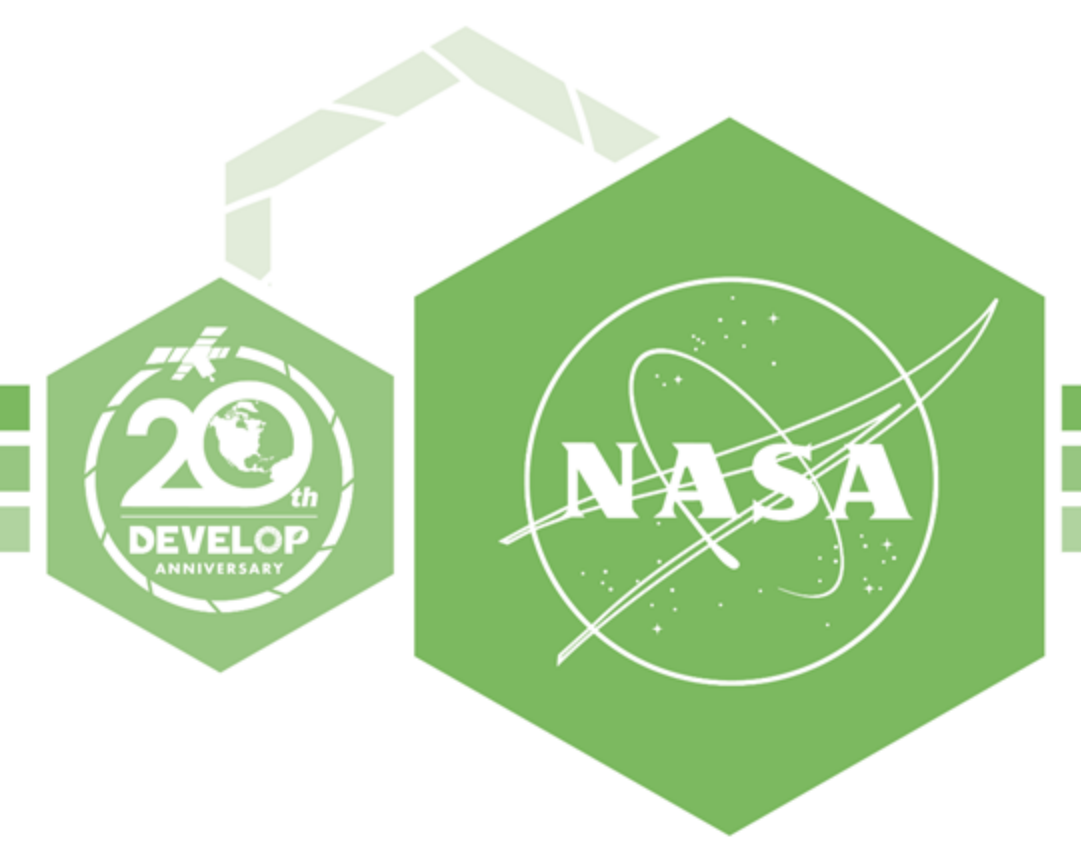# Incorporating NASA Earth Observations into an Assessment Tool to Identify Correlations Between Factors Associated with Bee Health
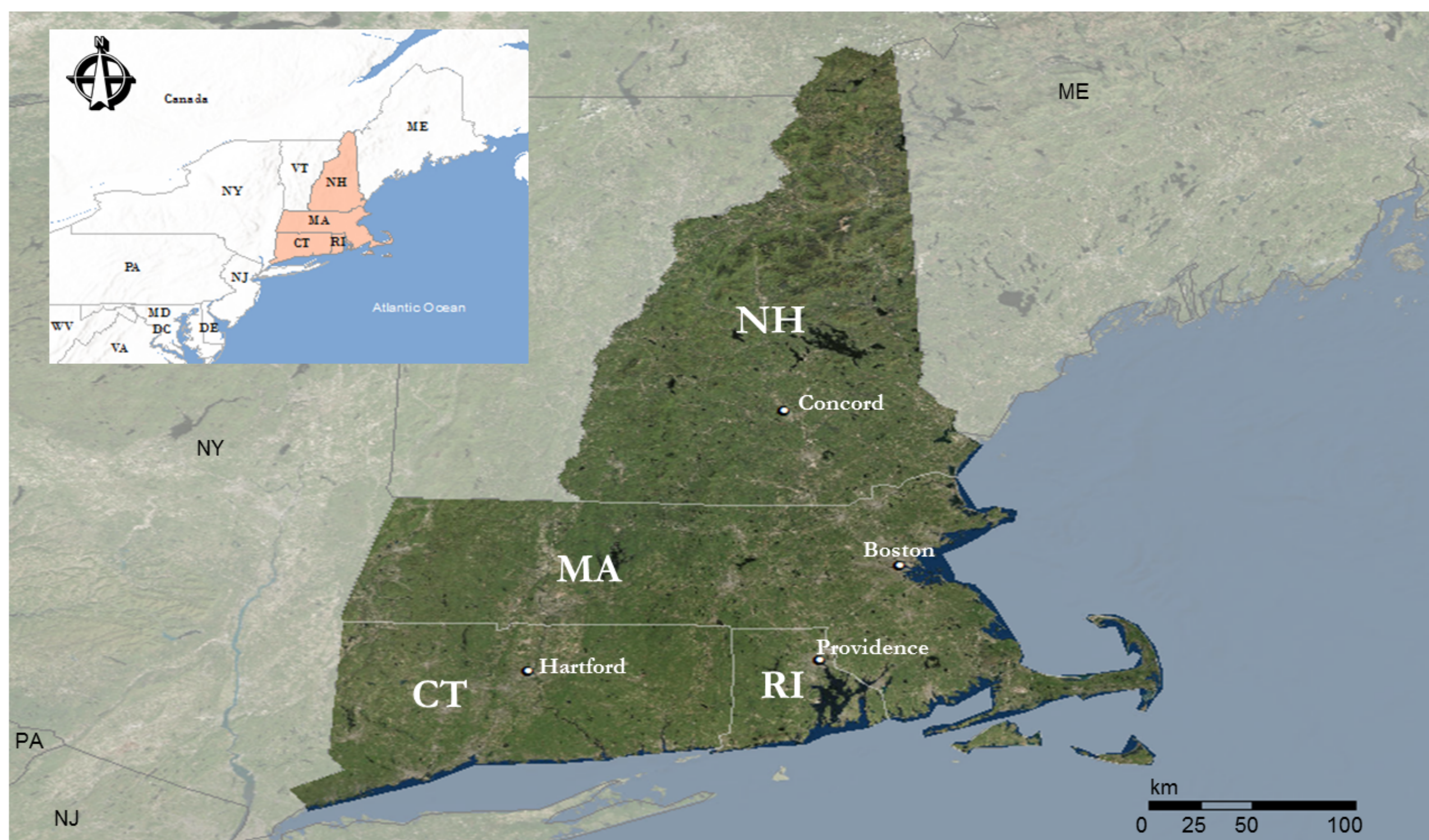
Abstract

Honey bees (*Apis mellifera*) are a vital component to global agriculture, however, over recent decades their populations have been declining. Honey bees provide pollination services to more than 90% of the leading 107 global crop types, and without them it is estimated that 5-8% of global production would be lost. Anthropogenic drivers such as land use change, habitat fragmentation, existence of vegetative land cover (native or agricultural), climate, and the use of fertilizers and pesticides, contribute to honey bee health complications and annual population losses. Also, the presence of invasive pests (Varroa mite [*Varroa destructor*], tracheal mites, and small hive beetles) and pathogens (e.g. *Nosema*) further compound these issues. Leveraging citizen science, NASA Earth observations, and nationally reported statistics, a comprehensive methodology was developed to illuminate environmental variables that are linked to honey bee prosperity in the New England region of the United States from 2015 to 2018. The team created a tool harnessing Google Earth Engine to incorporate *in situ* data collected from local hives and apiaries and biophysical variables, such as vegetation indices, and soil moisture collected from satellite data. The tool will aid in the development of historical trends in honey bee welfare and will provide insight for better understanding of bee habitat suitability conditions.

Objectives

▸ **Visualize** honey bee hive environmental factors from satellite data between 2016 and 2018

▸ **Produce** a graphical user interface that allows collaborators to look at historical environmental trends that correlate with in-hive measurements

▸ **Enhance** honey bee research methodologies

▸ **Utilize** the computational power of Google Earth Engine to summarize remotely sensed attributes
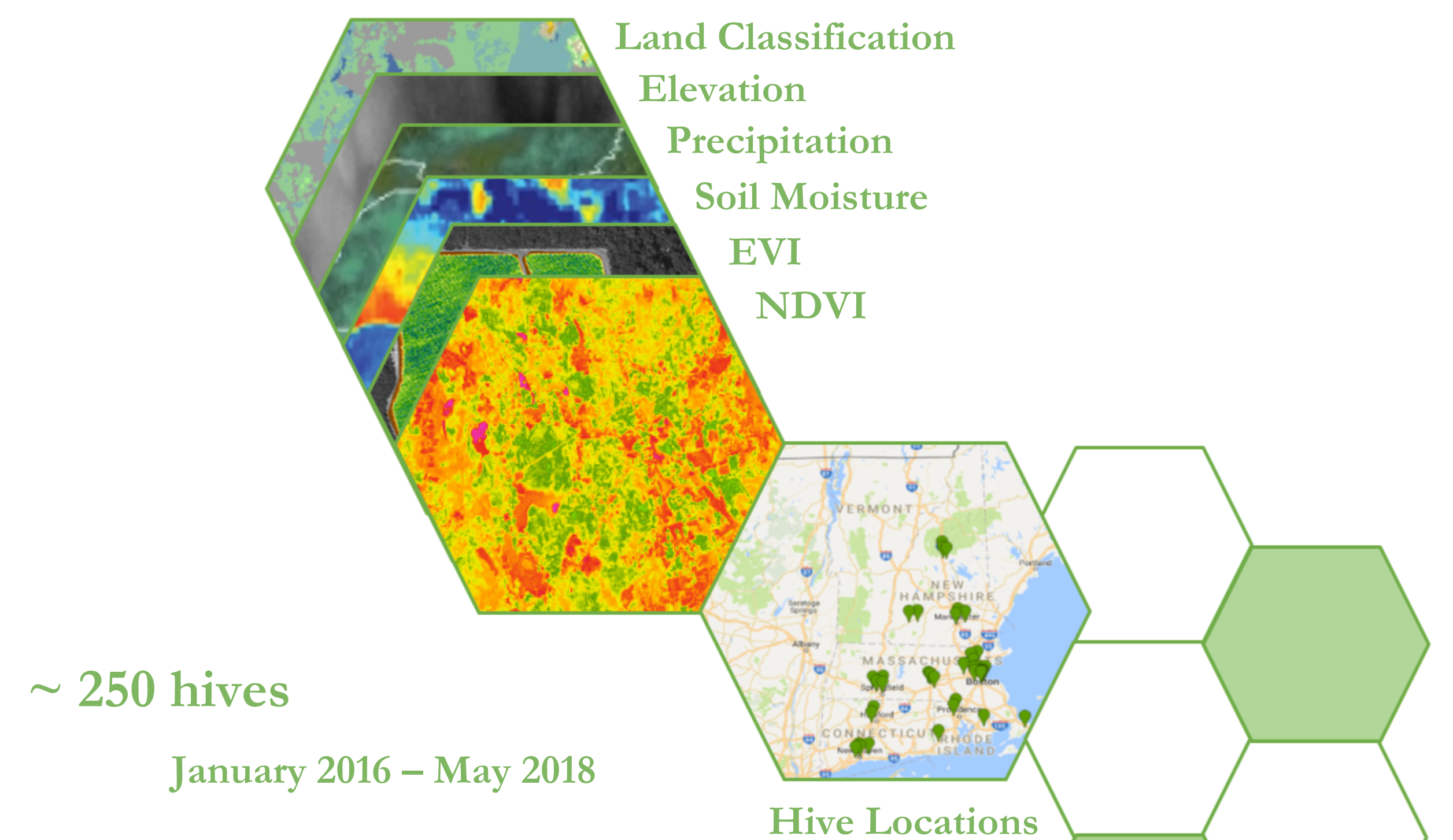
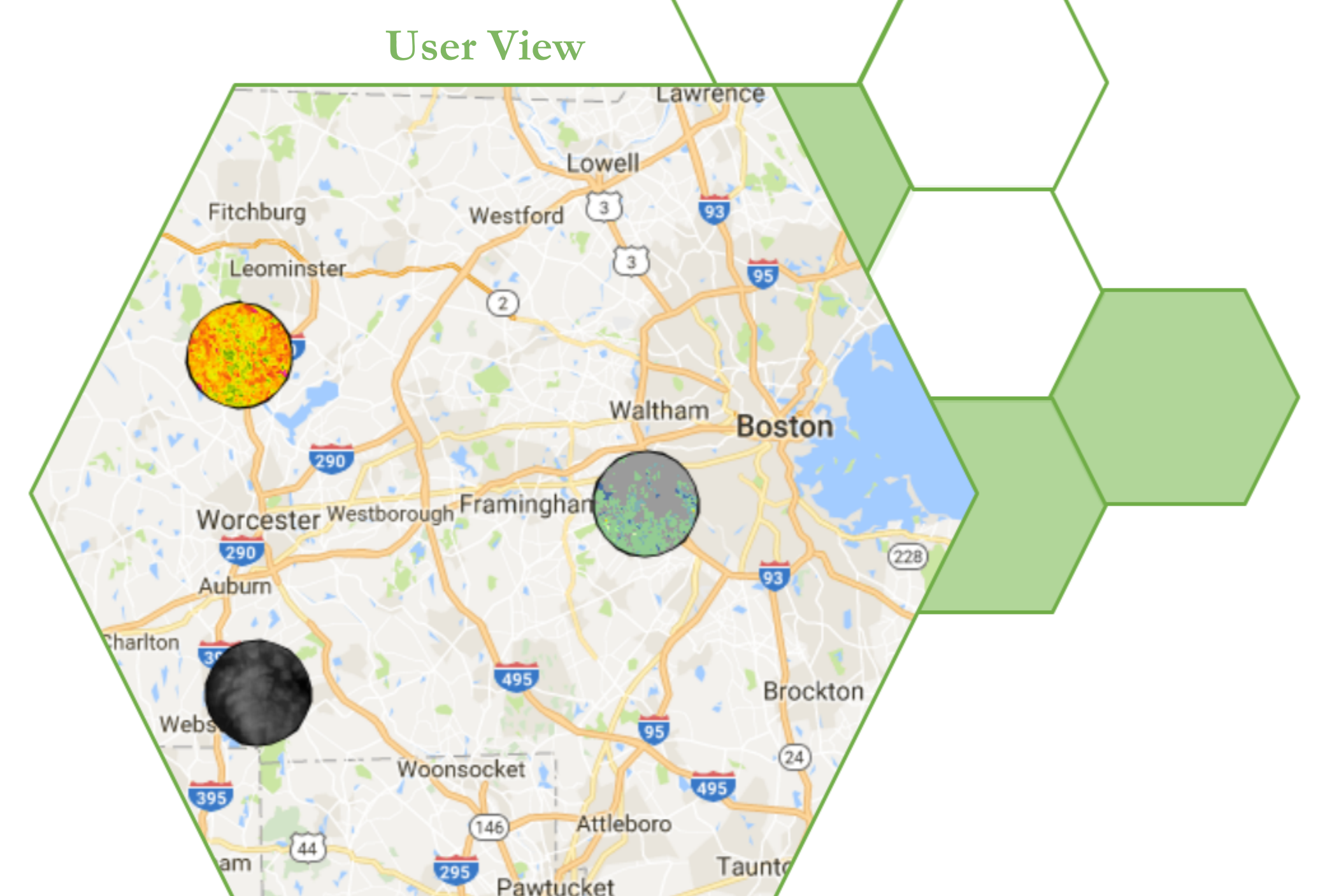## Study Area

Earth Observations

Landsat 8 OLI   Sentinel-2 MSI   GPM IMERG   ALOS PALSAR

Landsat 7 ETM+   SRTM   SMAP
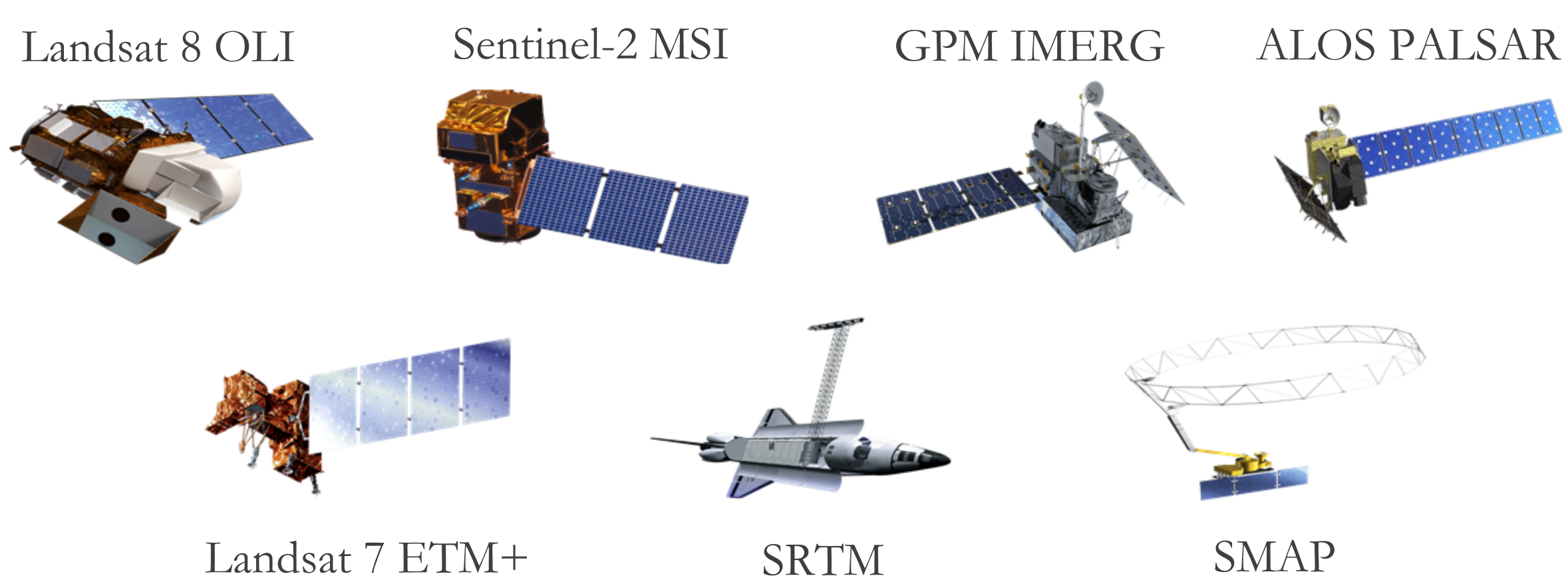
Project Partners

▸ **Urban Beekeeping Laboratory and Bee Sanctuary, Inc.**
▸ **The Bee Informed Partnership**
▸ **University of Maryland, vanEngelsdorp Honey Bee Research Lab**
▸ **BeekeepingIO**

Methodology

Land Classification
Elevation
Precipitation
Soil Moisture
EVI
NDVI

~ 250 hives

January 2016 – May 2018

Hive Locations

Results

User View

Conclusions

▸ This tool allows users to visualize and explore current and future hive locations through an interactive map displaying environmental and geophysical attributes pertinent to hive health. The tool also promotes independent user analysis by having functionality to export temporally-correlated remotely sensed data.

▸ Hive health is likely correlated with environmental parameters. However the effects associated with these parameters are dynamic and confounding, masking the individual effect of any one single variable.

▸ Future work should integrate high spatial and temporal resolution imagery, as well as air quality data, to precisely quantify regional impacts on hive health.

Team Members

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Acknowledgements