Beekeeping Enters the Cloud

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Beekeeping made easy ™
HIVE TRACKS

Faith Mountain Farm

Beekeeping Challenge

- *Keeping hives alive through the winter*
- Various factors since the mid 1980s, especially Varroa mites, have increased winter losses and forced beekeepers to proactively manage hives in order to improve winter survival
- Colony Collapse Disorder (CCD) appeared in 2006 and as yet the cause is not known
- Annual winter loss surveys performed by Dennis vanEngelsdorp following the appearance of CCD have shown national winter losses in the 30% range for the past 5 years.
- This rate of loss is unsustainable for beekeepers

Your breakfast without bees

Scientific American April 2009

Value of crops in US that depend on pollination:

>18.9 billion

($217 billion worldwide)

My Background

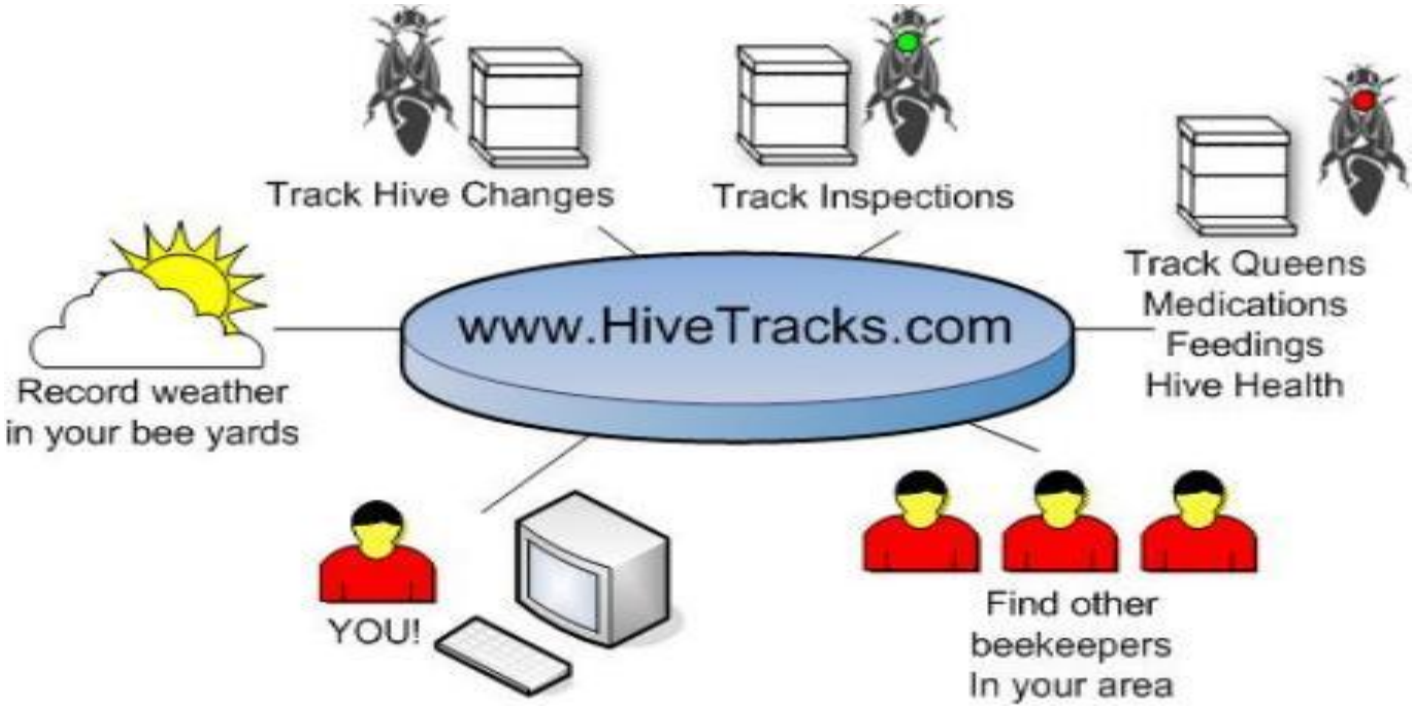
- BS, Mathematics and Computer Science, 1983, Appalachian State University
- MS and PhD, Computer Science, Duke University, Parallel Computing, Scientific Computing, 1994
- Teaching at Appalachian State University since 1992
- Department Chair since 2006
- My father had bees starting in 1964, so I grew up with them in my backyard
- Kept own hives (3) starting in 2000 and moved to a farm in 2005
- Currently keep about a hundred hives (doubled this year)
- *Beekeeper, Professor and Chair of Computer Science at Appalachian State University, Owner of Faith Mountain Farm, Co-founder of HiveTracks, IT Lead for Bee Informed Partnership*

Vision: Technology Can Provide Assistance!

Bee Yard (Apiary)

Hive Inspection

Hive Tracks


Track Hive Changes
Track Inspections
Track Queens
Medications
Feedings
Hive Health
www.HiveTracks.com
Record weather
in your bee yards
YOU!
Find other
beekeepers
In your area

hivetracks.com

- Free web based (cloud) hive record management tool
- Developed over 2.5 years by Mark Henson and James Wilkes
- Released at annual Eastern Apiculture Society meeting in August 2011
- Current number of users in thousands

Features:

- Organized by bee yards and hives within yards
- Records are kept at the hive level including physical configuration, current health status, inspection history with notes, and weather
- Interface is simple with most input by clicking rather than typing
- Provides high level graphical indicators of hive health and activity
- Google map showing location of bee yards
- Record honey harvest
- Demo?

Hive Tracks Further Development

- Build customized modules for targeted operations like queen rearing, nuc production, and pollination.
- Instrumented hive to collect sensor data
- Image processing of video from hive entrance
- Data mining and visualization tools for hive data
- Develop models to suggest hive management interventions based on data
- Generate prompts, reminders, suggestions, etc. for various levels of beekeepers

Bee Informed Partnership

United States Department of Agriculture: National Institute of Food and Agriculture

- Extension project that endeavors to decrease the number of managed honey bee colonies that die over the winter using an epidemiological approach
- $5 million, five year grant involving a diverse team from across the US headed by Dennis vanEngelsdorp
- Central part of the project is a honey bee health database that includes new data from this project and historical data from other research groups
- *Using beekeepers' real world experience to solve beekeepers' real world problems*

Bee Informed Partnership

- Beeinformed.org
- Collect survey data about individual beekeeper practices and colony health at varying levels of detail
- Use epidemiological and statistical methods to analyze using R and SAS
- Results communicated back to the beekeeping community, eventually in real time
- Cloud tools include surveys, web site, web applications, and mobile apps for collecting, inputting, analyzing and visualizing data

Educational activities

- Bee Informed Partnership grant includes money for student developers
- NSF STEP grant supported a student research cluster that developed a mobile app for Hive Tracks
- Mobile applications class is considering honey bee related apps
- Embedded systems course is using an instrumented hive as a learning context
- Two graduate students are working on image processing projects to study bees at the hive entrance

Research possibilities

- Bee Informed Partnership database will create a new data set never before accessible to honey bee researchers and regional data sets for beekeepers
- Hive Tracks database also has great potential for data mining and visualization on an individual and collective basis

Related projects

- Honeybee Net – Wayne Esaias at NASA studying correlation of nectar flow detected through scaled hives and satellite "green up"
- eXtension – online agriculture extension service for Q&A. Submit a question and a content expert answers. Michael Wilson from UT works on the IT side of this and is on the Bee Informed team.

Bee Yard 2016

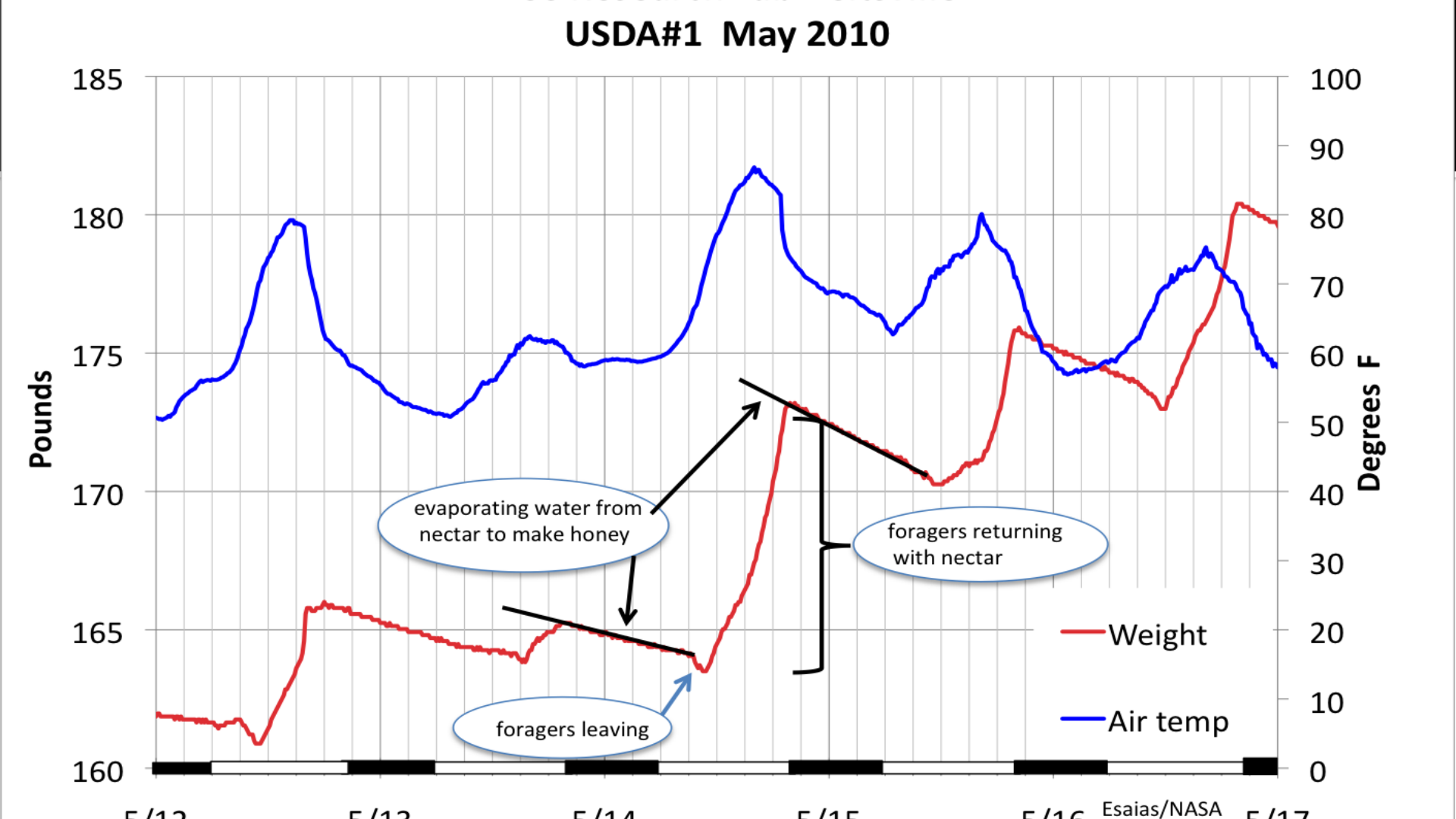
- Hive Tracks monitor connecting pieces together
- Multiple instrumented hives – more as cost decreases
- Weather station
- Automated periodic analysis of data by Bee Informed Partnership system
- Link to eXtension for unusual problems with request prepopulated with data for context of problem
- Alerts and indicators for special events: swarm, honey flow, dearth, pest load, pathogen presence, medication, feeding, IPM methods, management activity

Acknowledgements and Questions and more fun videos (search “faith mountain farm” on youtube)!

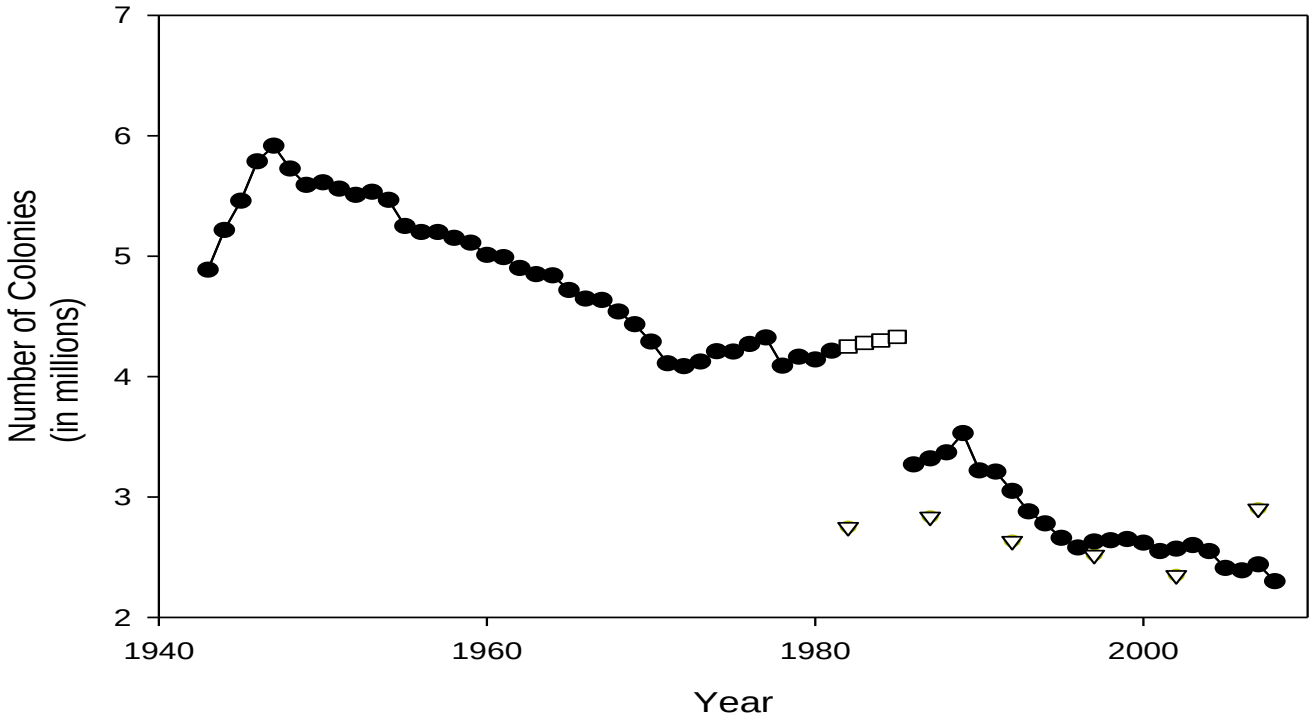
[Swarm catching 101]


Beekeeping made easy ™
HIVE TRACKS

Microsoft®
Research


USDA#1 May 2010
Pounds
Degrees F
185
180
175
170
165
160
100
90
80
70
60
50
40
30
20
10
0
evaporating water from nectar to make honey
foragers returning with nectar
foragers leaving
Weight
Air temp
Esaias/NASA

Population of Honey Bee Colonies in the US



Importance of Hive Records

- Make better hive management decisions
- More efficient operation
- Interesting information – identify trends, best practices, etc.
- Research – joined with records from other beekeepers, collective data can contribute to a better understanding of beekeeping
- Important for all of these reasons for both the beginner and expert and hobbyist and commercial beekeeper

Hive Tracks

- Web based hive management tool accessed at hivetracks.com
- Developed in Boone, NC by Mark Henson and James Wilkes over the past 2.5 years in their spare time ☺
- Secure – users create an account with a username and password
- Data privacy policy – personal information will not be sold or given to third party for any reason. Data may be used internally to analyze trends, best practices, etc.
- Free – How's that? We will utilize other means of generating revenue, though donations are accepted!