USING AGOL TO MANAGE CONNECTICUT BEEKEEPING
COLONY COLLAPSE DISORDER (CCD)

CCD could occur from one or all of the following:

- Pesticides
- Loss of Habitat
- Climate Change
- Disease
SOLUTIONS FOR CCD

- Ban dangerous pesticides

Nicotine-based Clothianidin
Imidacloprid
Thiametoxam
Clorpyriphos
Cypermethrin
Deltamethrin
Fipronil

Producers:
- Syngenta
- Bayer
- Dow
- Monsanto
- DuPont
SOLUTIONS FOR CCD

Preserve wild habitat
SOLUTIONS FOR CCD

Restore ecological agriculture

Ecological farming includes all methods, including organic, which regenerate ecosystem services like: prevention of soil erosion, water infiltration and retention, and increased biodiversity. Many techniques are used including no till, multispecies cover crops, strip cropping, terrace cultivation, shelter belts, pasture cropping etc.
POLLINATION FAILURE IN APPLE CROP AND FARMERS' MANAGEMENT STRATEGIES IN HENGDUAN MOUNTAINS, CHINA

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Keywords: Apple, hand pollination, pollen, Maoxian country, China

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Abstract:
The present paper highlights declining apple productivity due to the lack of proper floral pollination. At the same time, it discusses farmers’ awareness about pollination failures and their strategies to cope with the crisis by hand pollination. Pollination-related productivity problems in apple crop and farmers’ management strategies were studied in six villages (Suangma Shidaguan, Mati Guangming, Daguo Jingzhou Fengyi, Jingzhou Fengyi, Zhonggu Shiggu, and Jincu Nanxin) in the Maoxian County of Sichuan Province, China. The findings revealed apple productivity decline in Maoxian was caused by the lack of sufficient floral pollination or total pollination failures. Farmers were aware of it and they understood the significance of ensuring pollination of apple flowers for maintaining crop yield. Hand pollination of apples is a common practice adopted by farmers in Maoxian County of China to make sure that each flower is properly pollinated. It is a massive exercise in a sixty-km long valley in which every family member – men, women and children are involved. Various co-operation mechanisms among farmers have also evolved for sharing labour and skills. The practice of farmers renting honeybee colonies from beekeepers, even though cheap and bees are found in the area, is surprisingly absent. Two possible reasons for this: first, it was not promoted; and second, beekeepers are hesitant to rent their bee colonies because of excessive use of pesticide sprays on apples. Cost-benefit analysis of hand pollination revealed it is a laborious and time-consuming method of pollination. On the other hand, using bees for pollination by these poor farmers can be about eight times cheaper than hand pollination.
Apples  
Mangos  
Rambutan  
Kiwi Fruit  
Plums  
Peaches  
Nectarines  
Guava  
Rose Hips  
Pomegranates  
Pears  
Black and Red Currants  
Alfalfa  
Okra  
Strawberries  
Onions  
Cashews  
Cactus  
Prickly Pear  
Apricots  
Allspice  
Avocados  
Passion Fruit  
Lima Beans  
Kidney Beans  
Adzuki Beans  
Green Beans  
Orchid Plants  
Custard Apples  
Cherries  
Celery  
Coffee  
Walnut  
Cotton  
Lychee  
Flax  
Acerola – used in Vitamin C supplements  
Macadamia Nuts  
Sunflower Oil  
Goa beans  
Lemons  
Buckwheat  
Figs  
Fennel  
Limes  
Quince  
Carrots  
Persimmons  
Palm Oil  
Loquat  
Durian  
Cucumber  
Hazelnut  
Cantaloupe  
Tangelos  
Coriander  
Caraway  
Chestnut  
Watermelon  
Star Apples  
Coconut  
Tangerines  
Boysenberries  
Starfruit  
Brazil Nuts  
Beets  
Mustard Seed  
Rapeseed  
Broccoli  
Cauliflower  
Cabbage  
Brussels Sprouts  
Bok Choy (Chinese Cabbage)  
Turnips  
Congo Beans  
Sword beans  
Chili peppers, red peppers, bell peppers, green peppers  
Papaya  
Safflower  
Sesame  
Eggplant  
Raspberries  
Elderberries  
Blackberries  
Clover  
Tamarind  
Cocoa  
Black Eyed Peas  
Vanilla  
Cranberries  
Tomatoes  
Grapes
The Langstroth Hive

Primarily made of hollow boxes with an area for frames which will store honey, pollen and brood production.
The Langstroth Hive - Frames
BEES 101

- The Langstroth Hive - Frames
BEES 101

- The Langstroth Hive
Top Bar Hive

Horizontal top-bar hive is a single-story frameless beehive in which the comb hangs from removable bars. The Bars form a continuous roof over the comb.
Top Bar Hive

Horizontal top-bar hive is a single-story frameless beehive in which the comb hangs from removable bars. The Bars form a continuous roof over the comb,
Horizontal top-bar hive is a single-story frameless beehive in which the comb hangs from removable bars. The Bars form a continuous roof over the comb,
BEES 101

- Equipment Needed
BEES 101

- Equipment Needed
  - Veil, gloves
  - Smoker
  - Hive tool
  - Bee brush
BEES 101

Bee’s Social Hierchy

Worker = Sterile Female
Queen = Fertilized Female
Drone = Male
Bee’s Social Hierarchy
BEE'S 101

- Bee’s Social Hierarchy: THE QUEEN
Bee’s Social Hierarchy: THE QUEEN
Bee’s Social Hierchy: THE QUEEN

Life cycle of honeybees

- Queen lays egg
- Worker feeds larva and seals cell once larva reaches full growth

- Egg
- Larva day 6
- Larva day 10
- Pupa day 15
- Pupa day 18
- Adult day 21

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Bee’s Social Hierarchy: THE WORKERS
BEE’S SOCIAL HIERARCHY: THE WORKERS

- Undertakers: remove dead bees
- Nurse bees tend to brood
- Builders create the honeycomb and hive insulation
- Temp controllers ventilate the hive with wings and collect water
- Guards attack intruders
- The forager collect propolis (Tar), nectar and pollen
BEE'S SOCIAL HIERARCHY: THE DRONE

Photo by Alex Wild
Bee’s Social Hierarchy: THE WORKERS
BEE PACKAGE TYPES:

- Italian Bees purchased as a Package from Georgia
BEE PACKAGE TYPES:
BEE S 101

Bee Package Types:

- Queen not original mother, must be introduced into hive
Bee Package Types:
- Carnolian Nuc from Michigan
- Queen is the original mother, Frames are taken out of box and placed into hive.
BEE PACKAGES

Bee Package Types:

- Carnolian on the right, Italians on the left
SUGAR SYRUP 

- **Carbohydrates**
- **1:2 mix** in the spring
- **2:1 mix** fall and winter
Food supplies:

Pollen Patties for **Protein**

Recipe:

- sugar syrup
- white granulated table sugar and
- soy flour
- yeast
- pollen
BEEs 101

Products bees provide:

+ **Honey**: foraging bees collect sugar-rich flower nectar

+ Propolis

+ Wax

+ Pollen

+ Pheromones
BEES 101

Products bees provide:

+ Honey

+ Propolis: bee glue is a resinous mixture that honey bees produce from tree buds, sap flows, or other botanical sources.

+ Wax

+ Pollen

+ Pheromones
BEES 101

Products bees provide:

+ Honey
+ Propolis

+Wax: Bees convert the sugar in the honey into wax

+ Pollen
+ Pheromones
BEES 101

Products bees provide:

- Honey
- Propolis
- Wax

**Pollen:** 40% protein content. Used to feed the baby bees

- Pheromones
BEES 101

Products bees provide:

+ Honey
+ Propolis
+ Wax
+ Pollen

**Pheromones:** Bees have one of the most complex pheromonal communication systems found in nature.
Laws Pertaining to Honey Bees in Connecticut

Sec 22-89. Registration of honey bees. Each person owning one or more hives of bees shall, annually, on or before the first day of October, make application to the State Entomologist for the registration of bees. The State Entomologist shall issue to such applicant a certificate of registration without fee. The State Entomologist shall (1) keep accessible to the public a record of the registration, the name and place of residence of the registrant and the definite location in the municipality where the bees are kept and (2) transmit a copy of such information to the town clerk of the municipality in which the registrant resides. Any owner of bees who fails to register as required by the provisions of this section shall be fined not more than five dollars.

Sec. 22-90. Inspection of bees for contagious diseases. The State Entomologist shall, to such extent as he deems necessary or expedient, examine apiaries and quarantine such as are diseased and treat or destroy cases of the disease known as foul brood. The State Entomologist may appoint such inspectors as he deems necessary or expedient, and he or any person whom he appoints for that purpose shall have access at reasonable times to any apiary or place where bees are kept or where honeycomb and appliances are stored. He is authorized to make suitable regulations regarding inspections and quarantine and to prescribe suitable forms for permanent records which shall be on file and open to public inspection, and to make reasonable rules for the services of such inspectors, and may pay a reasonable sum for such services. No person or corporation shall remove bees under quarantine to another locality without obtaining the written permission of an authorized inspector. No person or transportation company shall receive for transportation any colony or package of bees, unless such colony or package is accompanied by a certificate of good health, furnished an authorized inspector. No person or transportation company shall deliver any colony or package of bees brought from any other country, province, state or territory unless accompanied by a certificate of health furnished by an authorized inspector of such country, province, state or territory. Any person or transportation company receiving a shipment of bees from without the state, unaccompanied by such certificate, shall, before delivering such shipment to its consignee, notify the State Entomologist and hold such shipment until inspected by an authorized inspector. If contagious diseases are found therein, such shipment shall be returned to the consignor or delivered to an authorized inspector of this state for treatment or destruction, provided the requirements of this section shall not apply to shipments of brood comb, with or without bees, suspected of being diseased and consigned to the State Entomologist, the Agricultural Experiment Station or any authorized apiary inspector of the state or to the Bureau of Entomology of the United States or the United States Department of Agriculture, and provided there shall be no destruction of any shipment of bees as herein provided in the absence of reasonable notice to the consignee thereof. No person shall resist or hinder the State Entomologist, or any inspector whom he appoints, in the performance of the duties imposed by this section. No person or corporation shall sell, to be removed to another location, bees, brood comb, frames or hives that have been in use, with or without combs, until they have been inspected by an authorized inspector, who shall issue a certificate of health if they are found free of contagious disease. Any person violating any provision of this section shall be fined not more than fifty dollars.


What is the end goal for the application?

- Collect hive/apiary locations
- Collect Owner communication Info
- Collect Inspection Data and History
- Notify Owners of Possible Chemical Spraying
What is the end goal for the application?

- Collect hive/apiary locations
- Inventory of hives
- Need to know how many and where

- Collect Owner communication Info
- Collect Inspection Data and History
- Notify Owners of Possible Chemical Spraying
THE APPLICATION

What is the end goal for the application?

- Collect hive/apiary locations
- Collect Owner communication Info
  In case of hive emergency
  Name/s, Mailing address, email, phone number
- Collect Inspection Data and History
- Notify Owners of Possible Chemical Spraying
THE APPLICATION

What is the end goal for the application?

- Collect hive/apiary locations
- Collect Owner communication Info
- Collect Inspection Data and History

Find a correlation with multiple hives in an area suffering from all or one of the main causes of CCD

- Notify Owners of Possible Chemical Spraying

SPATIAL ANALYSIS
What is the end goal for the application?

- Collect hive/apiary locations
- Collect Owner communication Info
- Collect Inspection Data and History
- Notify Owners of Possible Chemical Spraying

Zeeka spraying wiped out bees in the south due to the chemicals
Or could be for mosquito spraying
THE DATA

What is there for data to start? **SOURCE 1**

- A spreadsheet made by the Inspector during visits

Pro: Contained all the relevant fields needed for a base
Pro: Contained X,Y, coordinates of locations

Cons: collected only **25** X,Y, coords
Cons: suspects there may be **8000** more!
The Data

What is there for data to start? **SOURCE 2**

- A spreadsheet of all registered owners
  
  **Pro:** Contained all **Contact Info**
  
  **Pro:** Contained Addresses

  **Cons:** Has never been inspected, no data
  
  **Cons:** May not be the hive location
What is there for data to start?

**SOURCE 1:**
Create Layer from X,Y, in ARCMap
Result: Point Layer with correct fields

**SOURCE 2:**
Geocoding Tool in ARCMap
Using Addresses in Owner Table
Create Point Layer Along Centerline by Address Range
<table>
<thead>
<tr>
<th></th>
<th>The Recipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Make <a href="#">Original</a> 25 Point Layer With Fields Needed From X,Y,s</td>
</tr>
<tr>
<td>2</td>
<td>Make Point Layer from Geocoding Tool Using 1000 Addresses</td>
</tr>
<tr>
<td>3</td>
<td>Load Address Points into <a href="#">Original Point Layer</a></td>
</tr>
<tr>
<td>4</td>
<td>Create <a href="#">MXD</a> with Classifications of Inspected or Not</td>
</tr>
<tr>
<td>5</td>
<td>Create Service in ARCCatalog</td>
</tr>
<tr>
<td>6</td>
<td>Post Service and put Points as Feature Class in AGOL</td>
</tr>
<tr>
<td>7</td>
<td>Create Web Map, Configure Pop Up Box for Ref. of Location</td>
</tr>
<tr>
<td>8</td>
<td>Create Web Application and Add Widgets Needed</td>
</tr>
<tr>
<td>9</td>
<td>GO OUT IN THE FIELD, INSPECT HIVES, ADD OR EDIT EXISTING POINTS</td>
</tr>
<tr>
<td>10</td>
<td>SPATIAL ANALYSIS FOR TROUBLE AREAS (IN THE WORKS)</td>
</tr>
</tbody>
</table>
NOSEMA: Caused by two species of microsporidian parasites (a type of spore forming fungus)
THE FIELDS AND WHY

VARROA MITES:
The Fields and Why

Life cycle of honeybees

1. Queen lays egg
2. Worker feeds larva and seals cell once larva reaches full growth
3. Egg: day 0
   - Larva: day 6
   - Larva: day 10
   - Pupa: day 15
   - Pupa: day 18
   - Adult: day 21

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AMERICAN FOULBROOD DISEASE:
American foulbrood is one of the most widespread and the most destructive of the honey bee brood diseases.
Sources:
Mark H. Creighton,  
CT Apiary Inspector  
Mark.Creighton@ct.gov

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https://www.britannica.com/animal/honeybee  