

## **Appendix 1: Curriculum for the Greenhouse Scout School**

The school is organized as 6 weeks of on-line presentations and discussion (approximately 1.5 hours per week live/recorded), with associated hands-on activities and information to be posted outside of the on-line portion.

The information below includes the draft curriculum with information presented and activities to provide an idea of what will be done. Please note that this is a draft but has been reviewed by the grower advisory committee. The curriculum development is supported by NE-SARE Partnership Grant ONE21-396 Greenhouse IPM Scout School: Grower Input to Create the Curriculum and is in progress

## Things that will be done before classes/webinars start:

1. Know which students want the certificate (payment will indicate this)
2. Have sent equipment/resources
  - sticky cards
  - handlens,
  - Optivisor? Links from Elise
  - App
  - sample scouting forms?
  - pest management guides – Northeast Greenhouse (online) or Cornell recommends – how regional can we be?
  - lenses to attach to smartphone?
  - Flagging tape

List of what students should have themselves before start

Clipboard

Sharpie

Clothespins

Ziplock bags

Garden tool belt – apron

White paper or plates

Some sources from Elise

<https://www.ebay.com/p/1854738502> handlens

<https://www.ebay.com/itm/233575614233> garden tool belt – Dickies also has a version

<https://www.ebay.com/itm/133763113368> Optivisor

[http://www.forestry-suppliers.com/product\\_pages/products.php?mi=38281&itemnum=35965](http://www.forestry-suppliers.com/product_pages/products.php?mi=38281&itemnum=35965) – flagging tape and dispenser – also Granger, JC Smith, Inc. - there is one in Ithaca at 327 Elmira Road. – 2 colors

Sticky cards - Olsen Products, Inc., P.O. Box 1043, Medina, Ohio 44258

1-330-723-3210 phone

1-330-723-9977 FAX

Avoid those with grids as harder to read

3. Have identified a greenhouse for those students
4. Have created some way to keep documents 'forever' to serve as resources
  - Through teaching platform?
  - Is there a free accessible box system?
4. Have created as a document to be worked on throughout the series of webinars

- scouting fillable form
- scouting plan fillable form
- other?

5. Know what students must accomplish to get certificate and provide to students  
% of activities/modules/discussions participated in/finished

6. Have teaching platform set up and ready to go

Brightspace – comparable to Canvas

Easier for teachers and students

Once class is over, students can't get back in

Should work for anyone (if credits – do that through their own institution)

Moodle is a little clunky – more work for instructor

Indefinite information ?

Cornell Fair Use Policy Checklist:

[https://guides.library.cornell.edu/ld.php?content\\_id=63804356](https://guides.library.cornell.edu/ld.php?content_id=63804356)

## **Topic 1: Introduction to the class, scouting as the cornerstone of IPM, and the basic tools of scouting**

Students will know:

1. The reasons for scouting (see 'who does what' under agenda and some was moved to Week 6 – what questions to ask)
2. How scouting fits into an IPM plan for greenhouse production
3. How to create a scouting plan
4. How to select/use the appropriate tools
  - a. Create short videos to cover using the tools students receive; potentially create a video that unboxes and describes the items that participants receive
  - b. Use and placement of sticky cards (dating, location, how to put them in the crop)  
Video?
  - c. What is a 'good' picture – tips on taking one with smartphone  
Examples in webinar
5. Identification - fungus gnats, shore flies and drain flies  
\*\* each session will cover ID of 1-2 pest species, insect and disease

Students will be able to:

1. Use a hand lens and Optivisor magnifier
2. Use sticky cards and perhaps sticky tape
3. Know how to do a tap test and look at roots
4. Use a digital camera and added lenses or apps to take good pictures
5. Use a greenhouse scouting app
6. Identify fungus gnats, shore flies and drain flies (for these each week, identification to species level if necessary)

### **Class agenda**

- Introductions of students and presenters/team
- What is scouting and why do it (what is the goal)?
  - (how this fits into IPM)
  - (scouting as it relates to management - to provide information to person who makes decisions and also tell them when additional information is needed, what information is required/requested - may depend on the operation)
  - Discussion of where to find management information (as it isn't covered much in this class)?
- What tools can you use to scout
  - Videos/demos
- Identification – fungus gnats, shore flies and drain flies
  - Emphasis on identifying features, where you might find them

### **Discussion board – asynchronous not live**

Posting here could be an assignment or just a place to share information – see also Q&A board

Share tips on using handlenses?

Scouting app bingo or some other activity that can be done asynchronously

### **Assignment**

Put out sticky cards in greenhouse – send picture of placement

Map greenhouse – this could move to week 2

Send close-up pictures taken in greenhouse

\*\* for all weeks – which things should we ask students to post on discussion board- usually not everyone as it will result in too much information

### **Resources**

- Fungus gnat/shore fly/drain fly fact sheet
- Fact sheet on using sticky cards UConn
- Other resources on equipment?

These are other possibilities to include – may not be required for certificate. They would continue from week to week

**Q & A board** to post questions and get answers

### **Photo gallery**

What questions or thought processes go with this picture, or just to share

Intent is to develop a set of identified photos that can be used as a reference

### **Module with questions as review? Assignment? Test your knowledge?**

This could include be used to test knowledge on identification of the pests for each session

Sticky card with something circled – what's important

## Topic 2. Mechanics of scouting and record keeping

Students will know:

1. How to sample plants in a greenhouse for scouting
2. When, where and how often to scout
3. The concept of action thresholds
4. Methods of recording scouting information
5. Basic information on botrytis and thrips

Students will be able to:

1. Create a scouting plan for a greenhouse  
Scout a greenhouse – macro to micro – macro from all sides, 3 dimensional view – hanging baskets - video?
2. Record scouting data
3. Identify botrytis and thrips

### Class agenda

- Review/topics from discussion session/assignments related to week 1
- Questions from students
- Creating a sampling/scouting plan (Scouting plan fillable form should include places for these things)
  - Map of greenhouse/crops – places where pests could come in from outside,
  - Crop list – bedding plants, cannabis, vegetables, herbs, etc.?
    - Add resources on which pests to expect where?
  - Information gathered from grower/owner – pest history, key crops
  - Types of greenhouse and how that affects which diseases to expect
  - What factors determine which plants to sample
  - Look at whole crop – do plants seem different
  - Move to individual plants – which ones and why
  - What happens if plants move around
  - Other
- Physically sampling plants
  - Video
- When, where and how often to sample
  - Marking plants for repeated sampling
  - Training the eye
  - What is an action threshold, how to use them (as a scout) and what if there isn't one
  - Numbers over time
- Keeping records
  - Scouting forms – what information is essential/important

- (scouting fillable form introduced here)
- Identification – botrytis and thrips
  - Emphasis on identifying features, where/when you might find them

### **Discussion session**

Share what was found in week 1 – pictures

Issues with equipment? Need some questions/examples to start discussion

### **Assignment (not necessarily all these things)**

We create a greenhouse scenario with different crops, plants on benches/hanging/floor and intake fans or open sides, and have each student create a sampling plan

Post picture of sticky cards placed in week 1 – can you identify anything on them

Scout some portion of their greenhouse and describe what they did and what they found – could be video, audio or written

Replace sticky card – or count/photograph and leave

### **Module with questions as review? Assignment? Test your knowledge?**

Disease and insect id

### **Continue adding to:**

Q & A board

Photo gallery

### **Resources**

- There is a good resource with a few monitoring/reporting forms and descriptions of how/where to scout for some major pests from UMass (<https://ag.umass.edu/greenhouse-floriculture/fact-sheets/ipm-scouting-decision-making>)
- UConn also has some great forms for scouting: [sticky card forms](#), [summary form](#), [IPM monitoring form](#)
- UVM has a [Greenhouse Guide](#) online with some scouting template ideas.
- Fact sheets - viruses and mites

### Topic 3. Resources and how to find information

Students will know:

1. Where to find local resources such as Extension and University specialists
2. How to find and work with a diagnostic lab, including how to provide photographs and send samples
3. Basic information on viruses and spider mites

Students will be able to:

1. Find the Extension and University specialists in their state/region
2. Find the most logical diagnostic lab for their location
3. Prepare and send a sample to a diagnostic lab, including photos
4. Identify viruses and spider mites

#### Class agenda

- Review/topics from discussion session/assignments related to week 2
- Questions from students
- How to get help
  - Who are the local resources – Extension, University
  - Can you find a mentor?
  - How to get samples diagnosed
    - Where
    - How to sample and how to send samples
    - Why should you know where to send soil and plant tissue samples, too?
- Identification – viruses and spider mites (other mites?)
  - Emphasis on identifying features, where/when you might find them
  - Agdia videos on using test strips
- **Discussion session**
  - What are they finding in their greenhouses?
  - Share from sampling plans created
  - Share from sticky card pictures

#### Assignment

Research who the experts in their area might be – do we want to provide resource list after this is done?

Send a sample to a diagnostic lab (this costs money – can we facilitate?)

Post picture of sticky cards placed in week 2 – can you identify anything on them

Scout some portion of their greenhouse and describe what they did and what they found – could be video, audio or written

Replace sticky card – or count/photograph and leave

**Module with questions as review? Assignment? Test your knowledge?**



Disease and insect id

**Continue adding to:**

Q & A board

Photo gallery

**Resources**

- There is a list of Extension personnel in each state in the NE Floriculture guide; perhaps we could add/edit this; it looks like some folks are missing, but it could be a good starting place. (<http://negfg.uconn.edu/sectionAppendixI.php#personnel>)
- UVM compiled a comprehensive list of where to find information that we gave to growers at workshops. It would need to be updated. Or students could add their findings to it and expand the content.
- Fact sheets thrips and botrytis
- Provide a video describing how to submit a sample to local labs (Alicyn Smart created one for UMaine's disease diagnostic lab that we could potentially use with her permission)...

#### 4. Overview of scouting for primary disease and arthropod pests of greenhouse crops, including beneficial insects – Part 1

Over the 2 sessions, students will know:

1. How to identify and scout for economically important greenhouse insects/mites and beneficial insects
2. How to identify and scout for economically important greenhouse diseases and weeds
3. Basic information on aphids and root rots/damping off disease
4. Basic information on mites and mildews

Students will be able to:

1. Scout for economically important insects and mites
2. Scout for economically important diseases and weeds
3. Identify aphids and root rots/damping off
4. Identify mites and mildews

#### Class agenda

- Review/topics from discussion session/assignments related to week 3
- Questions from students
- Macro view of greenhouse – looking for damage or ‘odd looking’ plants. For each one, what are the possibilities and how do you differentiate between them. What other information do you need? Create resources for each
  - Leaf spots
  - Stem lesions
  - Damage/distortion
  - Plant color
  - Other?
- List of questions to ask – plant pathology (Mary)
  - [PLPPM 3010 Online Scouting Module](#)
    - Through an online module (see link for slides of flipped content in Canvas) we taught students a very general overview of the steps for scouting in the field
      - Know your plant (what does a normal plant for your crop look like?)
      - Assemble equipment
      - Make observations (all plants and individual plant)
        - Signs and symptoms
        - Look for patterns (random (biotic) vs. uniform (abiotic))
      - Record Observations
      - Ask questions (nutrient management? Agricultural practices? Pest management? Operations?)

- They went as groups to different locations (vegetable farm, orchard, vineyard) and practiced the above steps.
- The students worked in groups and compiled their scouting reports and generated management recommendations based on grower needs and what they found.
- Students also worked through case studies in class (face to face) in small groups and then presented preliminary diagnosis for the a given scenario and steps they would take to confirm the diagnosis, recommendations to the grower, etc. They were very able to do this for any crop and pathogen given the steps outlined above. We even gave them a banana disease as a case study and they were able to narrow it down to the correct pathogen/disease based on signs/symptoms/host.
- Identification – aphids, root diseases including damping off
  - Emphasis on identifying features, where/when you might find them

### **Discussion session**

What are they finding in their greenhouses?  
 Share from sticky card pictures  
 questions

### **Assignment**

Document scouting in their greenhouse for insect pests – what did they find, where,

Show results from sticky cards over time – are numbers increasing or decreasing of particular insects?

Report on samples sent in

### **Module with questions as review? Assignment? Test your knowledge?**

Disease and insect id

### **Continue adding to:**

Q & A board  
 Photo gallery

### **Resources**

- Fact sheets – whiteflies and mildews
- Resources on ordering/testing/etc. biocontrols – does this fit into the scouting curriculum?  
 Ask advisory committee?

## 5. Overview of scouting for primary disease and arthropod pests of greenhouse crops, including beneficial insects – Part 2

(See part 1 -

Students will know:

Students will be able to: )

### Class agenda

- Review/topics from discussion session/assignments related to week 4
- Questions from students
- Micro level – what are some of the specific ‘tricks’ that help to scout a greenhouse and find the issues as early as possible
  - Specific crop – pest interactions – aphids/pepper transplants, mealybug/tropicals
    - Add more
- Where/when/how to look for each of these.
  - Which ones on sticky traps
  - What might you look for (cast skins, honeydew, etc.)
  - Which plants or where on the plants
  - Tools – tap tests
- Abiotic issues - nutrient issues, etc.
- Weeds – why scout for weeds?
  - Scouting ON weeds
- Identification – – whiteflies, mildews
  - Emphasis on identifying features, where/when you might find them

### Discussion session

What are they finding in their greenhouses?

Share from sticky card pictures

questions

### Assignment

Document scouting in their greenhouse for disease pests – what did they find, where,

Post scouting forms for 3-5 week period

Report on samples sent in

### Module with questions as review? Assignment? Test your knowledge?

Disease and insect id

### Continue adding to:

Q & A board

## Photo gallery

### Resources

- NC State has a good [information sheet](#) on weed control in greenhouses, but I don't know if the list of herbicides is up to date. (Betsy has an up-to-date list of herbicides for greenhouses at least as it relates to NYS)
- Resources on abiotic issues

## 6. How to communicate scouting information to others

Students will know:

1. Methods of communicating with growers, owners, and staff – two way information – what questions to ask or what information scout will need
2. What information to communicate in different situations – presence of pests, management options for pest prevention, when and how to use different types of management
3. Basic information on mealybug and scales, and biocontrols
4. What questions should you be asking the grower – person in charge – expectations and responsibilities – who does what

Students will be able to:

1. Be able to present and discuss presence of pests and a management plan with a commercial greenhouse owner, grower or greenhouse staff
2. Identify mealybug, scales and common **biological controls** -references, check with what is being applied (work in conjunction with whoever is applying) and when

### Class agenda

- Review/topics from discussion session/assignments related to week 5
- Questions from students
- What questions to ask:
- Who does what in the business? Input vs decision making, conversations with growers – what are their priority crops and pests, history of pests in greenhouse (what do they already know about pests (disease insect weed etc.) and crops – where to put your time as a scout, who makes scouting plan. Things vary by business
- How to teach this to other staff members – tools to share
- How to motivate staff to report issues – is this up to the scout? May depend on who is scouting
- Video? Role playing?
- Identification – mealybug, biocontrols
  - Emphasis on identifying features, where/when you might find them
  - Biocontrol lookalikes

### Discussion session

Any last questions?

How to continue to interact with us?

### Assignment

Ask students to summarize the weekly scouting information they have been collecting and present it to the greenhouse they are working with

Report on samples sent in

Would they and how would they adapt the scouting plan they started with?

**Module with questions as review? Assignment? Test your knowledge?**

Disease and insect id

**Continue adding to:**

Q & A board

Photo gallery

**Resources**

- Cheryl - '[critical questions to help manage pests](#)' and we also have a list of questions to ask your biocontrol supplier that we give growers (it's not online).
- UConn has a [good slide set](#) with photos of insects on sticky cards.
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<https://ag.umass.edu/greenhouse-floriculture/fact-sheets/biological-control-in-greenhouses-preparing-for-spring-crops>