# Forest Tent Caterpillar Egg Mass Sampling Design

**Naja Kraus**
**NYSDEC**
**Division of Lands & Forests**
**Forest Health & Protection**

To determine management options one needs to quantify forest tent caterpillar densities and potential effects for the following year

# Egg Mass Sampling in NY State

- Field Protocol for Sampling FTC Egg Masses
  - Based on:
    - Field protocol for sampling forest tent caterpillar egg masses - Recommendation by Douglas C. Allen 1994
    - The development and application of a sequential sampling plan for forest tent caterpillar - Connola et al. 1957
- Objective: to classify stands with respect to "expected defoliation."
  - Noticeable defoliation v. no noticeable defoliation

# Sequential sampling method

- A sequential sampling plan helps to allocate labor

- Areas with very low or high populations require the least amount of sampling.

- Plot size may vary from 2 – 25 sugar maple trees



Figure 6.—Generic sequential sampling plan.
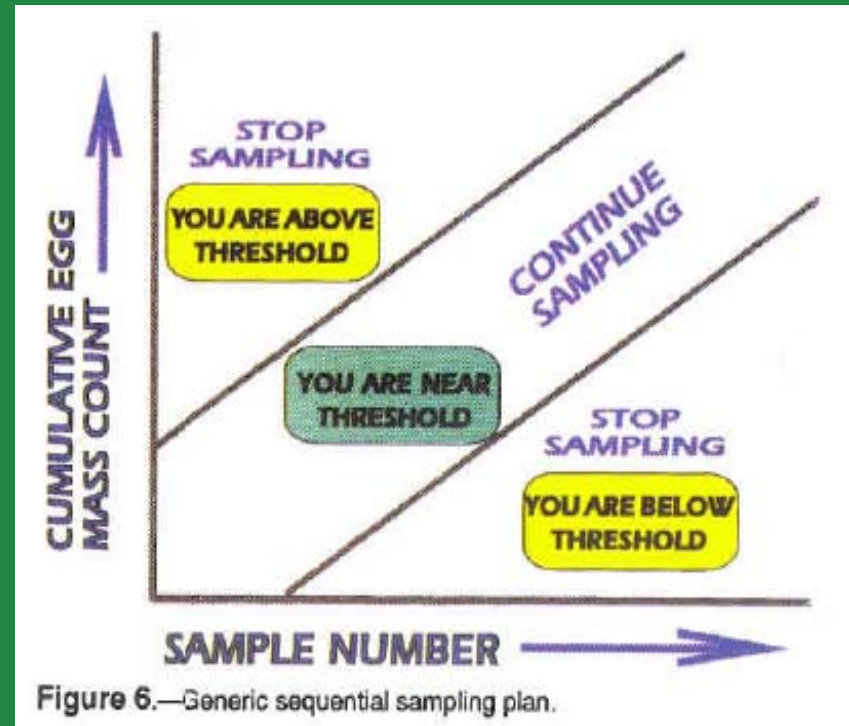
# Choose Survey Area

- Need to identify area of concern
    - Geographical boundaries
    - Ownership
    - Ecosystem
    - Areas of special concern
    - Personal choice

UGA0758040

# Number of Sampling Plots

| Woodlot Size | # of Plots |
|---|---|
| < 10 acres | 2 for each 5 acres |
| 10-50 acres | 1 for each 10 acres |
| 50-100 acres | 1 for each 25 acres |
| >100 acres | 1 for each 50 acres |

# Choosing Sample Points

- GIS
  - Place points randomly (100 feet from road) within 50 acre grid over identified survey area polygon

- Site Map
  - Highlight areas on map within which you wish to survey

# Prerequisites

- Distinguish new from old egg masses

- Delineate a 30-inch branch tip from the ground on varying height trees

- Practice, Practice, Practice

NEW egg mass

dark brown & shiny

OLD egg mass

lighter, almost whitish & dull

# Sampling Procedures

- Time of year
  - Egg masses present September to mid-April
  - Easier to see egg masses without tree leaves
  - Easier to tell old from new egg masses earlier in the season

- Ideal weather conditions
  - Good light
  - No wind
  - Dry conditions

# Navigating to the First Plot

- Use GPS to navigate to coordinates

OR

- Walk 130 ft (40 m, 2 chains) perpendicular from the nearest road or trail in the area you wish to sample.

OR

- Walk to an area you want to sample

# Data Sheet

**SAMPLE**  **Forest Tent Caterpillar Sequential Sampling Data Form**  **SAMPLE**

Observer Name(s): __**NAJA KRAUS**_____ Date: __**11/15/2005**___

Plot #: ____**1**____ County: __**WARREN**_____ Town: __**THURMAN**_____

Forest Type (&/or 3 dominant tree species): __**MAPLE, BEECH, BIRCH**_____

GPS coordinates (NYSDEC uses UTM NAD 83): __**18 589475 E**____ , ___**4823612 N**____ Elev: _**1350 feet**_

Weather observations:  Sky color:**GREY/CLOUDY** Amount of light: _**LOW/POOR**_ Wind:___**CALM**_____

Sample Method:  □ Binocular  □ Spotting Scope  □ Pole Pruner  □ Felled Tree
*Adjustment #:*  *Multiply by 4*  *Multiply by 2*  *Multiply by 1*  *Multiply by 1*

| Sugar Maple Tree # | Tree DBH | Number of NEW egg masses per 30-inch upper crown branch tips | | | | | | | | | | Total # of egg masses per tree *x 1,2 or 4* | Cumulative # of NEW egg masses |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Branch 1 | Branch 2 | Branch 3 | Branch 4 | Branch 5 | Branch 6 | Branch 7 | Branch 8 | Branch 9 | Branch 10 | | |
| 1 | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | |

Total number of trees sampled: _____ Total number of NEW egg masses found: _____
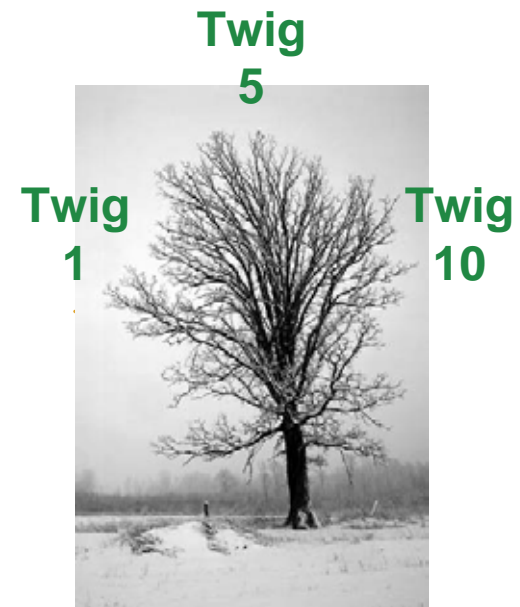
Noticeable defoliation predicted?  □ Yes  □ No  □ Undetermined

Average egg mass length (*measure 5 reachable egg masses*):  □ small  □ "normal"
                                                        (≤ ¼ inch, 7 mm)  (> ¼ inch, 7 mm)
_____  _____  _____  _____  _____

Comments:

# Sampling Protocol (1)

- Pick tree # 1 (an overstory sugar maple)
  - Tree closest to plot center (or choose randomly)

- Use binoculars or spotting scope to count the number of NEW egg masses on ten, 30-inch branch tips
  - Branch tips observed should cover the entire upper crown
  - Sample with back to the sun
  - Stand at the highest point



**Twig 5**

**Twig 1**

**Twig 10**

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Forest Type (&/or 3 dominant tree species): __MAPLE, BEECH, BIRCH_____

GPS coordinates (NYSDEC uses UTM NAD 83): __18 589475 E_____ , _____4823612 N_____ Elev: _1350 feet_

Weather observations: Sky color: GREY/CLOUDY Amount of light: _LOW/POOR__ Wind:____CALM_____

Sample Method: □ Binocular ☑ Spotting Scope □ Pole Pruner □ Felled Tree
*Adjustment #:* *Multiply by 4* *Multiply by 2* *Multiply by 1* *Multiply by 1*

| Sugar Maple Tree # | Tree DBH | Number of NEW egg masses per 30-inch upper crown branch tips | | | | | | | | | | Total # of egg masses per tree *x 1,2 or 4* | Cumulative # of NEW egg masses |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Branch 1 | Branch 2 | Branch 3 | Branch 4 | Branch 5 | Branch 6 | Branch 7 | Branch 8 | Branch 9 | Branch 10 | | |
| 1 | **12.6″** | **-** | **1** | **-** | **1** | **-** | **1** | **-** | **-** | **1** | **-** | **4 x 2 = 8** | **8** |
| 2 | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | |

Total number of trees sampled: _____ Total number of NEW egg masses found: _____

Noticeable defoliation predicted? □ Yes □ No □ Undetermined

Average egg mass length (*measure 5 reachable egg masses*): □ small □ "normal"
(≤ ¼ inch, 7 mm) (> ¼ inch, 7 mm)

_____ _____ _____ _____ _____

Comments:

# Sampling Protocol (2)

- Walk 100 feet in direction noted in the random direction table and pick the closest dominant or co-dominant sugar maple tree (tree # 2)
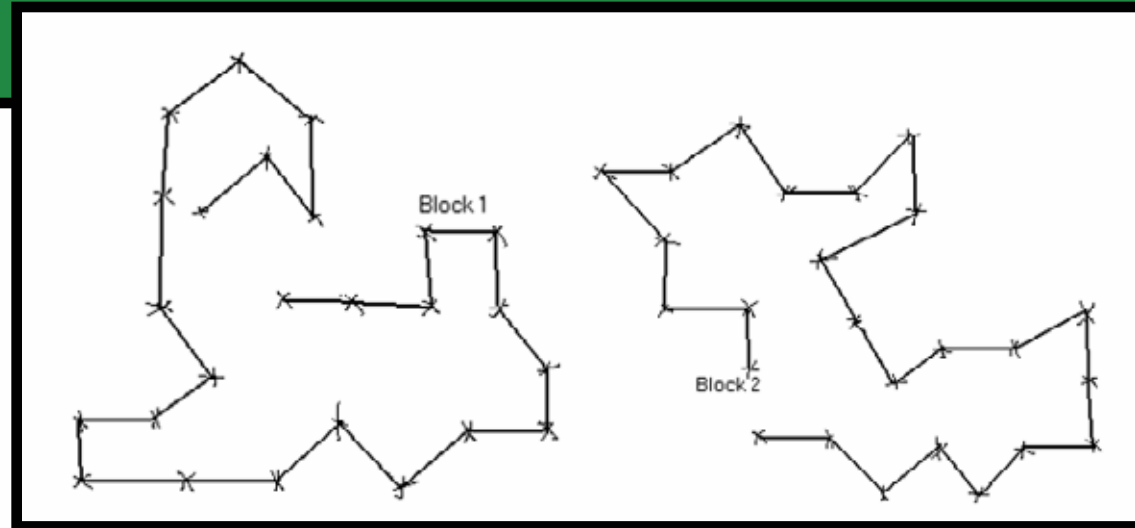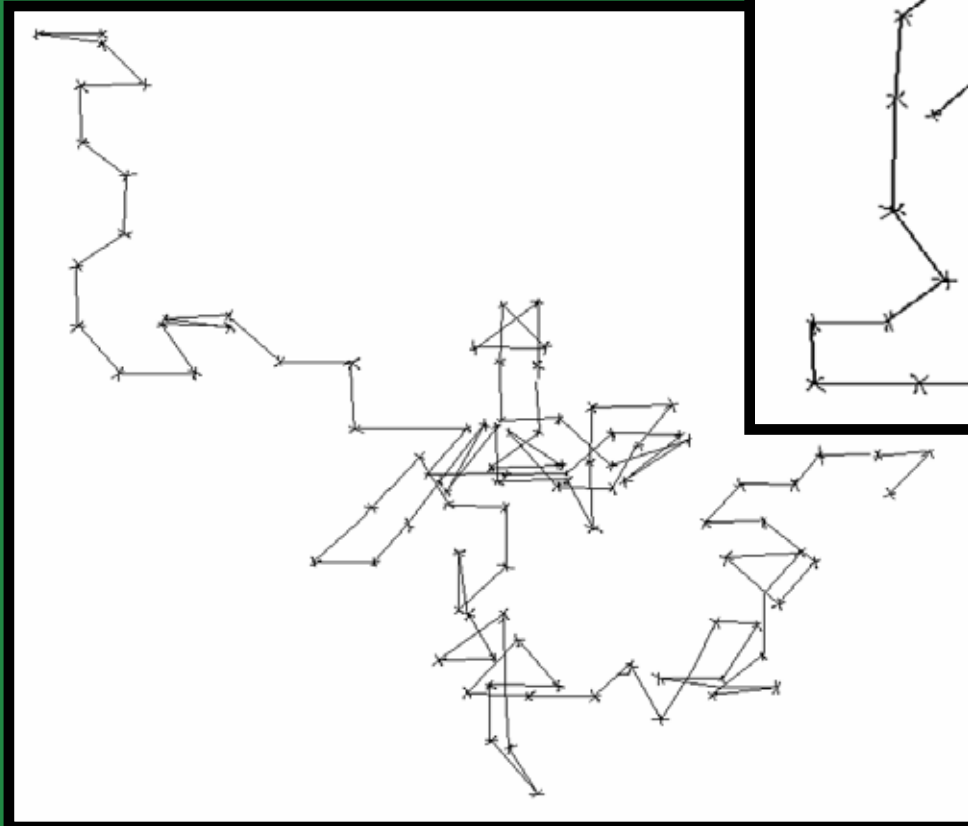


100 feet

- Red v. Sugar maple
  - do NOT survey on red maple

# Choosing a Random Direction

Developed by Scott Costa, University of VT, Entomology Research Lab



Semi-random Cardinal Path

Too much science?

# Random Direction Table

**Random Direction Table**[1]

The first plot should be chosen by walking 130 ft (40 m, 2 chains) perpendicular from the nearest road or trail in the area you wish to sample. If random coordinates were generated for sampling then that should be your first plot location. For the next plot, locate today's date on the table below and walk 100 ft (30 m, 1½ chains) in the direction noted and place a flag there as plot center. Today's date is the starting point; continue down the table to choose the walking direction for each additional plot sampled. If the direction takes you out of the desired forest type (i.e. into a conifer stand, cliff edge, road or swamp) then use the next direction instead.

| Date | Direction | | Date | Direction | | Date | Direction | | Date | Direction |
|------|-----------|---|------|-----------|---|------|-----------|---|------|-----------|
| 1 | NE | | 15 | SE | | 25 | E | | - | N |
| 2 | SE | | 16 | NE | | 26 | SE | | - | SW |
| 3 | N | | 17 | E | | 27 | NE | | - | W |
| 4 | NW | | 18 | N | | 28 | SE | | - | NW |
| 5 | SW | | 19 | NW | | 29 | NE | | - | SW |
| 6 | S | | 20 | N | | 30 | E | | - | W |
| 7 | S | | 21 | W | | 31 | N | | - | SE |
| 8 | SE | | 22 | S | | - | N | | - | S |
| 9 | SW | | 23 | W | | - | SW | | - | E |
| 10 | W | | 24 | W | | - | W | | - | S |
| 11 | S | | Return to 1 for additional directions | | | - | SW | | Return to 25 for additional directions | |
| 12 | E | | | | | - | NW | | | |
| 13 | E | | | | | - | NW | | | |
| 14 | NE | | | | | - | NE | | | |

[1] Random direction table based on Scott Costa's hemlock wooly adelgid sequential sampling plan.

# Sampling Protocol (3)

- Repeat the sampling procedure on tree # 2

- Sum the cumulative number of NEW egg masses counted
  - Multiply by 4 (binoculars)
  - Multiply by 2 (spotting scope)

# Data Sheet

**SAMPLE** **Forest Tent Caterpillar Sequential Sampling Data Form** **SAMPLE**

Observer Name(s): ____NAJA KRAUS_____ Date: __11/15/2005_____

Plot #: ____1_____ County: __WARREN_____ Town: ___THURMAN_____

Forest Type (&/or 3 dominant tree species): __MAPLE, BEECH, BIRCH_____

GPS coordinates (NYSDEC uses UTM NAD 83): ___18 589475 E_____ , _____4823612 N_____ Elev: _1350 feet_

Weather observations: Sky color: GREY/CLOUDY Amount of light: _LOW/POOR_ Wind:____CALM_____

Sample Method: □ Binocular ☑ Spotting Scope □ Pole Pruner □ Felled Tree
*Adjustment #:* *Multiply by 4* *Multiply by 2* *Multiply by 1* *Multiply by 1*

| Sugar Maple Tree # | Tree DBH | Number of NEW egg masses per 30-inch upper crown branch tips | | | | | | | | | | Total # of egg masses per tree *x 1,2 or 4* | Cumulative # of NEW egg masses |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Branch 1 | Branch 2 | Branch 3 | Branch 4 | Branch 5 | Branch 6 | Branch 7 | Branch 8 | Branch 9 | Branch 10 | | |
| 1 | 12.6″ | - | 1 | - | 1 | - | 1 | - | - | 1 | - | 4 x 2 = 8 | 8 |
| 2 | **15″** | **2** | **-** | **1** | **-** | **1** | **-** | **1** | **-** | **1** | **-** | **6 x 2 = 12** | **20** |
| 3 | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | |

Total number of trees sampled: _____ Total number of NEW egg masses found: _____

Noticeable defoliation predicted? □ Yes □ No □ Undetermined

Average egg mass length (*measure 5 reachable egg masses*): □ small □ "normal"
(≤ ¼ inch, 7 mm) (> ¼ inch, 7 mm)
_____ _____ _____ _____ _____

Comments:

# Sampling Protocol (4)

- Consult sequential sampling table to determine if you are able to predict the "expected defoliation" or if sampling additional trees is necessary.

- Continue sampling additional trees until the "expected defoliation" level can be predicted

# Sequential sampling table
## for FTC egg mass populations in NY

Sample guide showing minimum numbers of trees (10-twig samples) that must be examined in an egg mass survey to permit site classification with respect to expected forest tent caterpillar defoliation.

| # of trees (10-twigs) sampled | Total number of NEW egg masses counted | | |
|---|---|---|---|
| | No defoliation predicted. STOP sampling | Defoliation level unknown. Continue sampling | Noticeable defoliation predicted. STOP sampling |
| 1 | - | - | - |
| 2 | 0 | 1 – 7 | 8 or more |
| 3 | 2 or less | 3 – 9 | 10 or more |
| 4 | 4 or less | 5 – 11 | 12 or more |
| 5 | 6 or less | 7 – 14 | 15 or more |
| 6 | 8 or less | 9 – 16 | 17 or more |
| 7 | 11 or less | 12 – 18 | 19 or more |
| 8 | 13 or less | 14 – 20 | 21 or more |
| 9 | 15 or less | 16 – 22 | 23 or more |
| 10 | 17 or less | 18 – 24 | 25 or more |
| 11 | 20 or less | 21 – 27 | 28 or more |
| 12 | 22 or less | 23 – 29 | 30 or more |
| 13 | 24 or less | 25 – 31 | 32 or more |
| 14 | 26 or less | 27 – 33 | 34 or more |
| 15 | 28 or less | 29 – 35 | 36 or more |
| 16 | 30 or less | 31 – 38 | 39 or more |
| 17 | 33 or less | 34 – 40 | 41 or more |
| 18 | 35 or less | 36 – 42 | 43 or more |
| 19 | 37 or less | 38 – 44 | 45 or more |
| 20 | 39 or less | 40 – 46 | 47 or more |
| 21 | 41 or less | 42 – 48 | 49 or more |
| 22 | 43 or less | 44 – 51 | 52 or more |
| 23 | 46 or less | 47 – 53 | 54 or more |
| 24 | 48 or less | 49 – 55 | 56 or more |
| 25 | 50 or less | 51 – 57 | 58 or more |

# Data Sheet

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Observer Name(s): ____NAJA KRAUS_____ Date: __11/15/2005___

Plot #: ____1_____ County: __WARREN_____ Town: ___THURMAN_____

Forest Type (&/or 3 dominant tree species): __MAPLE, BEECH, BIRCH_____

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Sample Method:       □ Binocular          ☑ Spotting Scope          □ Pole Pruner          □ Felled Tree
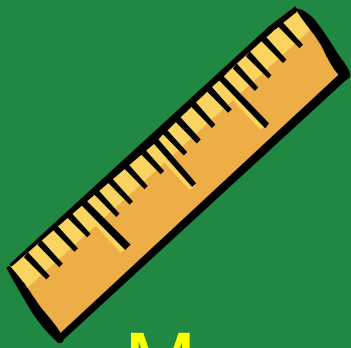*Adjustment #:*          *Multiply by 4*          *Multiply by 2*          *Multiply by 1*          *Multiply by 1*

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| 1 | 12.6″ | - | 1 | - | 1 | - | 1 | - | - | 1 | - | 4 x 2 = 8 | 8 |
| 2 | 15″ | 2 | - | 1 | - | 1 | - | 1 | - | 1 | - | 6 x 2 = 12 | 20 |
| 3 | ⬇ | | | ⬇ | | | | ⬇ | | | ⬇ | | ⬇ |
| 25 | | | | | | | | | | | | | |

Total number of trees sampled: _____**2**_____ Total number of NEW egg masses found: _____**20**_____

Noticeable defoliation predicted?      ☑ Yes          □ No          □ Undetermined

Average egg mass length (*measure 5 reachable egg masses*):          □ small                    □ "normal"
_____   _____   _____   _____   _____                ( ≤ ¼ inch, 7 mm)      (> ¼ inch, 7 mm)

Comments:

# Egg Mass Size

- Measure the length of 5 NEW egg masses

- Determine if the average length is ≤ or > than ¼ inch

- "Normal" egg masses are ½ inch long

- Egg masses ≤ ¼ inch may indicate decreasing population

# Data Sheet

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Sample Method:  □ Binocular  ☑ Spotting Scope  □ Pole Pruner  □ Felled Tree
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| 1 | 12.6″ | - | 1 | - | 1 | - | 1 | - | - | 1 | - | 4 x 2 = 8 | 8 |
| 2 | 15″ | 2 | - | 1 | - | 1 | - | 1 | - | 1 | - | 6 x 2 = 12 | 20 |
| 3 | ⇩ | | | ⇩ | | | ⇩ | | | ⇩ | | | ⇩ |
| 25 | | | | | | | | | | | | | |

Total number of trees sampled: _____2_____ Total number of NEW egg masses found: ____20_____

Noticeable defoliation predicted?  ☑ Yes  □ No  □ Undetermined

Average egg mass length (*measure 5 reachable egg masses*):  □ small  ☑ "normal"
__9 mm__  __8 mm__  __11 mm__  __9 mm__  __10 mm__  (≤ ¼ inch, 7 mm)  (> ¼ inch, 7 mm)

Comments: **This stand experienced moderate defoliation in 2004, heavy defoliation in 2005**

# Qualifiers

- This is a simplified population sampling survey tool. Be careful how you interpret and use the results.

- A determination of "noticeable" defoliation does not always mean that heavy defoliation will occur

- Weather, parasites and other factors may cause significant egg and larval mortality

# Modifiers



- Other factors to consider

  – levels of defoliation from previous years

  – numbers of years of previous defoliation
    - Heavy defoliation rarely occurs more than 3 years at a given site

  – extent of defoliation in adjacent areas

  – length of egg masses
    - Average length of ≤ ¼ inch may indicate lower defoliation than predicted

# Additional Information

- Edge trees may contain less egg masses than interior populations

- Typically can do 2-3 sites per day

- May want to flag or mark sampled trees in order to compare actual with predicted defoliation

- Sampling along an elevation gradient may help with predicting stand-level populations

# Choosing your Optics

- Get the best your $$$ can buy

- Increasing light and magnification- improves your ability to view egg masses

- Aperture of 60 is fine, 80 to 100 is better

# Spotting Scopes

**Advantages over binoculars:**
- Increases viewing accuracy
- Easier to differentiate between old & new egg masses

**Recommendations:**
- $45^0$ angle eyepiece
- Zoom eyepiece (e.g. 20-60x)
- Sturdy tripod
- Folding chair

**Comments:**
- With practice spotting scopes become easy to use
- Can be expensive to buy a scope that is good enough to work for egg mass surveys

# Binoculars



**Advantages over spotting scope:**

- Quick & easy tool
- Lighter and smaller to carry
- Fast learning curve
- Less expensive

**Recommendations:**

- Lie down when viewing egg masses
- Bring something to lie down on (e.g. piece of thick plastic)

**Comments:**

- Opposite buds may look like egg masses
- Difficult to differentiate between old & new egg masses

# Additional Options



- **Pole Pruners**
  - Must be able to reach the upper 1/3 of the tree crown.
  - <u>Cut</u> ten, 30" branches within the top 1/3 of tree crown
  - Count NEW egg masses on cut branches
  - Choose branches without looking for egg masses first
- **Felled Tree**
  - Fell a dominant or co-dominant Sugar Maple tree
  - Count new egg masses on ten, 30" branches spread across top 1/3 of tree crown
  - Choose branches without looking for egg masses first

# Suggested Survey Equipment

- Binoculars  or  spotting scope & tripod

- Personal Digital Assistant (i.e. IPAQ, datalogger) or  paper data sheets with clipboard & pencil

- Sequential sampling table & sampling protocol

- GPS, compass & site map

- DBH tape (if measuring tree DBH)

- Small ruler to measure egg masses

# Survey Equipment - Helpful Extras

- Plastic groundcloth (using binoculars)

- Campchair (using spotting scope)

- For Safety:
  - First aid kit
  - Cell phone or radio
  - Orange vest
  - Hardhat

# Submit your data

- Please email or mail your FTC egg mass sampling results to NYSDEC Forest Health and Protection so that your data can contribute to our understanding of forest tent caterpillar population levels throughout New York State.

  | | |
  |---|---|
  | NYSDEC | Telephone:  518-402-9425 |
  | Div. of Lands & Forests | Fax: 518-402-9028 |
  | Forest Health & Protection | Email: lands@gw.dec.state.ny.us |
  | 625 Broadway | In the subject line please write |
  | Albany, NY 12233-4253 | "To the Attention of Forest Health" |

- An outcome where no defoliation is predicted is also of interest to us.

- Contact your local NYSDEC foresters or the NYSDEC Forest Health and protection staff if you have any questions about this protocol.

- Thank you for your interest in our state forests!