Threats Template Matrix -- Non-native invasive insects and diseases

1. **Threat**: Non-native invasive (and some native) insects and diseases impacting native trees, causing decline and mortality and leading to undesirable successional trajectories and loss of biodiversity.

2. **Location**: Throughout Allegheny National Forest and region

3. **Impact or Severity**: Severity has been and can be very high, but ranges depending on host/damage casual agent relationship

4. **Desired Outcome:** Maintenance of native biodiversity and resilience by protection of native trees, breeding resistant native trees, and accomplishing diverse and vigorous regeneration through silvicultural operations.

5. Strategies to Achieve the Desired Outcome

   Strategy 1: Chemical – Chemical control is possible/desirous as far as we know for the following:

   - Hemlock woolly adelgid
   - Elongate hemlock scale
   - Gypsy moth – also treat hemlocks when egg mass densities warrant, as GM can cause hemlock mortality quickly at high densities (Bt and Mimic, treat hemlocks with Mimic or Gypcheck?)
   - Emerald ash borer – Triage, although treatment should be started in advance of infestation if at all possible so this may not be feasible on vast majority of ANF any longer
   - Asian longhorned beetle
   - Spotted wing drosophila???

   When:

   Who:

   Cost:

Threats Template Matrix -- Non-native invasive insects and diseases

Strategy 2: Biological – Biological control is possible/desirous as far as we know for the following:

- Hemlock woolly adelgid – see hemlock threat matrix
- Elongate hemlock scale (*Cybocephalus nipponicus*) but these predators are less readily available
- Emerald ash borer – sites need to be entered into mapbiocontrol.org, approved by APHIS. APHIS looking for more release sites and many locations on/near the ANF have suitable conditions (high ash density, variety of sixes, moderate EAB densities), but EAB densities increasing/tree health rapidly declining
- Spotted wing drosophila???

Naturalized/native controls:

- Cherry scallopshell moth, although virulence of populations of CSSM is combined with apparently declining overstory cherry health, making impact a concern despite native controls
- Gypsy moth fungus and virus

When:

Who:

Cost:

Considerations/ Information needed:

Strategy 3: Finding, Cataloging and Breeding Resistant Trees or Possibly Resistant Trees or "Lingering Trees"
Species:

- American beech
- Eastern hemlock
- White, green and black ash on the ANF
- Butternut? Already have plantings/orchards

When:

Who:

Cost:

Considerations/ Information needed: Locations of possibly resistant or lingering trees, appropriate reporting and/or seed collection methods once resistant or lingering tree identified

Threats Template Matrix -- Non-native invasive insects and diseases

Strategy 4: Timely removal of affected tree(s) and other silvicultural operations considering residual species and regeneration diversity
Oaks with oak wilt or stands with oak decline/mortality
White pine in key locations showing decline and mortality from multiple fungal pathogens identified?

When:

Who:

Cost:

Considerations/ Information needed:

Strategy 5: Seed collection and storage (USDA, National Repository, Camcore) Hemlock, Ash; any native tree

When:

Who:

Cost:

Considerations/ Information needed

6. Monitoring Strategies

Strategy 1: Early Detection/Rapid Response for species:

- Winter moth
- Asian longhorned beetle
- Spotted lanternfly

***if any of these are detected, immediate action for tree removal/chemical control for eradication should be triggered

When/Frequency: Yearly

Who:

Cost:
Considerations/ Information needed:

Threats Template Matrix -- Non-native invasive insects and diseases

Strategy 2: Longer term monitoring in priority locations once an invasive insect or disease is detected across the ANF but still low densities

Hemlock in HCAs and BOF General Hemlock Survey locations/along roads; these surveys will check for EHS as well
Spotted wing drosophila??

When/Frequency: Yearly

Who: Forest Service staff, BOF staff, volunteers

Cost:

Considerations/ Information needed:

Strategy 3: Permanent plot network(s)

- Northern Research Station/ANF ash research plots
- Permanent Hemlock Condition Monitoring Plots

When/Frequency: visitation frequency depends on protocols (for example, Permanent Hemlock Condition Monitoring Plots need only be visited once every other year or so)

Who: NRS, ANF, contractual

Cost:

Considerations/ Information needed

7. Additional Information Needs:

**Don't recommend any more permanent plot networks for any invasive insect pests identified at this time – too intensive??

8. Other: Developing some kind of scheme that could be applied to any non-native invasive insect or disease to determine best course of action, or best location to take what action among the available strategies – some list of questions or something that could be asked anytime a new invasive is faced. E.g., How much of the host is there ANF-wide and in what configuration; How much mortality is expected in the next 10 years ANF-wide; How much ecological value; How much social/economic value; Effective chemical available; Effective biocontrol available; Resistance. And each question would lead to "do something in the short term" or "wait and monitor" option or something. For example with EAB and ash: ash is patchy locations on ANF, low percentage of overall BA but significant in specific areas = I don't know if it's because I already know what I think about this as far as ash, but I think that this conclusion about any host would lead me to think that an

Threats Template Matrix -- Non-native invasive insects and diseases
in-depth prioritization analysis wouldn't be very necessary. Very significant mortality expected in next decade = do something in short term (??). How much ecological value = relatively moderate and other associated tree species may fulfill niche gap created. How much economic value = high, so it will be important to salvage some of this value. Effective chemical available = at this point on the ANF I'd say not really. Effective biocontrol available = as far as we know right now biocontrols are a decent option. Resistance = potential for lingering ash. This combination of factors leads to salvaging a good portion of the BA, developing a biocontrol program, and looking for lingering ash after most ash BA is dead. Seed collection would be efficacious with any host of a non-native invasive insect or disease, and hazard trees have to be dealt with no matter what the host/agent. Of course it's never this cut and dried, but even attempting to reach some kind of consensus with each of these questions would be a good way to outline reasonable actions. Tie in with other groups – Age class diversity group concerned with increasing stand resilience, diversity group concerned with increasing native diversity; these actions, using identified strategies (silvicultural, management of invasive plants, etc.), will possibly protect against future unknown invasives. Diversity is the best buffer against adversity in the face of uncertainty. Aerial survey for cherry scallopshell moth defoliation; native parasitoid, what's it doing, how much is it taking care of, is population crashing? Other natives like forest tent caterpillar during outbreak conditions – no funding support for treating a native, even though it may cause significant dieback and mortality Don't know yet what to do about new beech leaf disease, seems to only be affecting understory beech (i.e., root sprouts) Not sure what is done about winter moth in New England where it's an issue

Don's list from 6-23-2017 email to Maureen:

- Hemlock woolly adelgid - invasive
- Elongate hemlock scale – invasive; not yet present in NW PA, but it is moving westward in PA
- Emerald ash borer – invasive
- Ash yellows
- Gypsy moth - invasive
- Oak wilt – considered to be an invasive and has been present in PA a long time but is now expanding its range.
- Oak decline
- Forest tent caterpillar – native insect
- Beech bark disease and beech bark scale insect
- Beech leaf disease (new to PA – pathogen(s) not known; found in Ohio and western PA)
- Cherry scallop shell moth – native insect
- White pine decline and rapid mortality (multiple pathogens and stress factors involved)
- Winter moth - invasive (not in PA yet, but is a big problem in New England)
- Spotted lanternfly - invasive
- Sugar maple decline
- Asian longhorned beetle – invasive
- Thousand cankers disease and the vector walnut twig beetle – native to SW U.S. but is not native to the eastern U.S.