A. Trap Sites

Survey and monitoring traps should be placed in wooded areas near treatment sites but not in/upon coniferous trees on the site. Five locations have been monitored within the Bonanza Creek Experimental Forest since 1975. The locations of these plots are as follows (NAD83):

<table>
<thead>
<tr>
<th>Site</th>
<th>North</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNZ Insect 1</td>
<td>64.6955</td>
<td>-148.2854</td>
</tr>
<tr>
<td>BNZ Insect 2</td>
<td>64.7030</td>
<td>-148.3004</td>
</tr>
<tr>
<td>BNZ Insect 3</td>
<td>64.7054</td>
<td>-148.3212</td>
</tr>
<tr>
<td>BNZ Insect 4</td>
<td>64.7076</td>
<td>-148.3204</td>
</tr>
<tr>
<td>BNZ Insect 5</td>
<td>64.7659</td>
<td>-148.2929</td>
</tr>
</tbody>
</table>

- A site must be large enough to hold all the traps that will be placed there. Traps are normally placed no closer than 25-30 m apart. For monitoring, one trap per 5-10 acres (depending on tree density) is sufficient. The lures are very effective at attracting insects, and if hung on a suitable host tree, there is high potential for tree mortality.
- At each site five traps, each with a different lure, should be monitored throughout the growing season.

B. Number and Types of Traps and Lures

- 12-unit Lindgren funnel traps placed at least 25 m apart should be set up by the time of first beetle flight.
- Each trap is baited with one of the following five lures or lure combinations, depending on the species to be trapped (Alpha Scents, West Linn, OR, USA):
  - ETHANOL: Ultra-high release (UHR) ethanol lure (general attractants for woodboring insects in deciduous hosts).
  - ALPHA PINENE: UHR alpha-pinene (general attractants for woodboring insects in coniferous hosts).
  - IPS: Three-component Ips lure (or other specific lure as designated by species). These are more specific for conifer-feeding bark beetles, primarily Ips.
  - WOODBORER: Turpentine and UHR ethanol lure. General woodboring beetle attractant.
• SPRUCE BEETLE: Two-component spruce beetle lure. These are more specific for conifer-feeding bark beetles, primarily *Dendroctonus*.

C. **Trapping Period**

• Depending upon regional and local phenology, traps should be in place by early spring at about the time of bud break. The trapping period lasts for 12 weeks. Traps are deployed in late May.

• Traps should be checked and samples collected twice each summer, at 6 and 12 weeks from deployment.

D. **Trap Placement**

Lindgren funnel traps attract target species by lures (olfactory attraction) and by imitating tree boles (visual attraction). Traps should be placed in the most suitable and secure situation possible, given the constraints listed above. Some of the following trap placement criteria may not be met at a given site.

• Place traps within 100m of potential host trees. Trap effectiveness rapidly declines at greater distances. Traps placed on "asphalt or concrete deserts" are rarely productive. Generally, the expectation is that we will be detecting the consequences of past, hopefully recent, treatments. Suitable living hosts will vary according to target species.

• Set traps at least 25m apart when possible. Additional traps using different lures should not be set closer than 10m from other traps at the site to avoid possible trap interaction.

• Place traps out of direct sunlight, preferably in partial shade, or complete shade if the trap remains visible from a distance. Direct sunlight reduces lure lifespan and may make traps less attractive to target species. A good place to hang traps is at the margin of a stand of host trees.

• Avoid placing traps near obviously injured or fallen potential hosts, which could compete for target species. Tree volatiles may interfere with trap effectiveness.

• Place traps so they are visible by line-of-sight from potential sources of beetles (e.g. piles of slash, possible host trees etc.). Make sure that traps are not obscured by vegetation. If appropriate, clip or remove any such vegetation. This is especially true of vegetation likely to grow rapidly between trap visits. Remember, target species are attracted to visual aspects of Lindgren funnel traps as well as olfactory characteristics.

E. **Trap Set-up**

• Trap hanging: Various methods of hanging traps are acceptable. Traps may be suspended from a rope between trees, suspended from a tree branch, suspended from a trap stand or hung on a chain link fence. Trap stands are made from a nine foot length of 1/2" to 5/8" concrete reinforcing bar (rebar) with a one foot right angle bend at the top. Regardless of method used, traps should be hung so that the collecting container is at least 12" above the ground and any ground cover or other vegetation.

• Attach lures to the connecting supports so they hang on the outside of the trap at the middle of the funnel column. Attach the top of UHR ethanol and alpha-pinene lures so that the middle of the lure is at the middle of the funnel column. Tuck the lower portion of the pouch into a lower
funnel to provide support and prevent it from swinging freely. Be sure the pouch does not block the hole in the funnel. Attach *Ips* lures so all three components hang on the outside of the middle funnel at the same height.

- Ensure that the rubber stopper is secure inside the bottom of the collecting cup with the large end of the stopper on the inside of the cup to prevent it from falling out.
- **NOTE:** BE SURE THAT ALL THE FLANGES ON THE BOTTOM FUNNEL AND COLLECTING CUP ENGAGE PROPERLY. THIS IS OFTEN NOT EASY TO DO. Some collecting cups may originally fit tightly and require a certain amount of pressure when first attaching and twisting to secure to the trap. A lubricant (wax, bar soap etc.) can be applied to the cup lip if necessary before attaching it.
- If wet trapping, fill the collecting cup approximately 1/3 full with preservative AFTER attaching it to the trap. If dry trapping, a 1 cm piece of vapona (No Pest strip) is placed loose in the bottom of the cup.

**F. Trap Checking**

- Traps should be checked every six weeks for the 12 week trapping period.
- Examine trap and make sure it is undamaged. If damaged, disturbed or if the site has become unsuitable, consider moving the trap to a better, but nearby, location.
- **NOTE:** The following are suggestions for trap sample collection, and can be modified based on local needs and knowledge.
- Remove the cup from the bottom of the trap and examine its contents. Remove any large debris (leaves, twigs, etc.) from the collecting cup with a pair of long forceps. Before submitting a sample, please also remove all large dead animals (e.g., bats, birds, frogs, etc.). Before discarding this material, flush it with alcohol through a disposable paint filter to collect any entangled specimens. Check thoroughly for insects. Specimens are easily entangled or hidden in debris and some target species are **very** small. If you can’t be certain all specimens have been found, leave the debris in the sample (with the exception of large dead animals).
- If wet trapping, strain contents through a paint filter into a wide mouth container. If dry trapping, put insects into a plastic baggie and replace the vapona/No Pest strip in the cup.
- Ensure that no small insects remain on the walls or in the groove between the stopper and the bottom of the cup. Rinse if necessary.
- If wet trapping, rinse filter contents with a small amount of alcohol to rinse off antifreeze.
- Place the filter (wet trapping) and its insect contents into a quart-size ziploc freezer bag (if the sample is to be mailed) or a specimen jar (if the sample is to be hand-delivered).
- Place one or two paper towels in the bag and saturate them with alcohol, limiting the free alcohol in the bag if the sample is to be mailed. If the sample is to be hand-delivered, fill the specimen jar about 1/2 full with alcohol.
- Using **PENCIL**, complete and place a paper label (use sturdy index card-type paper) in the bag or specimen jar. (This is important. Even supposedly alcohol-proof ink will degrade when immersed in alcohol.) The label should contain the following information: state, site location
including GPS coordinates for the general site, date sample was collected, lure type, and collector’s name.

- Using indelible, alcohol-proof ink (first make SURE your marker is this type!), or pencil, complete and place an adhesive sample label (with the same information as on the paper label) on the outside of the bag or the specimen jar.
- Place the bag inside a one-gallon ziploc freezer bag. Not necessary with specimen jars.
- Place the rest of the sample bags for a sample period in the gallon bag, following the preceding directions. When all the samples for a period are in the gallon bag, remove the air, and zip it shut.
- Remove any debris blocking funnels, including leaves, twigs, spider webs, etc.
- Wet trapping: If the preservative is too dilute, discard into a used preservative container. **DO NOT** discard used preservative onto the ground, street, etc. Used antifreeze should be disposed of according to local state and federal regulations.
- Wet trapping: Pour preservative back into the collection cup and top up to 1/3 full with fresh preservative if necessary.
- Record the date the traps were set, checked or serviced, and removed.

G. **Lures and Lure Change Dates**

- Lures should be stored in a freezer until used.
- Store lures separately in a large container to prevent breakage and contain leaks.
- Bring along a few lures of each type and extra traps for routine trap checking in case lures or traps need to be replaced unexpectedly due to leaks, early depletion, vandalism, *et cetera*.
- Due to recent indications that release rates in these lures are variable, every two weeks when traps are serviced, lures should be checked to see if they are still functional. If lures appear empty, this should be noted and lures changed.
- To ensure that lures are continuously attractive, they should be changed every four weeks. (Note: temperatures in Alaska are frequently below maximum elution thresholds. Replacements are seldom required more than once every six weeks unless the summer is unusually hot and dry).

H. **Sample Submission**

Once a trap sample is collected and brought back to the office, the collector should place the specimens into a freezer, to store until identifications can be made by a trained identifier. Specimens should be identified to the lowest possible taxonomic division: Family, Genus, or Species.

Data should be recorded in two separate files: The sum of all sites and dates should be recorded for the appropriate species listed in the BNZ_Beetles_Werner_1975_20XX.xls file. Individual collection counts for each trap, location and date should be recorded for the appropriate species list in the BNZ_Beetles_Kruse_1975_20XX.xls file.