

Combining low-cost, organic control of the woody invasive, *Ailanthus altissima*, with production of edible mushrooms

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Abstract

This 21 month project investigates an alternative treatment for controlling the spread of the invasive tree species *Ailanthus altissima* (Tree of Heaven). The proposed alternative treatment:

- 1) is straightforward and inexpensive,
- 2) is environmentally benign with minimal impact on surrounding vegetation, soil, and water,
- 3) can be administered by a single person quickly and effectively;
- 4) has potential to produce a culinary mushroom cash crop



Problem

Ailanthus altissima (Fig. 1) is an invasive tree with no obvious redeeming qualities, capable of crowding out more desirable species such as oaks and walnuts which favor similar habitat¹. *Ailanthus* is already wide-spread in Ohio². A primary woodland management task is control of this invasive species, but is problematic because *Ailanthus*:

- grows quickly
- is allelopathic (exudes chemicals toxic to other plants)
- sprouts aggressively from stump and/or root system (Fig. 2)
- is useless as firewood, low BTU
- produces poor quality lumber
- leaves behind a long-lived seed bank
- is thought to respond only to very toxic, non-specific herbicides

Research Proposal

- 1) Evaluate and document effectiveness of an alternative, organic, mechanical method of control developed over the past decade.
- 2) Extend treatment methodology to include mushroom inoculation on baseline-treated trees.
- 3) Evaluate value of mushroom treatment for
 - a) edible mushroom (Fig. 3, Fig. 12) crop production potential
 - b) mycoforestry³ benefits, e.g., faster decomposition, improved soil quality through more thorough release of nutrients, etc.
 - c) improved morbidity, i.e., fewer stump sprouts, faster root system death
- 4) Determine the effect of timing that either treatment or inoculation has on re-sprout potential and mushroom production.



Methodology

8 test plots of 25 trees per plot were set aside, for a total of 200 trees. 3 strains of native Ohio culinary mushrooms were chosen for their suitability for tree cultivation⁴:

- Pleurotus ostreatus var "Ohio White" - White oyster
- Pleurotus ostreatus var "Ohio Brown" - Brown oyster
- Laetiporus sulphureus var "Ohio" - Sulphur shelf/Chicken of the woods

Trees were sorted by size within each plot and then randomly assigned to 1 of the following 5 categories of treatment:

- C = control; no treatment
- B = baseline; treatment alone, no mushroom inoculation
- M1 = treatment plus mushroom inoculation with *Pleurotus ostreatus* var "Ohio White"
- M2 = treatment plus mushroom inoculation with *Pleurotus ostreatus* var "Ohio Brown"
- M3 = treatment plus mushroom inoculation with *Laetiporus sulphureus* var "Ohio"

Plots were selected with similar soil type, aspect, slope, and light exposure. Treatments were scheduled over the course of a typical winter forest management season, broken down into 4 periods:

Period 1: Plots A & B treated Dec. 2008, inoculated Jan. 2009

Period 2: Plots C & D treated Jan. 2009, inoculated Feb. 2009

Period 3: Plots E & F treated Feb. 2009, inoculated Mar. 2009

Period 4: Plots G & H treated Mar. 2009, inoculated Apr. 2009

A lag of several weeks between treatment and inoculation allows time for the anti-fungal substances present in healthy trees to dissipate. This is typical for more conventional cut log mushroom inoculation.

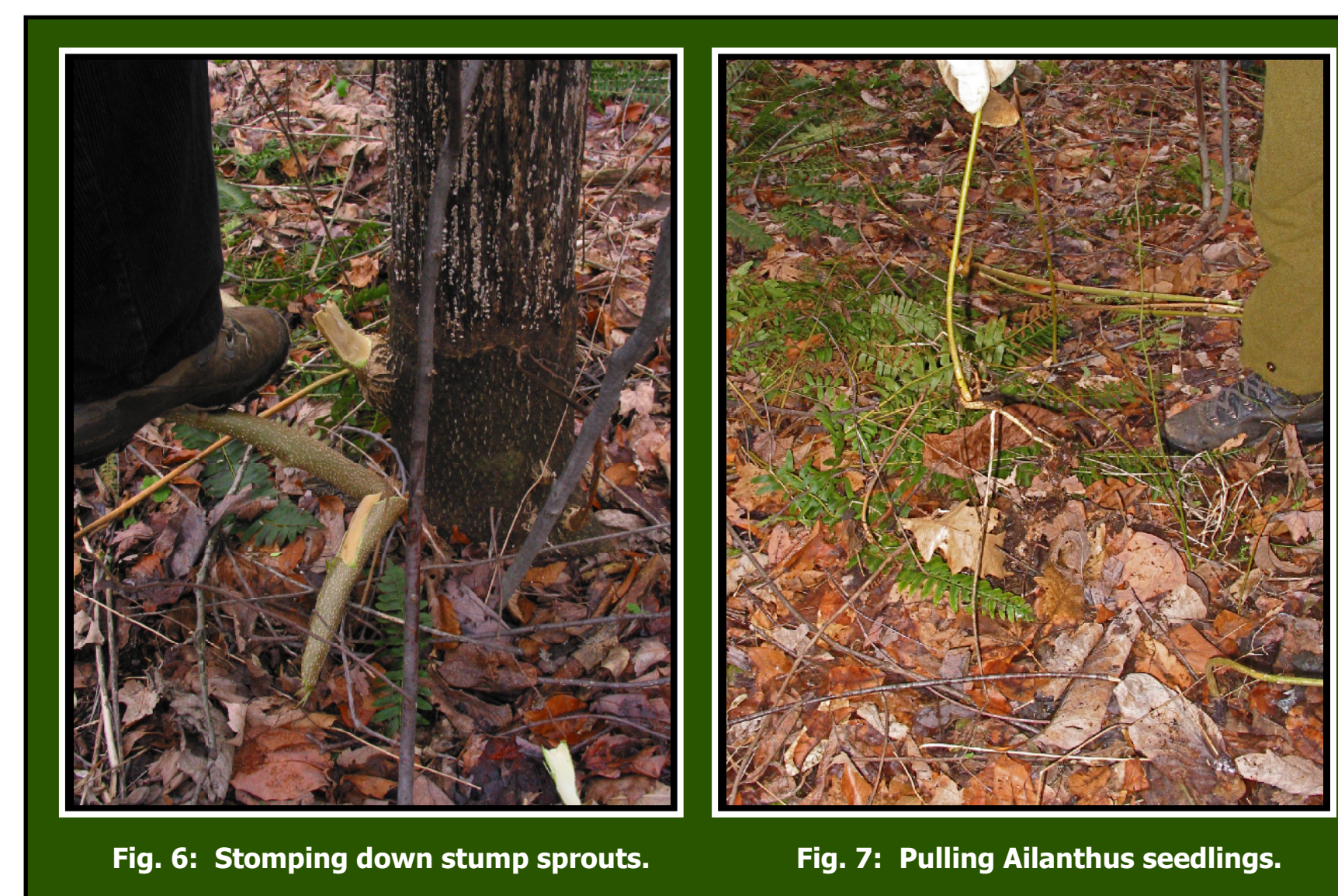
Ailanthus control

Timing: Late fall, winter, early spring

Tools: Short drawknife (6")

Technique: Starting at base of tree, draw knife up under bark of tree 18"-24"; completely remove bark all around tree (Fig.4).

Follow-up: After 1 growing season, re-visit treated trees, observe regrowth (Fig. 5), stomp down stump sprouts (Fig. 6). Pull small seedlings, if present (Fig. 7). Repeat after 2nd growing season, if necessary.



Mushroom production

Timing: Any time 3-4 weeks after above treatment, when daytime temperatures are above freezing.

Tools: 36V cordless drill with 5/16" or 8.5 mm high speed bit⁵; extra battery pack, if required (each slim-pack 36V battery does ~5 trees); hammer; aluminum tree tags & pencil; appropriate plug spawn of native Ohio medicinal or culinary mushroom (Fig. 8).

Technique: Drill 5-6 holes 4-6" apart in vertical rows spaced 2" apart in the tree just above the treated area, at about breast height (Fig. 9). This is the classic diamond shape inoculation pattern used in mushroom log cultivation⁶. The above will yield between 50-80 holes per tree, depending on diameter. Tap plug spawn into holes, flush with bark (Fig. 10). Label each tree with mushroom strain and date.

Follow-up: Monitor moisture content -- mycelium development requires >= 30% wood moisture content (Fig. 11). Inspect periodically, especially after rainy periods and dramatic temperature changes, for mushroom formation (Fig. 12). Re-visit and treat stump sprouts as above.



Assessment & Future Directions

At the end of the study period (Dec. 2009), the effectiveness of the treatment will be determined on the basis of the following criteria:

- 1) Does the treatment kill the entire root system of the weed tree within 1 growing season or is followup required?
- 2) How effective is the mushroom-enhanced treatment compared to the baseline, as measured by number of stump sprouts at the end of 1 growing season?
- 3) Are there significant differences in effectiveness between mushroom strains?
- 4) Is *Ailanthus* as a mushroom production medium worth the additional cost in time and materials, indexed by the going price for locally produced mushrooms at the farmer's market?
- 5) Were there significant variations in outcome corresponding to treatment periods and/or weather?

Future directions include more sophisticated treatment/inoculation timing variations and trials with additional mushroom species.

References

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Bureau of Land Management, 1849 C Street NW, LSB-204, Washington, DC 20240 (202) 452-0392
<http://www.nps.gov/plants/alien/fact/aial1.htm>
2. Ohio Division of Natural Areas and Preserves
1889 Fountain Square Dr., Bldg. F-1
Columbus, Ohio 43224 (614) 265-6453
<http://www.dnr.state.oh.us/dnap/invasive/17treeofheaven/tabid/1994/>
3. Stamets, Paul. 2005. Mycelium Running. Berkeley: Ten Speed Press.
4. Native Ohio mushroom cultures courtesy of:
Mushroom Harvest
PO Box 584
Athens, OH, 45701 (740)448-7376
<http://www.mushroomharvest.com/>
5. Specialized high-speed drill bit courtesy of:
Field & Forest Products Inc.
N3296 Kozuzek Road
Peshtigo, Wisconsin 54157 (800)-792-6220
<http://www.fieldforest.net/>
6. Ibid. Growing Oyster Mushrooms on Small Diameter Logs (factsheet).

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Resources

Field & Forest Products
<http://www.fieldforest.net/>

Fungi Perfecti
<http://www.fungiperfecti.com/>

Mushroom Harvest
<http://www.mushroomharvest.com/>

Ohio Mushroom Society
<http://www.ohmushroom.org/>

Plant Conservation Alliance, Alien Plant Working Group
<http://www.nps.gov/plants/alien/>