SARE Farmer Rancher Proposal 2007

Project Title:
Field study of a technique for combining low-cost, herbicide-free control of woody invasives, in particular *Ailanthus altissima*, with production of edible mushrooms.

One or Two Sentence Description of Project:
This proposal for a 21 month research project will investigate an alternative treatment for controlling the spread of the invasive tree species *Ailanthus altissima* (common name Ailanthus or Tree of Heaven) . This 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 and 4) enhances the economic potential of small farms and rural woodlands. The last point will be addressed by investigating the suitability for producing a culinary mushroom cash crop on the Ailanthus trees which are being treated.

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Is the applicant a Farmer/Rancher? Yes

Is this an Individual___X____ or Group_____ Project?

Grant Funds Requested: $5518

Have you previously received a SARE Farmer/Rancher Grant? No

1) Describe the problem your project will address, and provide a detailed description of the innovative plan you are proposing to test possible solutions to the problem.

Ailanthus altissima, aka Tree of Heaven, is an invasive tree capable of crowding out more desirable species, especially valuable native hardwoods such as oaks and walnuts which favor similar habitat. Ailanthus is already wide-spread in Ohio (ODNR Invasive Plant Factsheet #17). Introduced during a logging operation in the early 1990s, Ailanthus has become firmly established throughout our 130-acre property.

My husband and I have operated this tree farm since 1998, managing it for biodiversity and production of non-timber forest products. A primary management task has been control of this invasive species; we wish to eliminate it from our woodlot but it is tenacious and hard to control. Ailanthus grows quickly and is allelopathic, meaning that it exudes chemicals toxic to other plants, effectively out-competing other trees, shrubs and understory plants. Once cut, it has a strong tendency to sprout aggressively from stump and/or roots.

As a full-time woman tree farmer working alone (except on weekends), I have developed a prototype Ailanthus control treatment that is well-suited to our resource needs and agricultural philosophy, i.e., one that:

- is straightforward and inexpensive
- is environmentally benign with minimal impact on surrounding vegetation, soil, and water
- can be administered by a single person quickly and effectively
- enhances the economic potential of our forest farm

One standard recommended treatment for Ailanthus is felling with a chainsaw and applying one or more treatments of a strong herbicide, e.g., a glyphosate or triclopyr, to the stump. This treatment was inappropriate for me since tree felling work should never be attempted alone, introduces petrochemicals into the environment, and is time-consuming. It is also dangerous even under the best of circumstances and physically exhausting. Furthermore, the complementary use of strong herbicides has the potential to damage nearby vegetation, including valuable native medicinal herbs, such as ginseng and black cohosh. Other recommended treatments also require the use of strong herbicides, many using petroleum oils as carriers.

In contrast, the low-cost, low-tech treatment that I have developed over the last 7 years seems to be approximately as effective in killing these trees without cutting or treating with herbicides. However, in order to back up this claim, my method needs to be rigorously tested under controlled circumstances since, as with many organic techniques, I suspect effectiveness depends on timing and proper sequence of steps.

Alternative Ailanthus treatment: After vegetation dies back in fall, I carry a short drawknife with me on my regular woodlot inspections. When I identify a tree for treatment, I de-bark it from about ground level up ~2 ft. This essentially strangles the tree over a period of time, rather than killing it quickly as I am only disrupting part of the vascular system. Note that this is different from girdling, which disrupts the entire vascular transport system. Ailanthus has a very effective regeneration ability by using nutrients stored in the root system. The tree naturally depletes its root stores through winter and as it leafs out in spring. De-barking disrupts the tree's ability to replenish these nutrients and the main trunk eventually dies. Only a few weak stump/root sprouts survive and are easily broken while young. For this reason, it is necessary to revisit each tree the second winter. Winter treatment also provides the added benefit of desiccation. The cold, low humidity, and high winds pull out vital moisture from the exposed inner tissue of the tree, further damaging its regenerative ability.

This basic treatment is part of my normal winter woodlot management activity. I travel on foot, carrying only the drawknife. The key is speed; a moderate size tree (~6" diameter) takes about 1 minute. I've done as many as 25 in an hour, travel time included, but more typically my sustainable rate is about 10-15/hour.

This grant allows me to explore ways to make this activity more economically sustainable through the production of a cash crop, edible mushrooms. I am already producing oyster and shiitake mushrooms on logs harvested through crop tree release. Mycelium Running by Paul Stamets indicates that Ailanthus logs are suitable for culinary and medicinal mushroom production. I will test whether inoculation of the standing Ailanthus after de-barking with edible mushroom spawn is as effective as inoculation of a cut log. While more equipment is required for this additional step, it is still only the addition of a hand tool such as a small tree saw, bit brace or portable drill. Inoculation will also be more time-consuming (I estimate ~4-5 trees/hour) and inevitably will reduce the total number of trees treated in a season. Careful consideration of these trade-offs is required to determine if this mushroom production methodology is as cost-effective as others.

However, additional culinary mushroom production has the potential to further our management goals in several ways: 1) culinary mushrooms sold in local markets may be cost effective enough to justify the additional materials, spawn and time, 2) deliberately introduced fungi will almost certainly speed up degradation of the Ailanthus wood fiber, thereby returning nutrients to the forest more quickly, and 3) the introduced fungi may actually further reduce the ability of the tree to regenerate from stumps or root system.

I propose controlled testing both the baseline treatment described above as well as the the de-barking treatment plus inoculation with culinary mushroom spawn, repeated with several different strains or cultivars. An important aspect of this research is to use edible saprophytic or semi-parasitic mushrooms which are native to this ecosystem, if at all possible. The testing parameters are described below.

Test Plan:

1) Select 8 test sites, each containing 25 trees with approximately the same characteristics for a total of 200 trees in the study. At each site, trees will be individually marked, recorded, measured, and treated as follows:

- 5 trees will be given no treatment (control)
- 5 trees will be given the debarking treatment only (baseline treatment)
- 5 trees de-barked and then inoculated with one culinary mushroom strain (value-added treatment)
- 5 trees de-barked and inoculated with a second culinary mushroom strain (value-added treatment)
- 5 trees de-barked and inoculated with a third culinary mushroom strain (value-added treatment)

2) Pairs of test sites will be given the debarking treatments in each of the following 4 seasonal periods in order to identify more precisely how treatment timing affects the tree's regenerative ability. 1) October-November 2008, 2) December 2008-January 2009, 3) February-March 2009, 4) April-May 2009

3) Each site will then be revisited and recorded monthly throughout the entire test duration to evaluate progression for tree death/regeneration and/or mushroom development. Mushroom inoculation of logs and stumps can take 12-18 months or longer to produce fruiting bodies, depending on environmental conditions such as rainfall, temperature, etc., so the span of this project must be a minimum of 2 years. Additional visits may be required after rainfall events in the second year as mushroom fruiting becomes more likely.

Evaluation criteria:

- How effective is the current methodology compared to published studies of the traditional methodology? Calculate effort involved in the treatment. For this and other evaluation points, analysis consists of measuring effectiveness through both written and photographic documentation.
- How effective is the methodology plus introduced fungi? Is there a difference between re-sprouting of control trees and inoculated trees? Again, measure effectiveness as above.
- Do the inoculated trees provide a sufficiently robust crop of edible mushrooms to justify the additional costs to inoculate them? Calculate additional effort required to inoculate treated trees and measure as above.
- Is the season for the de-barking treatment important? Is fall or spring better for mushroom inoculation? Evaluate effects of timing on the behavior of the various test sites.

2) Describe how you will add to or build on previous work done on this problem.

As described above, I am basing this proposal on previous personal experience in controlling Ailanthus and in inoculating mushroom logs.

I have also found work done by researchers at Penn State, Washington University, and elsewhere into Ailanthus biology and control to be very useful, particularly the work of Dr. Rod Heisey on Ailanthus allelopathy. In the course of my research, I plan to further investigate the available literature in this area.

Critical to the success of this project is the expertise offered in mycoforestry and mushroom cultivation by Paul Stamets and Fungi Perfecti. A major portion of grant funding will go towards attending a mushroom cultivation seminar offered by these mycology experts in mushroom cultivation, spawn propagation, and mycelium management in forested environments.

3) How will you share information from your project with other farmers/ranchers?

My outreach plan involves other farmers and natural resource professionals at local, state and regional levels:

- I have been working closely with our ODNR service forester, Cotton Randall, on various forest management

topics, in particular woody invasive treatments. As mentioned previously, control of Ailanthus is a major management activity; we have applied for 2008 EQIP funding which is largely directed towards control of woody invasives. If successful, these funds will be directed towards this same project. As a professional state forester, Cotton Randall will be able to pass along knowledge acquired through this study to other forest landowners in the four Ohio counties he serves as well as to his professional colleagues at the state and regional level. Mr. Randall has submitted a letter in support of this proposal.

- I will cooperate with Jim Kiracofe, Program Administrator for the Licking Co. SWCD in arranging a demonstration of this treatment model as part of a forestry Field Day in 2009. The cooperation with SWCD has the potential to reach a wide range of farmers and landowners in Licking Co. and adjacent counties. He has indicated that interest in woodland management in Licking Co. has increased significantly over the last several years and this sort of management activity is apt to be of interest to Licking Co. landowners. Mr. Kiracofe also has submitted a letter in support of this proposal.
- I have communicated with David Apsley, OSU Extension, about this Ailanthus control technique. If effective at controlling the spread and regeneration of Ailanthus, he will incorporate it into his extension activities for Forest Management in Southern Ohio.
- I am a founding member of a central Ohio sustainable agriculture organization which supports women farmers called POWA (Promoting Ohio Women in Agriculture). With 30+ members, we meet quarterly for business and a hands-on program. The results of this research will be presented in one of these programs.
- As a member of OEFFA (Ohio Ecological Food and Farm Association), I will submit a presentation proposal to describe this project at the annual conference. Alternatively, I could write an article for the OEFFA newsletter. Either of these venues would reach other organic growers in Ohio and surrounding states.
- Another of my cooperators, Dr. Richard Doyle, is an active member of the OH Mushroom Society. He will assist in both the execution of this research and in outreach which will take the form of a mushroom foray and field demonstration for interested members of the Society, many of whom are also tree farmers.
- A neighboring farm family, the Roshons of Roshon Farm, homeschool their children. Together we will work out a 2-year science curriculum which complements this research, including both reading and hands-on field work: the children will help with the treatment, documentation and evaluation of the project. In addition, we hope to arrange a field day for others in Ohio homeschooling network of which the Roshons are a part.
- A description of this research will be posted on the Blue Owl Hollow farm website (now in development).
- Assuming this research results in a marketable product at the Farmer's Market, I will include flyers next to the mushrooms describing how they are part of an integrated and sustainable agricultural practice.

4) How will you evaluate the environmental, economic, and social impacts of your project and how will those impacts contribute to the growth of sustainable agriculture?

Environmental impacts: Any effort to control this invasive species is a positive endeavor. I believe that this technique is sufficiently effective to kill Ailanthus without the use of strong herbicides or major equipment. A simple, straightforward approach to invasive tree control will be attractive to ordinary landowners who may not have the time, skills, equipment, or expertise to engage in what may seem to be a major forestry activity. Wide-spread application of this technique throughout the region could significantly impact the spread of this invasive. If successful, other invasive tree species could be investigated for similar treatment, e.g., Autumn Olive, Flowering Crab, Amur Cork, etc. Finally, selecting and propagating local ecotypes for mushroom production not only ensures the best fit for local growing conditions, it minimizes the environmental risks inherent in introducing outside species.

Economic impacts: Developing a low-barrier (barriers such as cost, skill, or personnel) technique for combating this invasive woody perennial increases the overall value of Ohio's forests both now (in terms of high-value timber trees as well as prime forest habitat necessary for optimal production of non-timber forest products) and for future generations (preservation of genetic diversity in the seed bank). A viable technique which both neutralizes a known threat to the natural resource base and creates the potential for a non-timber forest cash crop is a win-win situation, esp. in Licking Co., which has a higher percentage of woodlands (38%) than the state average (31%). Mushroom production is another diversified niche product from forested land in

rural areas suitable for sale locally or regionally. The labor savings by making this a part of regular forest stewardship activities may make this economically feasible where straight mushroom log production is not.

Social impacts: This technique creates feasible options for a wide range of landowners, especially those working alone, e.g., women farmers. The USDA reports that the number of women farm operators in the U.S. rose from 7% in 1997 to 27% in 2002. The same 2002 agricultural census reports 922 women as principal farm owners in central Ohio's 7 counties, managing 71,000 acres. Their average age is 54 years and their farms tend to be smaller, 61% under 50 acres. Many of these farmers own and manage woodlands, which account for 12% of central Ohio's total farmland. On the natural resources side, 87% of Ohio's 8.5 million acres of woodlands are privately owned; 1,850 woodland owners in Ohio are designated Tree Farmers. This proposal will be of particular interest to farmers with these demographics: single woman farmers, older farmers, tree farmers.

5) Describe your farm or ranch operation if you are submitting an individual proposal.

Our farming operation is really 2 separate farms. We own a 130-acre tree farm (known as Blue Owl Hollow) in NE Licking Co., enrolled in the American Tree Farm system since 2005. Consisting of mature native hardwoods and conifers, it is managed primarily for biodiversity conservation and non-timber forest products, e.g., mushrooms, medicinal herbs, crafting materials, honey & beeswax, for personal consumption and for sale locally. I own a portable sawmill, used to process lumber from storm-damaged or selectively thinned timber primarily for farm use.

In 2002, we purchased 3 additional acres nearby with several historically significant buildings, including rural store buildings, house and barn, dating from the 1850s-1870s. I am establishing an herb farm on that acreage (doing business as Blue Owl Garden Emporium), growing culinary and crafting herbs, 19th c. heirloom fruits, flowers, and vegetables for sale at local markets. After the buildings are restored to their 19th c. appearance, this location will be principal point of sale for my products as well as those of other local farmers.

I am the primary farm operator for both properties, having left a lucrative, but stressful, career as a web developer in 2005 to take up farming full-time. Philosophically, I am committed to an economically viable and environmentally sustainable local agricultural economy.

6) List the names, addresses, and phone numbers of any cooperators. Include how they will participate or what they will contribute.

- Dr. Peter Kuhlman, Asst. Professor of Chemistry, Denison University, 6000 Porter Road, Newark, OH 43055 740-345-4689: will contribute scientific rigor to research setup and evaluation of results as well as providing labor and moral support throughout the course of the project.
- Cotton Randall, Service Forester, ODNR Division of Forestry, 359 Main Road, Rm 204, Delaware, OH 43015 740-368-0053: will cooperate with me in the implementation and evaluation of the effectiveness for Ailanthus control and other aspects of forest management impacted by this proposal.
- Jim Kirakofe, District Program Administrator, Licking Co. SWCD, 771 E. Main St., Ste. 100, Newark, OH, 740-670-5330: will participate by providing opportunities for outreach, such as an on-farm field day event for Licking Co. landowners.
- Dave Apsley, Natural Resources Specialist, OSU Extension South Centers, 1864 Shyville Road, Piketon, OH 45661 740-289-2071: will provide technical assistance with research setup and evaluation for effectiveness of Ailanthus control.
- Dr. Richard Doyle, Professor Emeritus of Chemistry, Denison University, 14 Sunset Hill, Granville, OH 43023 740-587-0019: will participate in the implementation of the project by contributing his mushroom expertise and work with me to arrange an OH Mushroom Society mushroom foray and demonstration event.
- Bethany and Lance Roshon, Roshon Farm, 5035 Hickman Road, Newark, OH 43055 740-763-2705: will participate in the hands-on research as part of their homeschool science curriculum as well as work with me to arrange a field day for their Ohio homeschool network.

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Signature of Applicant (**must** be a Farmer/Rancher)