*Western SARE Competitive Grants: Graduate Student*

***New tools to manage understories for ecological value in organic hazelnut orchards and matrix oak woodland habitat.***

**A. Project Basic Information**

Primary subject matter:

Proposed starting and ending dates:

Where the project will be conducted:

Main commodities and practices of the proposed project:

**B. Project Team**

Principal Investigator: Dr. Lauren Hallett.

Graduate Student*:* Alejandro Brambila

Producer cooperators:

* Taylor Larson: Co-owner of “My Brother’s Farm”. A diversified organic farm that includes riparian forest and oak woodland. Among other things, Taylor produces hazelnuts, apples, pork and bison.
* Marissa Lane-Masse: Conventional, large scale hazelnut prodcuers. The Lane-Masses have been growing hazelnuts for over 60 years on X total acres.
* Contract filbertworm monitoring farm: X have been producing hazelnuts organically and monitoring filbertworm populations on their farm since \_\_\_ and are interested in participating in alternative methods.

*-Betsey somehow?*

\*include CV, Current and Pending, Conflict of interest

**C. Summary** (250 words)

Description of the problem, a creative approach to solve it, and why it is important. Clearly ID research question, explain how you will disseminate findings among producers, agricultural professionals, and academic community. ID significance of project and expected outcomes. Clear and concise.

**D.** **Narrative** (5000 words max)

*Relevance to Sustainable Agriculture (800 words – currently at 1200)*

Hazelnuts are a booming industry in Oregon’s Willamette Valley, where 99% of the US crop is produced. The vast majority of hazelnuts are farmed in monoculture using conventional methods to produce a commodity crop for sale overseas. As this industry expands, it is at a crossroads. Will hazelnuts be grown as a commodity, or sustainably? While the commodity route has so far returned healthy profits to farmers, these are at risk from global politics and it has come at the cost of environmental degradation across the farm-wildland matrix.

We have identified key opportunities for improvement on conventional understory management stemming from the need to manage pests and harvest a crop effectively. Across the landscape, understory management can connect farmed and natural areas, either through conflict or mutual benefit. Traditionally, conventional farms have used intensive spraying, flailing, and scraping to eliminate pests and understory vegetation in the orchard and increasingly throughout their properties. We suggest that instead of posing a threat, the hazelnut boom poses a unique opportunity to develop novel approaches to understory management across the farm-wildland matrix. **Our overarching goal is to develop win-win solutions for conservation and sustainable farming across the farm-wildland matrix.** Specifically, we propose to test alternative strategies of grazing to reduce pest loads and incorporating native cover crops to support soil and wildlife communities.

Before widescale land conversion, much of the Willamette Valley was dominated by diverse oak-savannah, woodlands and grasslands. These habitats, collectively referred to as “oak-prairie” have been reduced to less than 5% of their original extent. Of these remnants, over 80% are on private, often agricultural, lands. Oak-prairie habitats are therefore among the most endangered ecosystems in the Pacific Northwest, and working with farmers for their protection is essential for their conservation. Accordingly, the Oregon Conservation Strategy, … … have recognized the priority status of these habitats. They also have cultural value, native people, resources, supporting native pollinator base for western Oregon.

In 2016, a small but growing number of farms organized to form the Oregon Organic Hazelnut Cooperative to support organic growers through educational outreach, nut processing and marketing. A transition to organic hazelnut production has the potential for increased profits, more stable markets, and the support of healthier local ecosystems. At the same time, there are challenges that limit the widespread adoption of sustainable approaches. In fall 2017, members of the OOHC reached out to Hallett for advice on pest management, a central challenge for organic farms that limit their use of synthetic insecticides. Specifically, the filbertworm, *Cydia laiferreana,* is a native moth that burrows into nuts and renders them inedible. Organic producers rely on a combination of OMRI pesticides, pheromone mating disrupters, and nut removal to reduce filbertworm pest pressure. Because the larva burrows in nuts, removing all nuts from the ground at the end of the growing season breaks the month’s lifecycle and curtail its population size.

Although this combination of approaches to organic filbertworm management can be effective at the local level, it can be confounded by dynamics over the larger farm-wildland matrix. Specifically, the filbertworm’s native host is the Oregon white oak (*Quercus garryana*), a major component of oak-prairie ecosystems. Oaks near orchards serve as source pools of pests to re-invade hazelnuts. As a consequence, there is pressure on organic growers to remove oaks from their lands. This represents a potentially large clash between environmental and production aims.

Our focus is to develop a solution that protects organic farms against filbertworm infestation while at the same time conserving rare oak habitat. **A promising strategy to address this oak conservation-sustainable farming conflict is to co-manage oak and hazelnut understories by grazing for acorn and nut removal**. Pigs have a preference for acorns, and acorn-fed pig is an increasingly popular food type in the US. We hypothesize that pigs can be used to indirectly reduce pest pressure by removing acorns and nuts that would otherwise host the moth larvae. This type of pest control has successfully been employed in other systems such as the use of chickens for blueberry pest management. This project is relevant to the components of sustainable agriculture through adding a revenue stream (pork), increasing the value of nuts (organic), preserving native oak habitats, and reducing the exposure of farmers and farming communities to pesticides.

In addition to managing the farm understory to reduce pest loads, hazelnuts require considerable understory management to facilitate harvest. Hazelnuts are harvested from the ground, using tractor-pulled sweepers. To gather the nuts, farmers need a clean, level orchard floor. Traditionally, this floor has been maintained through annual spraying, flailing and scraping. This results in a sterile understory with no vegetation to stabilize and shade soils, or provide habitat or forage for wildlife*.* In recent years, OSU has been suggesting hazelnut farmers plant cover crops to improve the stability and health of orchard soils*.*

We propose that orchard understories provide another potential mutually beneficial opportunity for the goals of production and conservation. In addition to the boom of new orchards being developed, many of the oldest orchards (80-100 years old) are being replanted lowering the average orchard age. While mature orchards have closed canopies resembling woodlands, these younger orchards with open canopies are structurally similar to oak-prairie habitats. **Our goal is to test the potential for using native prairie plants as a cover crop in hazelnut orchards.** This would not only provide cover crop benefits to the orchard, but also provide a unique opportunity to perform a partial restoration on prime agricultural land that is generally too economically valuable to restore outright. Prairie plants, like typical cover crops are quick to establish, small in stature, and senesce by fall harvest. Especially in young orchards with immature trees, these plants can help anchor, shade and build soil. Within the context of the farm-wildland matrix, extending a prairie understory below orchards can support wildlife including native pollinators which are essential to the success of many regionally important crops including blueberries, apples and marionberries.

A major limitation to the use of native plants as a cover crop is their cost. To be economically feasible, prairie plants must create-self sustaining populations and not require reseeding year after year (potentially resulting in long-term economic savings). To create sustainable populations, these plants must survive (perennials) or reach maturity and produce seeds in the context of orchard management activities. We will test the compatibility of selected prairie plants with different management activities and canopy structure. Specifically, we will examine the effects of flailing and scraping in orchards of varied maturity. We will also pay specific attention to factors relevant to sustainable farming including soil moisture, amount of exposed soil, and pollinator presence.

Here, we present ecologically-based strategies of understory management to support sustainable whole-farm systems. Our overarching goal is to support sustainable hazelnut production in the Willamette Valley by lowering practical barriers. Adoption of sustainable farming practices will not only benefit the local farming community but also play a major role in regional ecological conservation efforts. We have researched the topic and consulted with OOHC and Dr. Betsey Miller at OSU to confirm that this work is underexplored in the academic literature. We will continue this iterative engagement throughout the course of the project to ensure that our findings are widely disseminated and applied

*Objectives (300 words – currently at 520)*

Our **overarching objective** is to develop novel strategies of understory management on hazelnut farms that allow for more sustainable agriculture and support regional conservation efforts. These strategies include pig grazing of infected nuts to reduce pests and incorporation of native prairie plants as cover crops.

H1) Pig grazing in oak and hazelnut stands will reduce the proportion of infected acorns and nuts. We predict that pigs will preferentially graze acorns and hazelnuts when confined in areas where these are available. Because infected nuts fall early, timing pig rotations early in the season will preferentially remove infected seeds. We will establish plots below trees and measure the total number of infected nuts and acorns before and after pig grazing to assess the effectiveness of pigs in removing pest vectors. Our hypothesis will be supported if there is a significant decline in infected acorns relative to total acorn densities after grazing.

H2) Pig grazing in oak and hazelnut stands will reduce filbertworm pressure. If infected acorns are removed, the filbertworm lifecycle should be interrupted, and their population sizes should decrease. We will measure filbertworm populations using emergence and aerial traps before and after grazing in a grazed and control plot using a BACI design. Our hypothesis will be supported if filbertworm densities at significantly lower in areas that have been grazed compared to those areas prior to grazing or in controls. We expect to see these results both in oak stands and in the orchard. Because of a potential lag effect where an interruption in filbertworm lifecycle one year doesn’t show up until adults emerge the following spring, populations will be monitored over two years.

H3) Native cover crops will survive and reproduce in a working orchard context. We predict that robust native species that produce large amounts of seed will be able to establish and persist in a working orchard context. We have chosen locally harvested seeds from species that are adapted to environmental conditions where orchards are located. We have also chosen species that are adapted to the savanna-like structural overstory conditions present in orchards. By comparing the survival and reproduction of various native annual and perennial forbs and grasses with that of traditional cover crops (wheat, barley, clover), we will identify appropriate species for use as cover. Our results will be supported if we find comparable cover of natives to cover crops, and if natives reseed and continue to provide cover over time. To carry out this objective, plots established in hazelnut orchards will need to be observed for a minimum of two growing seasons (fall-summer).

H4) Native cover crops will provide comparable benefits to traditional cover crops. If natives establish and survive in orchards, we expect they will provide similar or greater levels of soil shading, soil moisture, erosion control, soil building and pollinator attraction as traditional cover crops. To asses these services, we will use percent bare ground as a proxy for shading and erosion control, spring soil moisture monitoring, peak standing biomass to represent potential carbon inputs to the soil, and pollinator surveys. Our results will be supported by comparable or improved levels of each metric.

H5) Something about economics?

*Research Materials and Methods (1500 words)*

1. For each objective: experimental design, research methods, project site, and methods for data analysis.

*Educational Outreach Plan (500 words)*

1. Communication of the project activities and their findings to producers and the general public. Yearly plan for outreach. Should identify dates, locations, and methods for outreach using field days, workshops, demonstrations or other networking events. Address how the project outreach products will be disseminated among producers not directly involved in your events. (Media, websites)

*Scholarly Publications & Educational Materials (500 words)*

1. Both scientific publications and targeted extension/outreach publications are required outcomes. Ex: 4-H, videos, posters, slideshows, brochures, fact sheets, surveys, web materials. How will these get to the hands of producers?

*Evaluation of Producer Adoption (300 words)*

1. How will the project educational material and outreach be evaluated. How changes in producers’ knowledge, awareness, attitudes, new skills and practices will be measured using surveys, interviews, etc. You can use the WSARE Survey online, fill it out by every participant at each outreach event in addition to any other evaluation form. This is required annually.

*Timeline (300 words)*

1. Gantt chart of milestones and activities.

*Innovations and Contributions to Sustainable Agriculture (500 words)*

1. Evidence of originality and innovativeness of the project and its contributions to the body of knowledge of sustainable agriculture. Potential impacts at local state, regional levels. How will the project outcomes affect overall productivity, profit, soil or water quality or quantity, communities, and society as a whole. Use specific estimates of benefits such as dollars per acre, tons of soil protected from erosion, pounds of chemical reduced, number of acres or people affected, markets expanded, jobs created, etc.
2. Organic=stability, higher prices, not sell to china with trade war

**E. Budget**

Provide a detailed budget and justification using the Western SARE Budget Worksheet online.

ices, supplies, communication, travel, conference