# Cover Cropping with Native Plants in Oregon Hazelnut Orchards

## Introduction:

Covering your orchard's soils can benefit your hazelnut farming operation by reducing fluctuations during extreme temperatures, improving water filtration and orchard trafficability, enhancing nutrient cycling, and preserving and enhancing soil microbiology. Finding cover crops for a hazelnut operation can sometimes be trivial, as there are not many options available on the market, and with those options, limited research has been conducted tailored toward usability in Oregon hazelnut systems. A cover crop type that may be ideal for some conditions is native conservation cover. Native conservation cover (NCC) is a type of cover designed to tailor to specific farm needs, and is comprised of native wildflower and grass species of the given region. Here, NCC is made of native Willamette Valley prairie and woodland species, particularly adapted to disturbance-tolerant environments. NCC may be suited for the needs of orchard operations that have established trees (young through mature stands), operations that mechanically harvest, for farmers that want to find a permanent cover crop solution, and are inclined to staying a little more "hands-off". NCC is particularly useful when wanting to cover a mature orchard with a full canopy, as many native plants of the Willamette Valley are adapted to low-light conditions. In younger orchards with more light availability, there are more cover options available on the market, though NCC is well suited in these conditions as well, as it is highly disturbance tolerant, self-sustaining, and easily managed for mechanical hazelnut harvest.

## Species Selection:

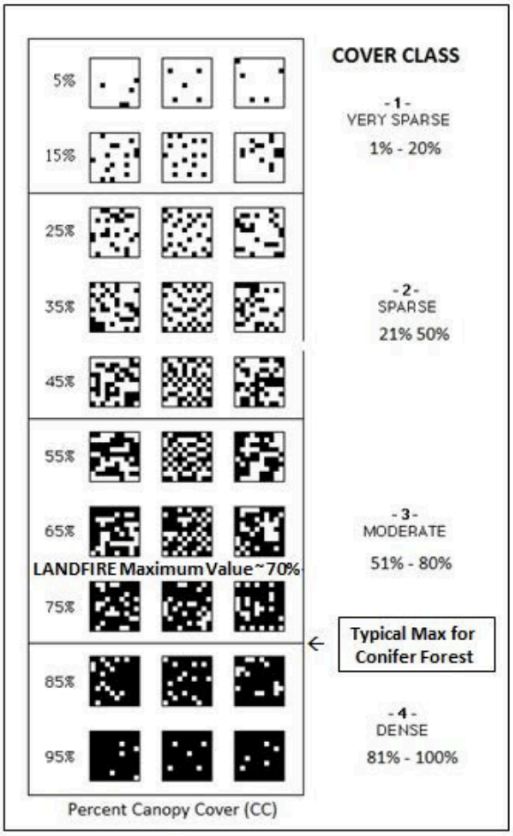
Selecting native conservation cover species that match your orchard's canopy cover, management, and goals are important. While many different types of cover crops consist of individual species or a mix of 4-5 species, NCC mixes should consist of 5-8 species minimum, to ensure optimal community synergy for excluding weeds, retaining soil moisture, and to avoid entangling nuts during hazelnut harvest. When designing a mix, choose a variety of species from different families (ex. Rosaceae, Polemoniaceae, etc.), growth habits (bulb-forming, basal rosette forming, etc.), and life habits (annuals, perennials, etc.). Aim for a 1:3 ratio of annuals to perennials plus one grass species to ensure that NCC establishes well and occupies many niches. When calculating your seed need, use a seed calculator like Xerces Society's (https://efotg.sc.egov.usda.gov/api/CPSFile/21676/___) and aim for 10-15 lbs for your target lbs/acre.

When making these selections, consider your sucker management tactics and the height of your selected cover species. Also consider your flailing patterns throughout your orchard, as you may want to only seed the rows in one direction (or strip spray in one direction) if you only flail one direction. Make sure to avoid species with feathery leaves or bunching features that may entangle nuts during harvest (ex. Achillea millefolium, Festuca roemeri, etc.).

Our base mix for light-available orchards usually includes Collomia grandiflora, Collinsia grandiflora, Geum macrophyllum, Phacelia nemoralis, and Prunella vulgaris. Our base mix for closed-canopy orchards usually includes Geum macrophyllum, Phacelia nemoralis, Prunella vularis, Sanicula crassicaulis, and Tellima grandiflora. After we select our base mix, we then add additional species to the mix that display desirable characteristics for that given orchard. Please keep in mind that these base mixes may not be suitable for your orchard conditions and management, so customization is absolutely key! Note that our base mix for a closed-canopy orchard does not include annuals, as no annuals are available for this mix currently. The short-lived perennials semi-fuction as annuals in this situation.

Also, be aware that there are a vast amount of native species not available in bulk quantities, thus, the lists below only include commercially available species that we have investigated and have found to perform well in hazelnut orchard settings.

| Commercially Available Bulk Native Seeds | | |
|---|---|---|
| **Sun (0 - 25% shade)** | **Mixed (25 - 55% shade)** | **Shade (55%+)** |
| Allium amplectens | Allium amplectens | |
| Aquilegia formosa | Aquilegia formosa | |
| | Bromus sitchensis | Bromus sitchensis |
| Camassia leichtlinii | Camassia leichtlinii | |
| Collinsia grandiflora | Collinsia grandiflora | |
| Collomia grandiflora | Collomia grandiflora | |
| | Delphinium trolliifolium | Delphinium trolliifolium |
| Deschampsia elongata | Deschampsia elongata | |
| Drymocallis glandulosa | Drymocallis glandulosa | |
| Eriophyllum lanatum | Eriophyllum lanatum | |
| Eschscholzia californica | Eschscholzia californica | |
| Festuca rubra | Festuca rubra | |
| Geum macrophyllum | Geum macrophyllum | Geum macrophyllum |
| Gilia capitata | | |
| Limnanthes alba | Limnanthes alba | |
| Liguisticum apiifolium | Liguisticum apiifolium | Liguisticum apiifolium |
| | Lomatium dissectum | Lomatium dissectum |
| Lomatium nudicaule | Lomatium nudicaule | |
| Lupinus bicolor | | |
| Nemophila menziesii | | |
| | Osmorhiza occidentalis | Osmorhiza occidentalis |
| Phacelia nemoralis | Phacelia nemoralis | Phacelia nemoralis |
| Plectritis congesta | Plectritis congesta | |
| Potentilla gracilis | Potentilla gracilis | |
| Prunella vulgaris | Prunella vulgaris | Prunella vulgaris |
| | Sanicula crassicaulis | Sanicula crassicaulis |
| Sidalcea virgata | Sidalcea virgata | |
| | Tellima grandiflora | Tellima grandiflora |
| | Thalictrum polycarpum | Thalictrum polycarpum |
| | Viola praemorsa | Viola praemorsa |



| Species | Family | Life Habit | Growth Pattern | Height | Flowering Period | # Seeds / LB |
|---|---|---|---|---|---|---|
| Allium amplectens | Amaryllidaceae | Perennial | Bulb forming | < 1.5 ft | April - July | 351,529 |
| Aquilegia formosa | Ranunculaceae | Perennial | Large, slender | 1 - 3 ft | April - July | 248,000 |
| Bromus sitchensis | Poaceae | Perennial | Grass | 2 - 6 ft | May - August | 71,000 |
| Camassia leichtlinii | Asparagaceae | Perennial | Bulb forming | 1 - 3 ft | March - June | 49,890 |
| Collinsia grandiflora | Plantaginaceae | Annual | Small, slender | < 1.5 ft | April - June | 464,687 |
| Collomia grandiflora | Polemoniaceae | Annual | Large, slender | 1 - 3 ft | June - July | 121,715 |
| Delphinium trolliifolium | Ranunculaceae | Perennial | Basal leaf rosette, spreading | 2 - 3 ft | April - May | ~142000 |
| Deschampsia elongata | Poaceae | Perennial | Grass, thin | 1 - 3 ft | May - July | ~1,500,000 |
| Drymocallis glandulosa | Rosaceae | Perennial | Basal leaf rosette, medium | 2 - 4 ft | May - July | 1,417,469 |
| Eriophyllum lanatum | Asteraceae | Perennial | Medium, spreading | 1 - 2 ft | May - June | 1,169,047 |
| Eschscholzia californica | Papaveraceae | Perennial | Medium, slender | 1 - 3 ft | April - October | 293,000 |
| Festuca rubra | Poaceae | Perennial | Grass | < 2 ft | May - July | ~546000 |
| Geum macrophyllum | Rosaceae | Perennial | Basal leaf rosette | < 3.5 ft | April - June | 760,037 |
| Gilia capitata | Polemoniaceae | Annual | Slender | < 3 ft | May - July | 1,008,888 |
| Limnanthes alba | Limnanthaceae | Annual | Basal leaf rosette, small | < 1 ft | April - June | ~50,000 |
| Liguisticum apiifolium | Apiaceae | Perennial | Variable, taproot | 2 - 4 ft | May - August | 112,000 |
| Lomatium dissectum | Apiaceae | Perennial | Large, stocky, taproot | 3 - 5 ft | March - June | 28,499 |
| Lomatium nudicaule | Apiaceae | Perennial | Small, slender, taproot | < 2.5 ft | March - June | 39,557 |
| Lupinus bicolor | Fabaceae | Annual | Small, slender | < 1 ft | April - June | 89,019 |
| Nemophila menziesii | Hydrophyllaceae | Annual | Small, slender | < 1 ft | March - June | 258,000 |
| Osmorhiza occidentalis | Apiaceae | Perennial | Small, slender | 2 - 3 ft | April - June | 34,846 |
| Phacelia nemoralis | Hydrophyllaceae | Short-lived perennial | Basal leaf rosette | 2 - 3 ft | June - July | 559,172 |
| Plectritis congesta | Valerianaceae | Annual | Small, slender | < 2 ft | April - June | 1,311,698 |
| Potentilla gracilis | Rosaceae | Perennial | Basal leaf rosette, large | < 3 ft | May - July | 1,135,000 |
| Prunella vulgaris | Lamiaceae | Short-lived perennial | Basal leaf rosette | 1 - 2 ft | June - July | 400,228 |
| Sanicula crassicaulis | Apiaceae | Perennial | Basal leaf rosette | 1 - 4 ft | April - June | 40,000 |
| Sidalcea virgata | Malvaceae | Perennial | Basal leaf rosette, spreading | < 3.5 ft | May - July | 133,000 |
| Tellima grandiflora | Saxifragaceae | Perennial | Basal leaf rosette | 2 - 3 ft | April - June | 7,408,800 |
| Thalictrum polycarpum | Ranunculaceae | Perennial | Stocky | 2 - 6 ft | April - June | 151,333 |
| Viola praemorsa | Violaceae | Perennial | Small, spreading | < 1 ft | March - May | 10,509 |

## Ground Preparation:

Preparing your orchard floor for NCC establishment is **one of the most important aspects** for creating a healthy, robust stand of native cover. Optimally, your orchard floor should remain weed-free for two years prior to seeding. This can be done through various treatments of herbicide spraying, flailing, and scraping. Avoid using long-lasting pre-emergents, which may affect the germination rates of your native cover. Using another cover crop is fine, as long as it is properly terminated prior to seeding your NCC and does not produce seed in the years prior to planting. Your goal should be to reduce and exhaust the orchard's existing seed bank. After harvesting your hazelnut crop in fall, remove any debris on your orchard floor and do any additional vegetation removal.

## Establishment:

After you complete ground preparation in fall after hazelnut harvest, spread your NCC. Broadcast spread your broadleaf species across the orchard floor. Native grasses may be broadcasted with the broadleaf species or drilled into your orchard floor separately.

During the establishment period, from when the seeds are spread to around April, ensure that the ground is not substantially disturbed. Disturbances like continuous driving, pushing brush, and early season flailing will hamper the cover's ability to establish. One-time driving passes, like when spraying for blight and suckers, pruning, or shredding, are fine.

## Annual Management:

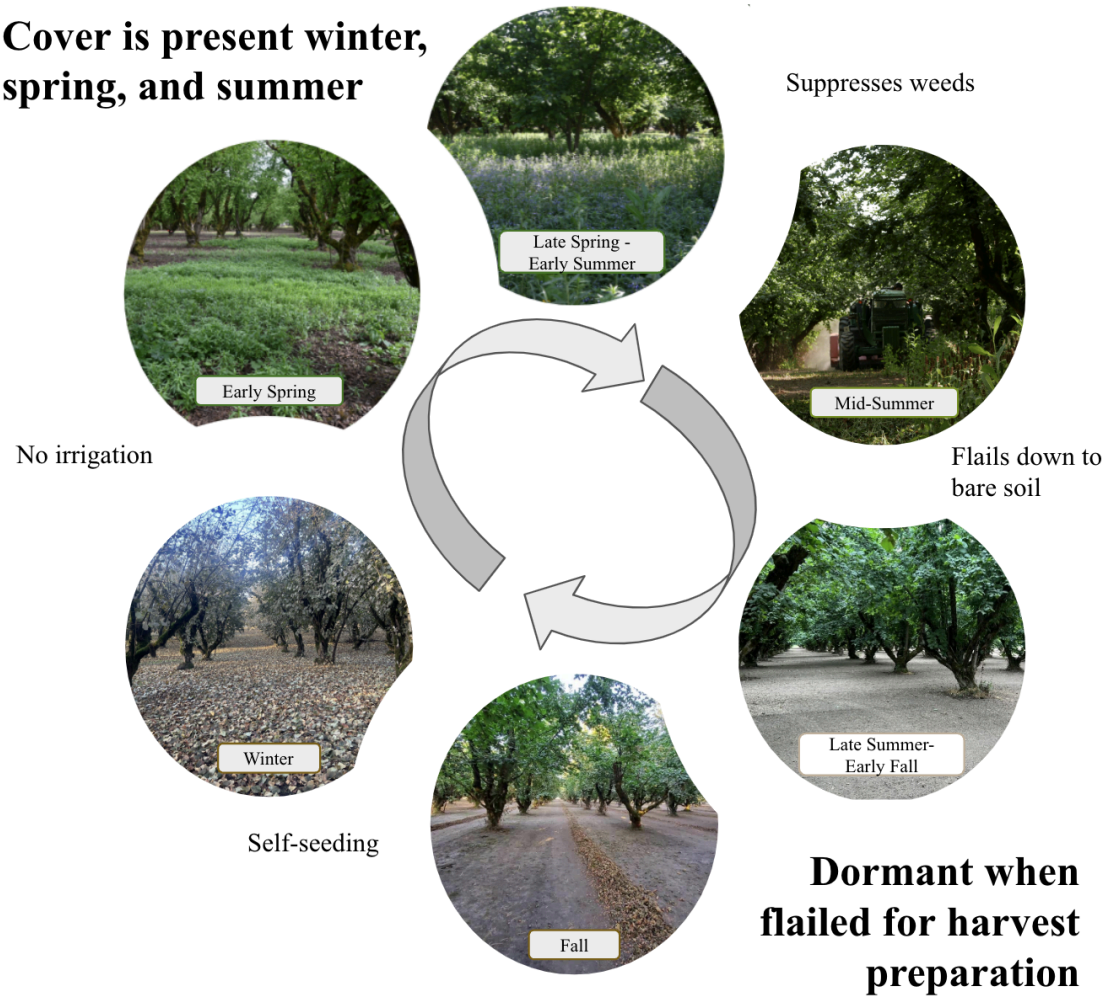
Native cover is easily managed and requires very little input. Once your seed mix has gone to seed, flail your orchard floor to your liking. It is generally recommended to do this in a consolidated time period to reduce regrowth being exhausted by continuous flailing. We recommend flailing 2-3 times right after cover seed maturation and then once again during blank hazelnut fall during final flail. Flail as low as possible to ensure an unimpeded mechanical hazelnut harvest– there should be minimal vegetation left intact and just a light layer of fine residue. Once the cover has been properly mowed down for the season, harvest your hazelnut crop over the top. After harvest, wait for NCC regrowth and germination to occur. Conduct regular orchard activities except for flailing (and other high-disturbance activities) until your cover has gone to seed again next summer. Continue this cycle.

While scraping is optional, it is not advisable as it rips up the cover roots and opens the seed bank to weed colonization. Spot scraping is fine if properly conducted.

If you choose to spray insecticides for filbert worm management, it is best to flail the cover down prior to spraying to avoid killing beneficial insects.

While we have not found the need to reseed when letting the NCC go to seed, adding additional seed to your NCC seed bank is never a bad idea. Especially if your orchard is transitioning from one canopy cover category into the next, adding seed that will thrive in the projected category will help you reduce weeds throughout this transition.

Seed mixes will generally take three or more years to mature, with annual species dominating establishment in years 1-2 and perennials maturing by year 3.




## Additional Resources:

*Where to Buy Native Seeds in Bulk:*

- Buzz Cover Crop Seeds - https://www.buzzcovercropseeds.com/
- Heritage Seedlings and Liners - https://www.heritageseedlings.com/native-seed
- River Refuge Seed Company - https://www.riverrefugeseed.com/native-seed
- Silver Falls Seed Company - https://silverfallsseed.com/products/

*Smaller Retail Native Seed Sources:*

- Friends of Buford Park - https://bufordpark.org/collections/seed-packets
- Northwest Meadowscapes - https://northwestmeadowscapes.com/
- Steele Acres - https://www.steeleacres.com/
- Willamette Wildlings - https://willamettewildlings.com/seed-products/

*Additional Information:*


- Brambila, Alejandro, et al. "Native Cover Crops Enhance Biodiversity and Ecosystem Services in Hazelnut Orchards." Journal of Applied Ecology, vol. 62, no. 2, 26 Dec. 2024, pp. 401–413, https://doi.org/10.1111/1365-2664.14850.

- Lane-Massee, Marissa. "Ecological Intensification of Oregon Hazelnut Orchards: Restoring Native Plant Communities in Shared Ecosystems." Uoregon.edu, University of Oregon, 7 Aug. 2024, scholarsbank.uoregon.edu/items/b00cc4ce-455d-4d85-b1ec-b0eb56b6adee.

- Pease, Corin. "Pollinator Cover Crops in Hazelnut Orchards." *https://Www.xerces.org/*, Xerces Society, Nov. 2024, www.xerces.org/sites/default/files/publications/24-011.pdf.


*Additional Questions:*

Feel free to contact mlanemas@uoregon.edu for any additional questions you may have.

UNIVERSITY OF OREGON

HALLETT LAB

WESTERN SARE Sustainable Agriculture Research & Education

USDA NRCS