Agroforestry Initiative: Current Projects and Funding Opportunities

George Powell
BC Agroforestry Industry Development Initiative
support@agroforestry.info

The British Columbia Agroforestry Industry Development Initiative (AIDI) is working to support the development and adoption of agroforestry practices for the benefit of all British Columbians. The AIDI is distributing up to $421,000 in cost-share funding (minimum of 32% cash contribution from proponents, with up to 68% cash contribution from the program) for projects addressing our strategic goals:

1. Develop the Business Case for Agroforestry in BC:
   - Develop enterprise-level BC agroforestry economic information
   - Develop cost-benefit information and business case studies

2. Improve Agroforestry Market Connections:
   - Improve links between buyers and suppliers for alternate crops and NTFP’s produced using agroforestry systems
   - Improve value chain management through partnerships from production to processing and distribution

3. Demonstrate Agroforestry Practices to showcase:
   - Operational examples of agroforestry systems implemented
   - Gaps in regional and key practices addressed

4. Improve Agroforestry Awareness, Extension and Education through:
   - Improved awareness among industry, agencies and the public
   - Expanded body of BC-based extension resources
   - Self-sustaining industry peer network for future agroforestry extension

5. Expand and Strengthen Agroforestry Partnerships through:
   - Stakeholder leadership of development activity and greater sector self-reliance
   - Increased recognition and partnerships with affiliated stakeholder groups
   - Increased number of stakeholders participating in development and self-identifying with the sector

Some of the projects currently being supported through the AIDI include:

In the area of business development and marketing support:

1. Business Development Tools for Agroforestry Initiatives
   The Splatsin First Nation is working to developing a user-friendly Agroforestry Business Planning and Development Guide to help current or future Interior agroforestry producers to enhance profits and support the enterprise’s environmental sustainability. Workshops will be held with stakeholders in Thompson and Cariboo regions.

2. Agroforestry Production Development Tool for New Ventures
   Brinkman & Associates with the UBC Farm are creating a decision-making tool and methodology for producers to assess the feasibility of new agroforestry enterprises. This tool will aid in assessing the multitude of considerations necessary in agroforestry planning to better anticipate costs, revenues, challenges and benefits of a specific endeavour. They will trial the tool at the UBC farm and with five other farms across BC.
3. **Practitioner Sales Channel Assessment for Hawthorn**  
The Naturally Grown Herb & Spice Producers Cooperative (HerbPro) has completed an evaluation of the potential for sales of raw hawthorn ingredients and value-added products through natural health products practitioners. Download the final report from the AIDI website.

Operational demonstrations underway include:

4. **East Kootenay Food Forest Demonstration**  
Clear Sky Farm, in Fort Steele is developing a 1-acre food forest site to test diverse food plant varieties arranged into multiple canopy layers and alleys. They will conduct tours and a food forest design training session in 2013.

5. **Alley Cropping Demonstration - Gulf Islands**  
Just Another Weed Patch Farm, on Gabriola Island is developing a diverse nut and timber tree grove grown in combination with livestock and annual vegetable and flower crops. They are documenting their experiences at [http://justanotherweedpatch.com](http://justanotherweedpatch.com)

6. **Integrating Apiculture in Riparian Buffers**  
Murray Family Woodlot in Slocan Lake are demonstrating a riparian management system that can provide multiple production benefits (including honey) and conservation of watershed and biodiversity values. They will also be conducting a cost-benefit analysis of this production system.

7. **Best Silvopasture Management Practices - Christmas Trees**  
Kootenay Tree Farms in Cranbrook are testing methods to increase integrated tree and forage production, while reducing incidence of disease in the Christmas trees. A cost-benefit analysis and field workshops will be done in the study area.

8. **Alley Cropping Demonstration – Okanagan**  
Curly Frog Farm in Kelowna are demonstrating an alley cropping system utilizing black walnut and pawpaw tree rows. They will host site tours focused on production methods, resources and costs this year.

9. **Cariboo Silvopasture Demonstration**  
Zirnhelt Ranch, near Big Lake Ranch is addressing existing information gaps that limit the adoption of silvopasture practices in areas affected by mountain pine beetle. This summer they will host an on-site workshop will discuss silvopasture systems and applications, and the potential for expanding this system design in the region.

10. **Agroforestry Practices for Devil’s Club Cultivation**  
Pacific Reishi Ltd, in Powell River is showcasing the cultivation of Devil’s Club (*Oplopanax horridus*) in greenhouse, nursery and forest settings and synthesizing market information. A workshop will be held this year at the cultivation facility to discuss management and markets.

Support for agroforestry extension includes:

11. **Agroforestry Sessions at the Hort Growers Short Courses**  
In partnership with the Lower Mainland Horticulture Improvement Association, agroforestry information has been highlighted at the 2012 & 2013 Horticulture Growers’ Short Courses, in conjunction with the Pacific Agriculture Show.
Cultivating Sustainable Agroforestry Through Collaboration, Demonstration, and Extension
Delta Farmers Institute with the UBC Farm delivered a one-day agroforestry workshop with hands-on demonstrations at the UBC Farm. They are creating a quick-reference guide summarizing agroforestry trends, opportunities, practices, marketing considerations, and challenges based on information presented at the workshop.

Agroforestry Tour at the 85th Annual BCCA Convention
The BC Cattlemen’s Association will be hosting an agroforestry tour in conjunction with their annual education day in Vernon on Saturday May 25th. The tour will focus on silvopasture, integrated riparian management, and watershed issues in the North Okanagan.

Riparian Stewardship Through the Use of Agroforestry
The Farm Riparian Interface Stewardship Program (FRISP) will be delivering six agroforestry information sessions around BC this year as part of their education and outreach program. The focus will be on agroforestry as an integrated option for watershed stewardship.

Support for building partnerships is imbedded in all of the foregoing projects, and one specifically designed to address a need in northern BC:

Agroforestry Capacity Building in Northern BC
The Resources North Association (RNA) is working to stimulate the implementation and evolution of agroforestry as a viable element of integrated resource management in northern BC. RNA will improve regional agroforestry awareness, education, and networking in northern BC.

All funds for the AIDI's cost-share program are now committed. Other potential agroforestry-related funding sources include Investment Agriculture Foundation's Emerging Sectors Initiative, the Environment Farm Plan Program for shelterbelts and hedgerows (anticipated post-April 2013), and the BC Government’s Buy Local Program for marketing work.

For more information on the BC Agroforestry Industry Development Initiative please visit our website at http://www.agroforestry.info. On the website you will find links to sign up for email updates and our contact information through Facebook or Twitter.

Funding for the Agroforestry Industry Development Initiative (AIDI) has been provided by Agriculture and Agri-Food Canada through the Canadian Agricultural Adaptation Program (CAAP). In British Columbia, this program is delivered by the Investment Agriculture Foundation of BC.

The Province of British Columbia provides in-kind support to the AIDI. The Federation of BC Woodlot Associations administers the AIDI with the guidance of the Agroforestry Management Committee.
One Acre Food Forest Demonstration Project

Cara Conroy-Low
Clear Sky Meditation & Study Foundation, Fort Steele, BC
cara@clearskycenter.org

Presentation Summary

At Clear Sky Centre, we came across the concept of 'food forest', permaculture influenced agriculture, in a rather organic way, based on a fortunate string of events. My colleague and friend, Michelle Heinz and I, came to Canada in 2008. At that time we were looking for a crop to grow on the agricultural portion of the land at Clear Sky Centre, in the East Kootenay, and wanted to develop a social enterprise from it. Seabuckthorn was a crop we were particularly interested in.

As part of our research into seabuckthorn, we met Richard Walker, one of Canada's pioneers of Food Forest agriculture. We visited Richard at his 3.5 acre mature Food Forest in Grand Forks, BC in 2008, and since then Richard has consulted with us and taught two day intensive food forest workshops at Clear Sky Centre every year. We are now very grateful for the funding from AIDI to be able to implement a one acre demonstration food forest model together with Richard at the Centre.

About Food Forests

A food forest is a unique and complex ecosystem-based agroforestry system. Food forests are human designed systems that mimic the structure and design of a forest ecosystem, with the goal of optimal soil and plant health in order to maximise caloric output for minimum caloric input.

Features of a Food Forest:

- **Multiple Canopy Layerings**
  A food forest consists of multiple layers of plants, utilising vertical stacking to accomplish more food and organic matter per square foot of land. Layers include root, herbaceous, shrub, small trees, large trees and vines.

- **High Diversity**
  Food forests are highly diverse systems with a wide variety of species of plants that provide greater overall stability and resilience to pests, diseases and climate than a mono crop system.

- **Beneficials, Pest Control and Pollination**
  Different species in the food forest play different roles in the overall healthy functioning of the system, such as the attraction of beneficials to provide natural inbuilt pest control and pollinators to improve pollination and therefore fruit yields.

- **Full Season of Multiple Harvests**
  A food forest has the potential to produce harvests from snow melt to snow fall each year. The yields of a food forest can include fresh fruit, nuts, herbs, vegetables, medicinals, which can also be turned into
value added products including herbal tinctures and teas, fruit wines and preserves. There is also potential to generate income from plant propagation and a nursery business. Plant species are selected according to hardiness for that particular site and climate.

- **Soil Building, No Tillage, Self Fertilising**
  Leaf drop builds mulch and cover which further nourishes a healthy, living soil food web. Nitrogen fixers and dynamic accumulator plant species are placed strategically throughout the food forest to provide living fertility sources that can be 'chopped and dropped' where necessary. Tillage is no longer needed once the system is established.

- **Less Inputs / Fossil Fuels**
  The need for fossil fuels and inputs such as fertiliser are reduced in a food forest – fertiliser is grown within the food forest itself, annual tillage is eliminated, and the need for introduced pest and disease controls are reduced by the diversity, soil, plant and beneficial insect health of the system.

- **Lower Water Requirements**
  Dense mulch and healthy soils mean greater cover that prevents evaporation, and a greater ability for the soil to hold water.

- **Quality Soil and Quality Food**
  Because soil is undisturbed by tillage and improved year after year through the leaf and root drop of plants in the system, the soil food web is also healthier, resulting in higher quality, more nourishing food.

### One Acre Demonstration Food Forest Description

#### Site Description

The site for this one acre demonstration is at Clear Sky Centre, near Fort Steele, Cranbrook and Fernie, in the East Kootenay. It is a Zone 4 climate, with low rainfall and mountain conditions. There is good sun exposure and wind comes from all directions. The one acre food forest is located within a 25 acre agricultural field that is surrounded by an elk fence. This field was previously a hay field, with moderate to low fertility. The site will be irrigated with well water in the short term, and gravity fed mountain stream water in the medium term.

#### Design Summary

The one acre demonstration is in an oval design with a buffer zone/wind break and five major rings of plants, three minor and a large central area:

- **Buffer Zone** plants include poplars, amur maple, saskatoons, filberts, haskaps, lilacs.
  - **Circle # 5** trembling aspen, lindens, burr oak, with room for annual crops / covers between
  - **Circle #4** nanny berry, willows, black locust, hawthorn, European mountain ash, caragana, box elder, linden
- **Circle #3a** filberts, seabuckthorn, currants
  
  *With solomon seal, echinacea, bee balm, painted daisy, asters, sweet Cecily, milkweed*

- **Circle #3** heavily planted to apples, pears
  
  *with comfrey in between (chokes grass, compatible with fruit trees, soft for fruit fall also)*

- **Circle #2a** some plums, pear, caragana, villosa lilac, cherries.
  
  *With comfrey, greek oregano lovage, anise hyssop underneath*

- **Circle 2** plums

- **Circle #1a** mostly cherries, a siberian salt tree

- **Circle #1** cherries

  *above 3 rings with sweet Cecily, good king henry, comfrey, sedum, yarrow, Joe-pye weed, hosta*

- **Centre**: education /seating area with intensive amounts of blueberry, raspberry, honeysuckle, saskatoon, gooseberry, grapes and possibly hardy kiwi. Also asparagus beds about 1/10th an acre. Spoked wheel medicinal bed including astragalus, echinacea, siberian ginseng, goldenrod, motherwort, mints, allheal and valerian. The whole centre is quite large, nearly half an acre.

- **Herbaceous, spread throughout** – in the understory, a wide range of herbaceous, herbs and vegetables include: chives, dill, horseradish, orach, borage, seakale, arugula, lemonbalm, day lily, Jerusalem artichoke, solmon's seal, salad burnet, sorrel, skirtet, thyme and ostrich fern. Native forbs and grasses include: heart-leaf arnica, arrow-leaf balsam root, showy aster, flat top spirea, silky lupine, rough fescue and prairie junegrass.

*Circles 4 and 5 are 25 feet apart*

3a and 3, 2a and 2, etc., are 20 feet apart

*Please see Landscape Diagram in Presentation for full plant lists.*

**Yields**

Here are some estimated food forest yields in 5 Years, from this 1 acre model, in a zone 4 climate.

**Fruit & Berries**

- 600 lbs of Saskatoon from 30 trees
- 300lbs of haskap berries from 20 bushes
- 200lbs of cherries from 30 trees
- 200lbs of raspberries from 100 canes
- 30lbs of gooseberries from 10 bushes
- 70lbs of blueberries from 12 bushes
- 150lbs of seabuckthorn berries from 10 thornless seabuckthorn trees
- 1500 lbs of apples from 20 apple trees
- 600lbs of pears from 12 trees
- 600lbs of plums from 15 trees
- 800lbs of choke cherries
- 300lbs of hazelnuts from a few small groves
- 100lbs of currants from 12 bushes
25lbs of goji from 5 plants
50lbs of kolamitka hardy kiwis from 5 vines
175lbs of grapes from 8 hardy vines

**Herbaceous & Early Vegetables**

750 lbs of asparagus per year.
Small early and late season harvests of perennial & often unusual gourmet vegetables: include chives, sea kale, specialty mints, linden leaves, sweet Cecily, day lilies, edible flowers, Jerusalem artichokes and ostrich fern.

**Nursery Sales**

There is also possible income from nursery and seed sales for:

- Fruit, berries and nuts
- Insectary plants & seeds (pollinators) for cold climates
- Varieties of medicinals for cold climates
- Native forbs and grasses seed mixes
- Soil improvement plants such as sterile comfrey blocking 14, and sorrels.

**Value Added Products**

- Medicinals grown can also be made into many herbal medicines & remedies
- Craft materials such as basket willow, cut flowers, husks and seed pods
- Dye from plants such as black walnut leaves, linden flowers, stinging nettles
- Wide range of potential value added products from various berries & fruit: juices, syrups, vinegars, wines.

Yields are diverse but lower than in fruit growing areas such as the Okanagan or Creston. However, it is encouraging to recognise that these are substantially improved yields for difficult cold climate production, which otherwise would be producing an extremely limited selection and volume of food.

The yields of a food forest are obviously dependent on how the food forest was designed. A good food forest design should look at the needs and wants of the people who will be cultivating it – the farmer's goals should be at the centre of the system.

**Challenges**

With more diverse yields at a lower scale of production, challenges include how to bring fresh produce to market, or produce value added products profitably, given that yields might not warrant large scale mechanisation for any particular crop.

A whole range of unusual vegetables, fruit and nuts can be grown in a food forest that the general public doesn't ordinarily eat. Food forest farmers may therefore need to learn the art of cultivating excitement
and interest in new unusual foods.

The scale and spread of harvests throughout the year in food forest agriculture appears to be better suited to small scale agriculture, especially families and individuals who want to grow diverse food for themselves as well as generate some livelihood, on a smaller piece of property. However, more examples of food forest agriculture in practice are needed to test its potential and suitability to different farming models.

Another challenge is for farmers to have adequate knowledge to actually design and establish a food forest. Food forests are multifaceted, extremely diverse and less 'predictable' than monocultures. There are also fewer examples of them in Canada, though funding of projects like this certainly improve the situation.

Many thanks. See Presentation Final page for full thanks and Credits.
Current Research on New Hazelnut Varieties in British Columbia

Thomas E. O’Dell and Haley Argen
Nature Tech Nursery, Langley, BC
thom.odell@gmail.com

“When we develop an agriculture that fits this land, it will become an almost endless vista of green, crop-yielding trees.” - J. Russell Smith, Tree Crops: A Permanent Agriculture, 1950

I. Background and Brief History of Hazelnuts on the West Coast

Nature Tech

We started Nature Tech Nursery in 2010 in part to help revive the hazelnut industry in British Columbia by importing new varieties that combine disease resistance with substantial yield increases. We will briefly review hazelnuts as a crop and the BC industry, talk about the new varieties, and discuss agroforestry applications of hazelnut trees.

Hazelnut Species

Our focus is the cultivated hazelnut or filbert, Corylus avellana of European ancestry, because of its long history of selective breeding and superior crop value. You may have heard of Barcelona and Ennis of the older varieties or Jefferson and Yamhill of the new. There are three additional kinds of hazelnuts native to North America: the American Hazelnut (Corylus americana; original host of eastern filbert blight (1)), the Beaked Hazel (Corylus cornuta) and the California Hazel (Corylus cornuta var. californica or just C. californica); all certainly have agroforestry potential and are used in ecological restoration. Many efforts are underway to develop hazelnut trees suitable to a wider range of conditions, often by hybridizing Eurasian and North American species (e.g. ‘Trazels’). Below we refer to the main hazelnut of commerce, Corylus avellana.

Development of the Industry

Globally, most hazelnuts are grown in Turkey where they produce over 600,000 tonnes per year. Hazelnut trees were brought to California in the 1880’s and large orchards were established in Oregon by the 1890’s. Oregon currently produces most of North America’s hazelnut crop, but only about 5% of the world harvest. “The average farm-gate value (net value of hazelnuts when they leave the farm after marketing cost) of the U.S. crop in the past three years was about $63 million, with a processed value of nearly $160 million.” (2)

A commercial hazelnut crop in the Fraser Valley dates to at least the 1930’s and BC was home to a North American pioneer of nut tree breeding: David Gellatly Jr., who lived on Okanagan Lake. The remnant of his orchard, where he bred north hardy nut varieties from 1905 through the 1960’s, is a Regional Park and working Heritage farm (3). Credit for the development of the hazelnut crop here in the lower mainland of BC in the 1980’s goes in good measure to Henry Wigand, who tirelessly promoted the industry and started the processing plant that is now Canadian Hazelnuts (4). By 2000, there were over 800 acres of hazelnut trees in the Fraser Valley producing over 300 tons of nuts per year, mostly around Chilliwack and Agassiz. Then, eastern filbert blight (EFB) arrived.
Eastern Filbert Blight (EFB)

EFB is native to eastern North America where it lives, without causing disease, on the native Corylus americana and where its destructive effects on the cultivated hazelnut varieties prevents their adoption as a commercial crop. EFB arrived in Oregon in the 1970’s, where it wrought havoc on the hazelnut industry, and made it to BC around 2003. Many commercial hazelnut orchards in BC now have the blight; some have been cut down, others are dying, most are still productive.

In Oregon, some orchards have continued commercial production even with blight present for twenty or more years. Management strategies include reducing infection through aggressive pruning and spray programs. However, planting resistant varieties is probably the best long-term strategy. Before we get into the new, resistant varieties, you should know a few more things about the blight.

Different hazelnut varieties can be more or less susceptible to EFB but the newly released varieties from the Oregon State University breeding program are all highly resistant, even to many strains of EFB found in the East. However, EFB has many strains or races and it so far appears that few of these strains are present in the Pacific Northwest. If more strains of the disease arrive, the risk of infection increases and the disease organism has more opportunity to evolve and overcome plant defenses. Currently there is a quarantine preventing importation of hazelnut trees to British Columbia except in sterile culture. It is important to keep this quarantine in place to slow the spread of the disease (5).

New Varieties

Oregon State University in Corvallis hosts a large collection of hazelnut varieties with an active breeding program since 1969 (6), applying classic selective breeding to produce superior nut trees. The past 10 years has seen the release of many of new hazelnut varieties selected for EFB resistance and nut or pollen characteristics. Some new varieties can produce almost double the yield per acre of the old standard Barcelona (7). This shouldn’t surprise anyone, the Barcelona hazelnut variety is over 300 years old; four decades of selective breeding has led to substantial improvements.

Oregon hazelnut growers made this breeding work possible by providing about $4 million from a per ton assessment for research over the past 25 years, with additional funding from the USDA. Although varieties released prior to 2012 are not patent-protected, the latest ones are, with license fees going to support the continued research. The breeding program now delays release of new varieties outside of Oregon for at least three years as an additional benefit to the growers who funded the work.

By creating new varieties with high resistance to EFB, the OSU breeding program is widely credited with rescuing the hazelnut industry in Oregon, which currently grows by about 3000 acres per year. They continue to select for varieties with improved qualities such as better flavour; OSU released three more varieties in 2012 and we hear that more are on the way.

Because hazelnuts are obligate out-crossers, two different varieties are required for nut production, and grower’s plant 10-20% of each orchard with several varieties of pollinizer trees. Pollenizers have to be genetically compatible with the select nut variety and the pollen has to shed at the time when female flowers are receptive. Timing of pollen shed and female flowering differ between varieties and change from year to year. The recommendation is to have two or three compatible pollenizers in every planting to release pollen over the entire flowering period for maximum nut production. It is also why the current variety trial is so important: just about all existing information is from Oregon and the behavior of each variety may change when planted at a more northerly latitude.
The BC Hazelnut Variety Trial

Hazelnut farmers, the BC Hazelnut Grower’s Association (BCHGA), the Investment Agriculture Foundation (IAF) and Nature Tech Nursery are partnering to compare six new hazelnut varieties at six locations in the lower Mainland and Gulf Islands of BC. All of the sites were partially planted with the new trees over the past two years and the last planting will be finished this spring. We will measure timing of flowering and pollen shed and nut production for the next several years. Since the nut harvest can coincide with the onset of fall rains, harvest dates are also being evaluated. Interested growers will soon have local data to inform their decisions about planting hazelnuts in southwestern BC. In addition to producing the trees for this project, Nature Tech Nursery provides scientific support to collect and analyze data and communicate the results. We look forward to presenting more information about the hazelnut variety trial as it becomes available.

II. Using Hazelnuts in Agroforestry

What is Agroforestry?

“Agroforestry is an integrated approach of using the interactive benefits from combining trees and shrubs with crops and/or livestock. It combines agricultural and forestry technologies to create more diverse, productive, profitable, healthy, and sustainable land-use systems.” (8). So when trees are used on a farm by design to produce a crop of fruit or nuts, with the space under or between the trees used for forage, alley cropping or other production, that is a kind of agroforestry.

Why Hazelnuts?

There are few places in the world as suitable to hazelnut orchards as the Fraser Valley. Hazelnut trees require winters that are fairly mild to facilitate pollination (which tends to peak in January or February) yet cold enough to provide adequate chilling of about 1600 hours below 7° C. While they prefer well-drained soil, they can tolerate a wide range of soil conditions and they benefit from being well-watered. Hazelnuts fall from the trees in September or October (depending on the variety and the season), are swept into windrows with a mechanical sweeper and a harvester picks them up. They are then cleaned and dried before sale or processing. Dried hazelnuts store well for up to a year at room temperature.

The nuts are delicious, nutritious and healthful, rich in protein and unsaturated fats with significant amounts of B and E vitamins, calcium and cholesterol-reducing phytosterols. Most nuts are used in candy but other opportunities for value-added products are endless (dry roasted nuts, nut butter, flour, oil, cosmetics, etc.). Currently most BC Hazelnut growers are part-time, partly because hazelnuts are a relatively low input, low labour crop well suited to people with small acreage who want to grow food for supplemental income and farm tax status. Local hazelnut farmers have benefitted from the Canadian Hazelnut processing facility in Agassiz and Eagle View Hazelnut Processors in Chilliwack and many commercial orchards are in that area.

While hazelnuts are the only commercial nut crop in BC and have many advantages, there are some challenges to a vibrant BC hazelnut industry. They are generally considered hardy to Zone 5 US, though this can vary by cultivar and some varieties may survive in the Peace River area (3). In addition to the Lower Mainland and coastal islands of BC, older varieties are known to be hardy and produce nuts in some areas of the Okanagan, around Kamloops and Nelson, and most of the new cultivars we are trialing in BC have been successfully grown in the the zone 6 area around the Niagara Peninsula of southern Ontario. The area of potential success for the new cultivars in BC is unknown, since each cultivar and microclimate is different, and they have not been widely planted here (almost all current data is from Oregon).

Locally, there is a limited and aging infrastructure for processing and marketing hazelnuts; however, it is not presently used to capacity because production appears to be declining with the spread of EFB. There has been
little to no supply in BC of hazelnut trees for planting (or re-planting) for the past ten years. Therefore, in some ways we are trying to establish what amounts to a new crop. In addition, while some new varieties have been imported, in the future we can expect a three-year delay plus license fees on new releases. Finally, while hazelnuts can be profitable, so far they have not yielded the value per acre that berries do (9) and with the high cost of land farmers have opted for the highest returns. We are optimistic that the increased yields of the new varieties, together with the volatility of blueberry prices, will lead to diversification of local agriculture with more nuts grown.

How Can You Use Hazelnuts in Agroforestry?

Hazelnuts can be planted in traditional orchards, with intercropping, used in livestock pasture, hedgerows, windbreaks, for shading farm buildings, as hosts for truffles, and of course for the many other benefits (e.g. habitat, shade) that come from adding more kinds of trees on your farm.

Orchards typically are planted with 18 x 18 or 20 x 20 foot spacing (109 to 134 trees per acre). Some farmers plant at double-density (9x18 or 10x20) to increase yields. This is especially valuable for increasing yield early in orchard development and trees are transplanted successfully up to about ten years. The ‘extra’ trees can be transplanted to additional acreage with little delay in production. Some nut production can occur 3 to 5 yrs after field planting, commercial harvests begin at 5 to 7 years, and production plateaus at ten to fifteen. Yields of the old hazelnut varieties averaged about a ton per acre, but one of the new ones, Yamhill, has averaged 3600 lbs per acre in years eight to ten at an Oregon farm (7). The newer varieties also have higher percentages of nut kernel and fewer ‘blanks’ (empty shells) which increases value.

Intercropping can be very successful with crops such as garlic, squash, and clover seed between the hazelnut trees. With orchards, this works best during establishment - before nut production, when harvests impact the alleys between the rows and the orchard becomes more shaded. Nuts make excellent feed, and some livestock can clean up the nuts left after harvest. Feeding culls to livestock, allowing them to feed from nuts left on the ground after harvest, or growing nuts purposely for feed are time-proven agroforestry strategies.

Hazelnuts are also being touted as an oil or fuel crop in the Midwestern US where the climate is unsuitable to European varieties with large nuts, and the native species are being selectively bred for this purpose. Another innovative idea we have heard is to plant hazelnut trees between chicken houses to provide shade along with a cash crop. Hazelnuts are a traditional hedgerow plant, with the advantage of providing feed. Of course, any tree provides shade, wildlife habitat, and supports various beneficial insects, while helping reduce soil loss and fertilizer runoff.

Looking to the future, there is potential to produce truffles from inoculated hazelnut trees. Truffles are underground mushrooms produced by fungi associated with tree roots. There are hundreds of species of truffles but only about a dozen are harvested commercially. Italian white truffles are the most valuable food crop in the world and the Perigord black is not far behind. The Perigord truffle has been cultivated successfully in orchards of inoculated hazelnut trees (called truffieres) in Europe, the US, New Zealand and Australia. A prize has been offered by the Truffle Association of British Columbia for the first proven European truffle produced in BC. It has yet to be claimed, but several experimental truffieres are in development around the lower mainland of BC; time will tell of their success.
III. Summary

Our passion for growing, tree crops, and hazelnuts in particular, inspired us to start our nursery and we are excited to see the increasing demand for our trees. We view this as not just a business but also a contribution to food security and sustainability, since the surest way to keep a food supply stable and secure is by growing it locally.

Hazelnuts are a high-value, low input crop ideal for BC. Recent variety releases from Oregon State University’s breeding program, combining disease resistance with excellent nut quality and yields, are now being grown in BC. Extra maintenance on existing orchard and planting the new disease resistant varieties reduce the impact of EFB, but slowing the spread of disease ongoing diligence in regards to biosecurity and quarantine are also important measures (5).

Hazelnut trees have many uses and you can probably think of more! Whether you are thinking about an orchard, a hedge, or a few shade trees, it is a good time to consider hazelnut trees to diversify your farm.

Agroforestry is the ancient idea of using trees on the farm. There are so many possibilities for this that we can’t begin to list them all, but luckily we don’t have to; there are many resources if you need more information including books (10) and web pages (11).

IV. For More Information About Growing Hazelnuts

BC Hazelnut Growers Association: email: hazelnuts@shaw.ca, phone: 604-796-2550


Oregon State University: http://extension.oregonstate.edu/yamhill/hazelnuts-filberts

V. Works Cited


Devil’s Club: Management in British Columbia

Fidel Fogarty
Pacific Reishi Limited, Roberts Creek, BC
fidelfogarty@hotmail.com

Devil’s Club Cultivation

Family Scientific Name: Araliaceae
Family Common Name: Ginseng Family
Scientific Name: Oplopanax horridus Miq.
Common Synonym: Oplopanax horridum (Smith) Miq.
Common Name: Devil’s Club, ch’i7t’ay
Species Code: OPLHOR
Ecotype: ‘DCZ’
General Description: O. horridus occurs in moist forests from Alaska and BC to Oregon, east and west of the Coast Range, Cascades, east to Idaho and Montana, and in Michigan and Ontario.
Panax means “everything”, while Horridus means “spiny”. Devil’s club is basically ‘North American Ginseng’. It’s related to the Panax (Ginseng) family.

**Distribution Range**


**Ecology**

Devil’s club grows from sea level to high elevations - mostly in riparian zones – at moist, oxygenated micro-sites. ‘Devil’s Club Zone’ has a crown closure optimum of approximately 70%.

**Traditional Uses**

**First Nations West Coast**

Ethno-Botanists Nancy Turner and Trevor Lantz have studied the spiritual and medical significance of Devil’s club. It is used as a panacea in First Nations traditional medicine for: upper respiratory tract infection, arthritis, diabetes (blood sugar regulation).

“Devil's club (Oplopanax horridus; Araliaceae) is a deciduous, spiny shrub which was and still is an important medicinal plant for many Indian peoples in western North America. Its traditional uses involve both physical and spiritual realms of medicine. The inner bark and roots were used to treat rheumatism and arthritis, stomach and digestive ailments, tuberculosis, colds, skin disorders, diabetes, and many other ailments. Extracts from it have marked hypoglycemic properties, but little else is known of its pharmacological attributes. It was taken by shamans, initiates, and others wishing to attain supernatural powers. Special protective powers were attributed to it, presumably because of its prickliness. Its wood was used for fishing lures and the charcoal as a pigment in a protective facepaint for ceremonial dancers. Devil's-club was named in almost every Native language used within its geographic range. There are some 13 to 15 known separate etymons for it in more than 25 different languages. In most languages, the derivation of the name is presently unknown. More pharmacological research on this plant is needed.” (Turner, N. (1982). Traditional Use of Devil’s Club (Oplopanax horridus; araliaceae) by Native Peoples in Western North America. *J. Ethnobiol.* 2(1), 17-38.)

Devil’s club is also used in tools such as clubs (ouch!), fishhooks, canoe bowsprits, as well as in jewelry and culturally significant art forms.

**Traditional Chinese Medicine**
Acanthopanax, a related species with similar compounds, is used in traditional Chinese medicine. It is known as ‘wu jia pi’, and is spicy, bitter and warm.

<table>
<thead>
<tr>
<th>Channels:</th>
<th>KI, LIV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Properties:</td>
<td>Spicy, bitter, warm</td>
</tr>
<tr>
<td>Latin:</td>
<td>Cortex Radicis Acanthopanacis Gracistyli</td>
</tr>
<tr>
<td>Chinese:</td>
<td>五加皮</td>
</tr>
<tr>
<td>Tone Marks:</td>
<td>wū jiā pí</td>
</tr>
<tr>
<td>Translation:</td>
<td>Bark of Five Additions</td>
</tr>
</tbody>
</table>

For more information, see: [http://www.sacredlotus.com/herbs/get.cfm/chinese_herb/wu_jia_pi_acanthopanax_root_bark](http://www.sacredlotus.com/herbs/get.cfm/chinese_herb/wu_jia_pi_acanthopanax_root_bark)

**Western Herbal Medicine**

*Oplopanax horridus* is used in western herbal medicine to treat respiratory tract infection, anti-myco-bacterium (TB), arthritis, and diabetes (type 2), and as an anti-bacterial and an anti-viral. It can also be taken as a general immune system tonic (e.g. 20g/day as tea).

Bioactive compounds in *Oplopanax horridus*...there are lots of goodies! Several compounds have been isolated from Devil’s club extracts using high performance liquid chromatography (HPLC) techniques, including triterpenoid saponins (which are related ginsenosides). Other bio-active compounds have been isolated from *Acanthopanax*.

Other compounds isolated from Devil’s club using HPLC fractioning (at UBC and elsewhere):

- Sesquiterpenes—Equinopanacene, Oplopanacene.
- Polyacetylenes—Falcarindiol, Oplopanone. Polyenes.

The hydrophobic fraction of *Oplopanax horridus* was demonstrated to have strong anticancer activity on diverse cancer cells through a bioassay-guided fractionation technique: ovarian, breast and colon cancer *in vitro* cell proliferation was inhibited.

**Devil’s Club Products**

Devil’s club can be found in various forms, such as dried bark, root powders, teas, tinctures, whole spectrum extracts, capsules, tablets, purified compounds.

**Markets and Sales of Devil’s Club**

In Asia, *Acanthopanax* is very popular. It is used widely throughout Asia as food and herbal supplement. There are four huge farms in Korea and many smaller operations. Hi-tech, large-scale processing and packaging facilities exist throughout the country. Korean Devil’s Club is the largest single herbal product produced in Korea. Yet Korea still imports 10 times as much as produced locally!

We are currently examining the markets and sales in the US/Canada for Devil’s Club products - primarily sold as tincture (1 oz or 8 oz bottles for $10 to $150).
BC Scene: Wild Stocks of Devil’s Club

What is the reality of harvesting BC’s wild stocks for commercialization? One should be mindful of First Nations traditional rights and intellectual property rights. There are also issues with over-harvesting from sensitive ecosystems. Forest cultivation systems may take a decade or more to establish in British Columbia. However, as in Korea, farming of Devil’s Club appears to be the solution.

Forest Farming – Agroforestry Systems for Devil’s Club

- Established in natural or created riparian zones
- Gravity-fed watering systems adjacent to existing patches to create Devil’s club microsites
- Existing patches are enhanced with a combination of layering and cuttings

Propagation Protocols for Devil’s Club:

Vegetative: http://www.nativeplantnetwork.org/Content/Articles/2-2NPJ106-108.pdf


Tissue Culture: may become available as an option in the future, and would create a standardized product with a guaranteed supply.

Acknowledgments

Funding for the British Columbia Agroforestry Industry Development Initiative (AIDI) has been provided by Agriculture and Agri-Food Canada through the Canadian Agricultural Adaptation Program (CAAP). In British Columbia, this program is delivered by the Investment Agriculture Foundation of BC.

The Province of British Columbia provides in-kind support to the AIDI. The AIDI is administered by the Federation of BC Woodlot Associations with the guidance of the Agroforestry Management Committee.

*Agriculture and Agri-Food Canada (AAFC) is committed to working with industry partners. Opinions expressed in this document are those of the authors and not necessarily those of AAFC.*
Alley Cropping of High Value Hardwoods and Forage

Lavona Liggins
Agriculture and Agri-Food Canada, Kamloops, BC
Lavona.Liggins@agr.gc.ca

Background

Alley cropping is an agroforestry system that can be broadly defined as the planting of single or multiple rows of trees and/or shrubs at intervals to create alleyways within which crops are cultivated. In these systems, both the crop and tree/shrub are harvested for economic return and a large variety of crop and woody species combinations are possible. Alley cropping is practiced in many parts of the world both temperate and tropical, and was used in the early days of the BC orchard industry as an establishment practice.

In addition to providing economic diversification, alley crop systems have the potential to alter micro-environments and therefore growing conditions. Alley crops have also been shown to enhance productivity and environmental goods and services such as: carbon sequestration potential, soil quality/function, bird and insect diversity, and water management and use.

Alley crop systems have high potential for broader application but microclimate and other system effects need to be quantified and system interactions need to be better understood. Such information will contribute to practical recommendations for interested producers.

Project Objectives and Site

The project goal was to establish a replicated, operational scale demonstration site of alley cropping which will allow for development and showcasing of beneficial management practices (BMPs) related not only to establishment of alley crop systems but also high efficiency irrigation and irrigation scheduling. Following site establishment, system efficiencies related to integrated production can hopefully be evaluated including: microclimate modification, production efficiency, beneficial organisms (soil and other), and decreased need for external inputs.

This project is taking place at Agriculture and Agri-Food Canada’s Grassland Applied Technology Center (GATC) in Kamloops, BC and is being carried out in by AAFC – Science and Technology Branch and the Sustainable Agriculture Management Branch of the BC Ministry of Agriculture. The GATC site is located at the foot of the grasslands near the Thompson River, is currently used for hay production under irrigation, has a variety of soil types and textures, and experiences high temperatures and drying winds during the growing season.

Planning Considerations for Development and Layout

Like any agroforestry undertaking, the planning stage for alley cropping is very important. Some of the issues that were considered before proceeding with this project included:

- What area and resources are available on the site?
- What is the existing production knowledge and infrastructure?
- What products are needed in the area (will a market be available)?
- What production benefits would be of use to the operation; how can they be achieved?
- Is an alley crop compatible with other on-site operations?
This initial assessment led to the choice of a hardwood/forage combination with a focus on harvesting hay and the trees themselves for wood use. Following this first stage of planning a second assessment was made to select specific crops and trees. Some of the factors considered include:

- Suitability to growing conditions
- Market value and opportunity
- Labour and equipment requirements
- Compatibility of the trees and crops; be aware of competition issues
- Time to maturity
- Availability of locally adapted stock
- Legal and/or plant health issues related to potential invasiveness of a species or disease transmission.

The final selection included timothy as the hay crop and three hardwoods: Red Oak, Chinese Chestnut, and Black Walnut. All of these products are expected to be highly marketable with a good return to offset higher management requirements. Availability of locally adapted stock was a key consideration as a number of other trees were considered but were either not available or could not be brought into the area.

In planning the layout of the site several factors needed to be considered including: size of equipment, irrigation infrastructure placement and capacity, target product (wood trees can be planted closer together than can nut trees), prevailing winds (tree rows to be at ninety degrees to wind), and shade impacts of the trees on the crop and one another. The layout for the project at GATC also had to allow for the experimental design to be replicated three times and to compare control areas (no trees), single row plantings and triple row plantings. Following removal of the previous alfalfa-grass stand and the installation of irrigation infrastructure in 2011, the timothy was seeded and the trees were planted during the 2012 growing season.

Management Considerations

During the establishment phase of this alley crop a number of management issues were encountered and in each case a balance between the needs of the two crop types (hay and trees) had to be considered. Examples of these issues include: vegetation management, water, nutrients, and damage risks.

In the case of vegetation management, it was important to limit both the competition between the crop and the young trees and between both crop/trees and weedy species. Hardwood seedlings were planted into areas protected by long-life preamble fabric mulch. In the planting year the timothy quickly overtook the trees in terms of height. A combination of mechanical and chemical control was used to prevent the grasses from shading out the trees. Chemical control in a combination system such as an alley crop can be more complicated than in a single crop system since trees are sensitive to broadleaf herbicides ordinarily used in a hay crop. A mixed approach was used including: shielding trees, limiting broadcast sprays, specialty low volume sprayers near trees, spot spraying, and accepting a level of weed presence in the field. Shielded or hooded sprayers may be considered in these settings.

In the case of water and nutrients the different requirements of the trees and crop should be evaluated not only in the amount and, in the case of nutrients, type but also the timing of application because growing season start and duration may differ. In order to best provide for water requirement this project opted for a separately controlled irrigation system for the trees.

Where possible, steps to minimize damage risk to both crop and trees should be taken. In the case of the GATC installation the presence of wild ungulates on the site was considered as well as the presence of assorted small
mammals which may cause bark damage. An ungulate fence was used to restrict access to both the timothy and trees and tree wraps and monitoring were used to limit small mammal damage to bark. Monitoring is a key step in reducing risk; in the case of this project, basic monitoring of the seedlings led to the detection of leaf cutter bee damage. This damage was limited in nature during 2012 but ongoing monitoring will be implemented.

Next Steps & Lessons Learned

This project is in the early stages and in the coming year the focus will be on moving from establishment to production. During the establishment phase a number of lessons have become apparent including:

- Invest time and effort in the planning stage
- Take an adaptive management approach; stay flexible
- Integrated systems require a higher level of management
- Expect some trial and error
- Alley cropping involves at least two crops; sometime management will require finding the point of balance between them.

References and Additional Information:

Agroforestry Industry Development Initiative – Tools & Resources: [http://www.woodlot.bc.ca/agroforestry/tools.htm](http://www.woodlot.bc.ca/agroforestry/tools.htm)