

## **Abbotsford Permaculture Scenario**

This production scenario, using the design principals of permaculture, has been created to provide a sense of required inputs and possible outputs for \_\_\_\_ Farm in Abbotsford, BC.

Based on the size, topography, and bio-region of the property, the permaculture scenario presented here involves a design that would allow for the cultivation and harvest of chestnuts, hazelnuts, pine nuts, nuts of the monkey puzzle tree, apples, and berries/currants with potential cell grazing of cattle pigs and poultry, and alley cropping. In a diverse permaculture scenario, there is also great potential for niche products and value-added products, such as mushrooms, flowers, herbs, salsas/pestos, jams/preserves, dried fruits, honey, etc.

### **An Introduction to Permaculture**

*“Permaculture is a philosophy of working with, rather than against nature; of protracted & thoughtful observation rather than protracted & thoughtless action; of looking at systems in all their functions rather than asking only one yield of them & of allowing systems to demonstrate their own evolutions.” -Bill Milison, co-creator of Permaculture Design*

A permaculture designers role is to observe the landscape including microclimates, local fauna and flora and consider how this could shape the design of agricultural project for optimal efficiency. Naturally, the bioregion of this property is predominantly a forest system dominated by conifers, with an understory of ferns, berries and in season, an abundance of edible fungi, thus something similar would be the most natural approach to agriculture in this region. It is possible to mimic this system with minor, but important, alterations that will maximize productivity. These include 1) maximizing the productive edge (e.g where a forest meets a grassland or a grassland meets a body of water), which allows for more diversity of species and overall productivity and 2) reducing the amount of canopy cover so that there is a greater opportunity for annual or full sun agriculture and pastures. In this design, I've included ways of making sure rainwater is absorbed, captured and stored in subsoils and ponds, so that it can be utilised in the ever more common drought periods. Rainwater harvesting is always wise, however especially so in this circumstance, with extra concerns about residential zonation and possibility of increasingly stringent water use rules.

The production of specific products laid out earlier in the report can be integrated into a permaculture system, and thus the estimated profits from above can be used to estimate what a permaculture system might be able to produce. As a permaculture designer I've created this design to increase overall productivity and resiliency while reducing inputs beyond the other scenarios that Ione addresses. I have proposed elements to the system that will add yields and take very little space away from the main crops in the first few years. It should be noted that any crops suited to the Abbotsford climate can be grown within the system I propose as 'alley crops' within the rows of 'agroforestry'.

### **Site Design**

When looking at an overall site design, the first elements considered here are water, access, and structures. Consider that with unlimited man hours you could grow vertical aquaponic gardens, with gourmet mushroom production with indoor fruiting chambers, school trips as extra financial yields, and so on. The potential yield is only limited by creativity.

**Water** – Generally speaking we want to soak, store and spread water on the property, from wet areas to dry areas. Ideally we store water high on a ridge for gravity feeding to the rest of the property, which is not as complicated as one might think, (see keyline design below). Water off

roads and roofs can also be caught spread and stored. Using a yeomans plough or a subsoil plough is another invaluable tool for keeping orchards, alley cropping sites and pastures green through summer with minimal, if any irrigation.

**Access** – Apart from a new road to be built to the house and barn, access is already established at north of property. It would be wise to consider how the water will run off the road so that it can be captured, spread and stored within the agricultural system.

**Structures-** A key design tool in permaculture is 'zonation' and relative location.

Given that the production farm is to be separate from the main home, a new 'Zone 1' (central hub of activity) must be established. This is place where the workers will frequent most often. It is a good idea to keep any high maintenance crops in the zone 1-2, such as annual produce, delicate flowers, animal pens and niche products (except for the semi wild mushrooms and flowers that will be seasonal extras within the tree/shrub systems, and or as understory in a forested area).

Other structures would be the roads (as discussed above), a fence around the perimeter of the property to keep out wildlife, as well as fencing for the animals around the barn. If you choose to keep poultry and livestock, which can be added to the system at anytime (highly recommended for ecosystem benefits and carbon sequestration/soil building) they would be 'mob stock' 'cell grazed' via affordable mobile electric fences to mimic natural herding tendencies in the wild, where herding ungulates are circled by predators on their continuous migration. (see mob stock grazing)

### **Specific Design Elements**

#### **Key-line Design**

It is recommended that key-line design be utilized on the property to increase rainfall absorption. Key-line utilizes swales, which are ditch and mound structures, sloping downhill at 1:400 ratio towards a pond. The rainfall will soak into the swales, making water available that would otherwise runoff, for trees and alleycrops. The exact size of swales and ponds would need to be calculated in relation to maximum rain events (failure to do so can cause flooding and loss of crops).



#### **Agroforestry on Swale Berms**

Trees will be planted single-file on swale berms (mounds) surrounded by edible shrubs or vines. Crops or grazing is possible in the 30 meter spaces in between swales. Productive trees, shrubs and vines suited to this bioregion which could be planted on the swales include chestnut, grapes, monkey puzzle, pine nuts, apples, hazelnuts, prunus (plums, cherries, apricots), and berries.

In the beginning years there wouldn't be a substantial yield from the fruit and nut bearing trees, but would instead come from the shrubs and alley-crops. For example, there could be the harvest of beneficial herbs and flowers planted beneath the Malnus (apple) which could be sold to herbalists and florists. Over time as the trees on the herbs reach maturity the size of the alleys would decrease, while the production of fruit nuts would increase and the berries would creep further out. Around this time you'd hope to also begin to see extra seasonal harvests of volunteer mushrooms.

The climax system is one with a relatively small space between the Trees/Shrubs best suited for perennial grasses on which to graze cows and pigs periodically. This climax system is extremely low maintenance, with only pre harvest prep (mowing) followed by harvest, and then the grazers come through. With a system like this, even with possible smaller yields from each tree/bush, with the extra yields coming from the other crops in the system such as hazelnuts, chestnuts, beef/milk or bacon, as well as the comparatively non existent maintenance, the overall yields are likely to be greater. This type of system thrives most on the 'STUN method' (shear, total, utter, neglect) , creating more time for employees to work on projects such as harvesting and processing niche products.

### **Alley Cropping (between swale berms)**

Whatever you decide to grow, the best product is sold, the rest goes to the animals as feed, nothing is wasted within a permaculture system.

I would suggest more perennial crops such as asparagus, lower maintenance, higher profit.

Perhaps sunflowers, for making local 'nut' butters. Increasing financial yield by processing on site, creating another niche product.

### **If grazing, Mob Grazing/Cell Grazing**

Animals complete a permaculture system, nothing converts grass to soil, meat and milk like cows, and nothing converts food scraps and bugs to eggs and white meat like chickens and nothing converts bad fruit and other wastes to bacon like pigs. Animals make up fundamental parts of an ecosystem, building soil fertility, sequestering carbon and provide yields.

There are optimal and suboptimal ways of utilising them in a system.

Mob-grazing mimics wild herds which naturally would mob for protection from predators and be on a constant migration (in this case rotation), this helps to regenerate soil and the pasture for continual renewal so that the pastures never get exhausted and in fact soil increases in productivity. Combined with subsoil ploughing just off contour it's possible (in exception circumstances) to build as much as 18" of topsoil in 2-3 seasons.

### **Mushrooms**

The volunteer mushrooms are notoriously difficult to predict, but you can be sure to get substantial yields of an abundance of different types of mushrooms such as shiitakes and oysters throughout the year. Shiitakes can be grown on logs beneath a canopy forest. With an efficiently designed farm a couple of farm workers would have surplus time to manage a substantial mushroom operation. The costs would likely be only the cost of spawn, pasteurization of substrate and some irrigation over summer for optimal yields.

Spawn price in Vancouver for Oyster or Shiitake is \$35 for enough to inoculate 20 logs, and produce around 10Lbs. of mushrooms which would retail about \$16 per Lbs. I'm uncertain of how much forested land still exists on the property suitable for the understory mushroom production, yet

I'd feel confident there would be enough space to gain a substantial income stream from this project alone.

Indoor fruiting chambers yield greater quantities, year round and are great ways of recycling other waste products, but these include a greater initial investment and higher maintenance/ labour hours.



### **Other Niche Products/Income Sources**

#### **Food Products**

On site, or local processing and branding is a way to double the value of imperfect produce, for example:

Basil pine nuts and cheese into pesto

Tomatoes, onions, apple cider vinegar, peppers into hot sauce

Apples into cidre (hard or soft)

Apple into apple cidre vinegar

Tomatoes into sun-dried Tomatoes

Mushrooms into dried mushrooms

Herbs into tea

Sunflower Nut Butter

#### **Tree Nursery**

Once the trees begin to yield local farmers, homesteaders and farmsteaders will want to mimic, a tree nursery could be a valuable investment of time and resources.

#### **Loaning Tools**

Renting your subsoiler (if you choose to purchase one) to other local farms, or people with acreage wishing to practise water harvesting practices can be an extra income source.

#### **Produce for Herbalists**

Flowers

Herbs

Roots

#### **Relative location of Elements**

Permaculture design considers relative location of elements to one and other for optimal efficiency which reduces labour inputs, allowing for either less financial input, or more time to get creative,

designing for further yields. An example of relative location is placing high maintenance grow-beds & niche products, greenhouse, and animals that need feeding, clustered close to staff parking, eating etc, with lower maintenance savannah cell grazing or 'main cropping' further out. With well thought design all farm chores can be completed within a short period each morning, saving weeks of time each year.

A mandala garden between the barn/office and the greenhouse with pathways out towards livestock and poultry pens (to feed any non marketable vegetation to) would be a good use of relative location.

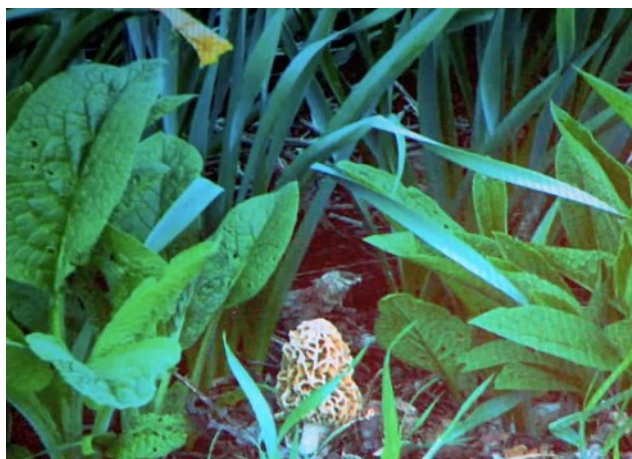


### **Examples of Permaculture and “Making the problem the solution”**

Apples generally don't like to have grass growing around their base, which usually creates work either in the form of mowing, or using chemicals, however, its possible to plant beneficial crops with marketable yields to outcompete this grass. By planting daffodils which flowers 3 weeks before the apples, they attract the pollinators early while providing a yield for sale to florists (also great whether you intend to have honey bees, and or support local pollinators). A bee has a life cycle of approximately 3 weeks, right on time for the next generation to follow pheromones towards pollinating the apple trees. By also planting comfrey, which happen to be one of the top habitats for over-wintering of beneficial insects, and act as dynamic accumulators of nutrients, comfrey can also be sold to herbalists as 2<sup>nd</sup> niche product. 3<sup>Rd</sup> niche product can be iris root, also used to outcompete grass under apples, and can be sold sold to herbalists and grown in the same 'guild' under the apple tree.

Another common challenge of apple trees is a fungi called apple scab. This can be reduced simply by allowing grazers to eat last years fallen leaves as well as the lower branches, meaning the spores cant reach the height of the lowest branches when a raindrop falls on them.

Non organic orchards use insecticides to control pest insects, however, by having ponds to store water, you also will have amphibian habitat that prey on insects, as well as the hazelnut bushes which make perfect habitat for insect eating birds. By not using fungicides it's also then common to establish mushroom patches right on the swale berms beneath the trees - niche product no. 4, by thoughtful observation as appose to thoughtless action.





### **Other benefits of such systems**

Not only does this kind of system produce food security for potentially 1000's of years, regenerate the soil, and sequester carbon, be more resilient to drought, floods or disease, provide habitat for wildlife, but the food will contain higher nutrient density. The drawback of course is the slight increase in financial input in the short term, in the form of earthworks, purchasing trees that won't bare substantial yields for some years and extra training/education of staff.

### **Financial Returns**

Estimating the financial return on a mixed-crop system such as this permaculture scenario is nearly impossible given the lack of government-provided figures to base calculations upon. Given the wide diversity of yields, fluctuating market price of products, and the seasonal variation in choices for crops, and value added/niche products, this section of the report does not include its own financial estimations. The yield is only limited by creativity (and appropriate management and marketing). By having increased water absorption, partial shade, wind protection, and habitat for beneficial insects and birds, it is inevitable to see increased yields in annual and perennial crops and animal products. The ponds, trees and key-line design also add resale value to the property almost immediately.

### **Start up**

There would be an increased start up for this system, although minimal in comparison to the money saved in the long run by decreased labour hours from efficient design and continuous growing yields and increasing soil fertility. Without another site visit with a transit level It's impossible to make assumptions as to exactly how many swales and berms would fit in, how much of the property would be ideally be left forested with potential understory of mushroom production.

### **Extra start up costs would be:**

Subsoiler \$500-3000

Electric fencing for cell grazing \$500-1000

Initial Earthworks (estimated 16 hours with excavator) \$1500-2000

2 full time staff would get the most out a property like this.

Staff/Management education budget \$5,000

Trees and shrubs (if not starting from seed, cuttings or grafts)\*

### **Estimated number of plants and or swale berm/keyline system.**

**24 Chestnut**

**24 Pine nut**

**24 Monkey Puzzle**

**96 Hazelnut Bushes**

**48 Apple trees**

**24 Pears,**

**12 Plums**

**12 Cherries**

**12 Apricots**

**12 Pomegranates (experimental)**

**12 Kiwi (experimental)**

**96 Goji Berries (experimental)**

**48 Black currants**

**24 Thornless Blackberries**

**96 Raspberries.**

\*To get a realistic and current pricing of these plants would take a decision on whether to start from seed, cuttings, grafts and then age of trees etc. Either way this would take local surveying, meeting with other nearby farmers and nurseries as well as further research beyond the scope of this report.

### **Summary** –

The yield from a permaculture system is impossible to predict, perhaps this is why system's are incredibly rare to find. Only through private ownership, and a dedication to research into more resilient and regenerative forms of providing food for communities do options like these become a reality. For those that dare to take the commitment, I believe there is a bounty to be had, and yields that far outstretch those that can be measured in dollars.

On a pure rational and profit basis, these systems do produce high outputs each year with minimal inputs. These types of products with appropriate marketing can rightly be sold at a premium. These are the farms of the future, and people want to support them and benefit from the nutrient rich quality produce.

I would definitely advise setting up a relationship with local markets and restaurants; an 8 acre farm with such diverse yields will be appreciated locally and regionally, but may not fit the needs of standard commercial supermarkets that want boxes and boxes of one product throughout the year. The food that comes from these systems will be richer in flavour and nutrients due to the diverse soil life and mixed diet of animals raised, and praised by those with the opportunity to enjoy it.

This is permaculture, 'actionism' towards a regenerative future for agriculture and human settlements, **“a philosophy of working with, rather than against nature”** **Permaculture - A Designers Manual - Bill Mollison**

## Glossary

**Agroforestry** - **Agroforestry** or agro-sylviculture is a land use management system in which trees or shrubs are grown around or among crops or pastureland. It combines agricultural and forestry technologies to create more diverse, productive, profitable, healthy, and sustainable land-use systems.n- Wikipedia

**Mob Stock Grazing** - In agriculture, **Managed intensive rotational grazing (MIRG)**, also known as cell grazing, mob grazing and holistic managed planned grazing, describes a variety of closely related systems of forage use in which ruminant and non-ruminant herds and/or flocks are regularly and systematically moved to fresh rested areas with the intent to maximize the quality and quantity of forage growth.

One primary goal of MIRG is to have a vegetative cover over all grazed areas at all times, and to prevent the complete removal of all vegetation from the grazed areas ("bare dirt") - Wikipedia

**Alley Cropping**- a method of planting in which rows of trees are interspersed with rows of crops, improving the soil and providing nutrients, particularly nitrogen, to the crops.

**Further reading on Permaculture** – Gaia's Garden, Mark Shepards' 'Restoration Agriculture, Permaculture – A Designers Manual.