

Balancing Conservation With Utilization: Restoring Populations of Commercially Valuable Medicinal Herbs in Forests and Agroforests.¹

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ABSTRACT: This paper discusses the medicinal herb industry in relation to conservation of medicinal plants, including an overview of sustainable wildcrafting and sustainable forest agriculture. Goldenseal (*Hydrastis canadensis*) and Black Cohosh (*Cimicifuga racemosa*) are given as examples of wild herbs of economic importance which may be readily cultivated. Includes guidelines and techniques for forest farming of hardwood forest dependent species.

Introduction

Old Louie leaned on the fence, bending down the top wire, a wire already seriously stretched by the daily escape of our buck goat, who nobody except myself was willing to tackle and bring back to pasture. Not that the rest of my family was afraid of the goat, but simply that he stank with an eye-smarting fragrance that only a doe goat in heat could admire, and only a staunch believer in social life after garlic could possibly withstand for long. But Louie paid no attention to the vestigial aroma of goat-grease that exuded from the fence and (probably) from my soiled blue-jeans. His good eye followed me from under the sun-scorched brow, in turns pleading and plotting, because there was something he wanted, and he was ready to use any persuasion available to get it (and given the daily marauding of my goats into his pasture, he figured he just might have some bargaining power). You see, there were Chittum (otherwise known as Cascara sagrada or *Rhamnus purshiana*) trees on my land, trees which yield a bark much in demand by pharmaceutical companies for the manufacture of a cathartic extract. It makes you go. In fact, the going joke among west coast woods people, a joke which has been funny for several centuries, is to off-handedly mis-pronounce Chittum as "Shit 'em." But I digress. The reason Louie wanted permission to cut the bark off my trees, was because all the trees on his side of the fence were already denuded of bark, from root to tip. I could see several white skeletons from my vantage point, and I was darned if the trees on my land would be similarly fated. So Louie went home disgruntled that evening, leaving me to reflect on how to keep a goat in, and when I grew tired of that, to continue to muse about conservation, and how to harvest without taking the life of the tree (or

plant). I was somewhere in the middle of a long learning. The answer for Chittum is, that if you cut the tree off with a tall stump, it will coppice (ie. resprout from the stump), producing multiple trunks which bear useable bark again in a couple of years. Louie didn't know this, because he simply stripped the trees standing, and they died.

I have made it my life work to learn the reproductive habits of many medicinal plants of prairie, forest, mountain and swamp. Knowing how a plant reproduces is the first step to encouraging its growth in wild settings or in domestic culture. Every farm-grown medicinal plant has the potential of saving the life of a plant of the same species growing somewhere in the wild. Because every ecology is defined in large by the plants that grow there (trees make the forest, and grasses make the prairie), the conservation of wild plants equates to the preservation of our wild places, a diminishing resource.

Among the major herb buyers, consisting of domestic and foreign herbal industry, the conversion from utilization of dwindling wild-harvested herbs to cultivated is driven mainly by economic factors. If the wild crop becomes too rare and therefore unavailable or too expensive to buy, companies will seek to convert to a cultivated source. Because open-market farm production of a number of significant herbs currently lags behind demand, companies are turning to growing their own medicinal plantations, or contracting directly with farmers to grow crops for their products, to assure supply. Assisting this trend is a groundswell of consumer demand for sustainable cultivated medicinal plants. But let us first examine the age-old occupation of wildcrafting (harvesting wild plants), in the light of our more

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recent concerns which involve sustainability of wild medicinal plant populations.

What is Sustainable Wildcrafting?

The short answer is, that in *sustainable* wildcrafting, every act of taking is coordinated with an act of planting. But even the most conscientious wildcrafting may impact plant populations, given that human support of the natural process of regeneration is not always successful, and also taking into account the *age* of the plants involved. This lesson is nowhere more apparent than in the case of largescale silviculture in the Pacific Northwest, where re-forestation is used as a justification for cutting of old-growth forests. There is a lot of difference between a "plug-one doug fir seedling" and a mature tree. In the same way, there is a lot of difference between digging a thirty year old Ginseng and pushing a ripe Ginseng seed (or twelve of them, for that matter) into the ground.

We must encourage utilization of renewable portions of the plant. Digging roots generally kills the plant, but aerial portions of many plants contain the same active constituents as the roots. Of course, when delving into the possible substitution of a less used plant part for the traditional preparation, one must remain alert for any potential side-effects, toxicities or differences in potency which may bear on the advisability or pragmatics of utilizing a previously un-tested plant part. This is a wide-open field for applied scientific investigation into the active constituents of plants. An example of this kind of applied science is Herb Pharm's (unpublished) chromatographic comparison of Goldenseal root and rhizome to Goldenseal leaf and stem. This study demonstrated that the two main alkaloids (berberine and hydrastine) are present in significant proportion in the sustainable harvested leaf and stem as well as the root and rhizome.³ If we can make medicine from the renewably harvested portions of the plant, our impact on wild plant populations will be minimized.

³ Personal communication with Ambrose Amarquaye, PhD, of the Herb Pharm analytical laboratory. Organically grown Goldenseal (*Hydrastis canadensis*) leaf and stem samples obtained from Horizon Herbs in Oregon showed a concentration of 2.1% berberine and 1.7% hydrastine (W/W). Samples of organically grown Goldenseal (*H. canadensis*) leaf and stem from Kentucky contained 1.2% berberine and .7% hydrastine (W/W). According to "Plant Drug Analysis, Vol II," by Wagner and Bladt, the normal range for berberine in *H. canadensis* rhizome is 2% to 4.5%, and the normal range for hydrastine is 3.2-4% (W/W). 4.5%, and the normal range for hydrastine is 3.2-4% (W/W).

Traditionally, most herbal medicines are made from dried herbs. Dehydration is an effective method of preservation, decreases transport costs, and often concentrates the relative weight of active constituents. In a few cases, the main active constituents or marker compounds are not even present in the fresh herb, but are formed as an artefact of the drying process. However, the potential for using fresh (undried) plant material bears consideration, since the process of dehydration does not always concentrate the weight of active constituents in relation to the total weight. In some cases, the process of dehydration actually diminishes relative constituent levels, either through volatilization, chemical degradation or chemical transformation of the active constituents. To further complicate this issue, the breakdown products of original compounds may also demonstrate medicinal activity. Further study into the possible use of fresh plant material instead of dry will allow manufacturers to choose the method which gives the greatest yield of desirable constituents from each precious plant.

Seasonality of harvest bears strongly on the impact of harvest. In the case of Ginseng and Goldenseal, we have seen that harvest prior to the setting of seed is damaging to plant populations because the plant has no "final chance" to reproduce itself through seed. Early harvest equates to bad herbalism, also, as a root is at its healthiest, heaviest and presumably highest potency in the late summer and fall, after recovery from dormancy and after accomplishing a new growth cycle. The common practice among states is to limit wild Ginseng harvest to a fall season. The main buyers of wild american Goldenseal have made a similar, unofficial agreement to buy Goldenseal in the fall, thereby discouraging wildcrafters from digging plants prior to maturation and dissemination of seed.

The bottom line is, has the act of wildcrafting, on a season-to season basis, reduced, maintained, or increased the mean age and population of desired plants? If economically significant species are maintained or increased, either through successful replanting or removal of competitive weed species, then the wildcrafting may be termed sustainable. Of course, this presupposes that wild places are being treated like wild gardens, which is rare, and that other wildcrafters are not impacting the same area, which is rarer still.

Forest Farming

Plant ecologists argue the advisability of planting wild herbs back into the woods. It is difficult for humans to re-establish, in a few seasons, a balance broken by years of thoughtless resource utilization. And, it is sometimes difficult to know which herbs belong where, or to obtain the appropriate strain which is adapted to a specific wild ecology. But when a forest is left alone, the earth will tend to heal itself in time, and barring distinction of species, diverse native plants which are best adapted will eventually re-establish into their appropriate niches. Because the forest is a whole system, dependent on the interaction of trees, insects, animals and non-woody plants, the practice of harvesting the wild plants as an alternative to cutting the trees is of short-lived viability. Better to set aside areas of forest which can be farmed intensively for production of desirable forest-dependent species. This ultimately improves the health of the forest, allows efficient production of large quantities of useable plant material, and diminishes traffic in wild areas.

Generally speaking, forested areas destined to provide cover for production of medicinal plants are climax hardwood forests. To start, underbrush and weedy species are removed and piled. The ground is then worked up into beds, thereby defining production areas and access corridors. Tree roots which get in the way in the beds may have to be chopped out. Ground preparation may be done by hand, by rototiller or by tractor. As far as tractor implements go, a spader works better than a tractor rototiller or a plow, being better suited to moist conditions, less disruptive to soil strata, and less apt to be damaged by roots and rocks. In ideal situations, no-till agriculture is possible. Weedy species are hand-pulled, and the desired crop is planted in without disturbing the natural soil structure, where rotting leaves disseminate nutrients down to the roots of the plants.

Maintaining soil fertility in agroforests is easier than maintaining the fertility of open fields. Practices which encourage healthy growth of the trees, such as thinning, trimming dead wood, removal of underbrush and irrigation during dry spells also serve to improve the health of the soil, which is further enhanced by leaf-fall. The herbal crop benefits. Mineral-rich soils (typical west of the Rockies) may be assisted by application of composts, while humus-rich soils (typical of the

eastern hardwood forest biome) may be assisted by application of rock powders, such as limestone and rock phosphate. Compost may be added at any time during the growth cycle, but a note of caution is advised as composting can increase the danger of fungal diseases, which occasionally pose a challenge to forest farmers. Rock powders should be applied during bed preparation or during dormancy.

Goldenseal (*Hydrastis canadensis*)

Goldenseal is following in the footsteps of American Ginseng (*Panax quinquefolius*) in terms of plant demographics (reduced wild populations), governmental status (both now regulated in appendix II of the Convention for International Trade in Endangered Species of Wild Fauna and Flora (CITES)), and by way of rising popularity and escalating price. However, Ginseng is widely cultivated, while Goldenseal cultivation is poorly understood and lags far behind demand. Cultivation of Goldenseal is unquestionably the most significant current herbal agricultural opportunity, but is a path fraught with challenges. United Plant Savers (UpS) is sponsoring on-going experimentation designed to determine sustainable wild-harvesting techniques and also to define preferred cultivation scenarios. Experimentation is taking place at the UpS Botanical Sanctuary in Rutland, Ohio. Results will be reported on an on-going basis in "United Plant Savers Newsletter."

As with cultivation of any forest-dependent species, successful cultivation of Goldenseal requires exact conditions of shade, soil and season. Choosing a site within the hardwood forest and within the original distribution range of the plant is more likely to prove successful than attempts to field cultivate the plant under shadecloth or lath, or grow it in woods outside its native range. The further one gets from native ecology, the more problems occur, and the more time, money and energy goes into adapting the environment to the plant. Ideally, one grows the plant where the right conditions already exist.

Monocropping in the forest may cause problems such as runaway disease and insect infestation. *Alternaria* fungus and Goldenseal mites are cases in point. Creating a diverse cropping system, where beds of the main crop are interspersed with plantings of their natural companions, helps the plants sequester soil bacteria and fungi which assist in nutrient assimilation and protect the plant from insects, parasites and disease organisms. Good

candidates for intercropping with Goldenseal are Jewel Weed (*Impatiens* spp.), Bloodroot (*Sanguinaria canadensis*), Black Cohosh (*Cimicifuga racemosa*) and Wild Yam (*Dioscorea villosa*). The woody species Spicebush (*Lindera benzoin*) and Paw Paw (*Asimina triloba*) may prove useful in further shading the understory. Just as healthy natural ecologies are characterized by the diversity of their plant life, a diversity of plantings in the agroforest contributes to the rapid growth and disease resistance of crop plants.

Cultivation of Goldenseal from seed is very promising. The seed must be washed from the ripe fruits and refrigerated (40 degrees F) in damp sand or peat until planting. The seed is fall-sown into nursery beds or production rows, in prepared beds under the shade of hardwoods. High germination rates may be expected the following spring. Plants started from seed are less likely to experience transplant shock or disease than plants grown from root cuttings.

To propagate by root cutting, each mature rhizome is divided into three or more cuttings, which are planted at twelve-inch centers in the fall or very early spring. The first year of growth from cuttings is usually a bit weak, typified by attrition of the rhizome, early dormancy and potential for fungal infection. This may be avoided, in part, by planting root cuttings in the fall, not the spring. Further protection from fungal disease is afforded by planting at wider spacing, thereby improving air circulation around the plants.

The lateral rootlets bear reproductive nodules, which serve to spread the plant in nature. Masses of free rootlets found in Goldenseal shipments may be planted in flats, or the nodule-bearing rootlets may be removed from rhizome cuttings and planted separately in flats. These produce hardy plants which may be transplanted out after a year of containerized growth.

Black Cohosh (*Cimicifuga racemosa*)

Black Cohosh root is experiencing a current resurgence of popularity, due to its application in treating pre-menstrual syndrome, menopause, estrogen deficiency, dull pain and some kinds of depression. The widely distributed native populations of this herb have been recently challenged by wholesale harvest amounting to

hundreds of thousands of plants⁴. Unlike Goldenseal, which is sold mostly to domestic markets, much of the Black Cohosh harvested in America is used by foreign phytopharmaceutical companies. A CITES listing for Black Cohosh would definitely reduce the harvest of wild plants, more so than in the case of Goldenseal, which is consumed, for the large part, within the United States.

Harvest of Black Cohosh may be made more sustainable by this technique: The plant is located in the fall by identifying the remaining blackened, characteristically pronged stem. The rhizome is uncovered, and the harvester breaks off the older portion (the "back" of the rhizome, without bud) for use, leaving the remainder of the rhizome in place, with nascent bud poised to continue the next year's growth. The plant is then covered up with soil, followed by leaf mulch. This aerates the plant, and may actually stimulate growth the following year. Cultivation by dividing the rhizome may result in high mortality rates. The division containing the nascent bud is good reproductive material. Older, woody portions of the rhizome, when planted, tend to rot instead of producing new growth.

Cultivation by seed is difficult, as the seed has short viability and stratification is required. The best approach is to use newly harvested seed, plant immediately in a moist, warm medium (70 degrees F) and keep this way for three months, then overwinter (40 degrees F or less), followed by germination in the spring. Seedlings may be transplanted out after a year of containerized growth, or may be maintained in woodland nursery beds for a year, then transplanted.

Black Cohosh likes good soil, and health of the crop as well as harvest weight may be increased by growing in a deep, loamy soil, and by the addition of composted hardwood leaves and/or composted manure. Irrigation during dry spells in the summer will prohibit early dormancy, thereby increasing yields. The plant tolerates much more sun than Goldenseal, and open field production with little or no shade is possible, but only when using very vigorous transplants.

Conclusion

⁴ Personal communication in spring of 1998 with one mid-scale broker indicated a purchasing volume of 10,000 dry pounds per week, which equates to 140,000 plants at the average of 14 entire roots per dry pound.

How much do we value wild ecologies? This is the practicality of medicinal plant utilization: Plants will

be taken from the wild until such time as they can be grown conveniently enough, and inexpensively enough, to supplant wild harvested material with cultivated crops. May this be a function not only of economics, where we grow a plant because it is now so scarce that the price is high enough to justify the effort, but also a labor of conservation, supported by industry, where the plants are grown because we care about the wilds, and because we are wise enough to garden and farm in a way that improves the earth in the same way that the trees improve the soil of the forest.

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