

Plants, Health, and Spirituality

Honors Course Geo 3930

Fall 2005

Lecture Notes
Part 2

Medicinal Plants

Globally, sales of herbal medicines are growing by about 10% annually. This is putting tremendous pressure on wild sources of traditional medicines, but is also providing a further stimulus to domestication of some of them. Both wild and cultivated plants are involved in local and international trade in medicinal plant products.

About 80% of the developing world's population depends on medicinal plants for its primary health care. In China, for example, plant-based medicine is the backbone of the health care system for about 1 billion people.

In India, traditional, plant-based medicinal traditions are sanctioned by the government and include the Ayurvedic system.

Traditional healers from developing countries are starting to set up practices in some urban areas in North America and Europe. And expensive tours are now advertised to visit healers in some tropical countries.

Homeopathic medicine is gradually becoming more “mainstream” in Europe and North America. In Germany, herbal medicines are a \$1.7 billion annual business. In the U.S., consumers purchase \$4 billion worth of herbal medicines every year (*The Economist*, 28 August 1999, p. 24; *The Wall Street Journal*, 29 August 2003, p. D1). Naturopathic doctors in the U.S. are now permitted to write prescriptions, perform minor surgeries, and are covered by insurance plans in some states, such as Connecticut and Washington. While the number of trained naturopaths practicing in the U.S. is small, about 4,000 in 2002, the number has doubled over the preceding 5 years (*WSJ*, 22 August 2002, p. D1). Medical schools and training hospitals in the U.S. are starting to offer more courses and practices in

“alternative” medicine, now more commonly referred to as complementary medicine (CAM), such as the Memorial Sloan-Kettering Cancer Center in New York and the Beth Israel Deaconess Medical Center in Boston.

Over-harvesting of medicinal plants in the wild

Packaged herbal medicines and plants sold in street markets come from both wild and domesticated plants. For wild plants, the growing demand for herbal medicines has jeopardized many wild populations. Echinacea is a case in point. This flower is native to central and eastern U.S., and three species in the genus *Echinacea* have medicinal value, but only one is domesticated. The wild species are thus under considerable pressure and the state government of Montana passed emergency legislation in 1999 that prohibits the taking of wild medicinal plant from state lands “in order to protect and preserve the natural system integrity” (*Diversity* vol. 15, no. 3, pp. 17-19). Other states that regulate or prohibit the gathering of wild medicinal plants include North Dakota and Missouri.

Another example of over harvesting: *Prunus africana*

This relative of the plum, native to highland Africa, could disappear within a decade or so because people are stripping off its bark for sale in Europe as a treatment for prostate problems. In 1999, sales of the bark in Europe amount to \$220 million, prompting farmers to remove 3,500 tons of the bark that year. Work is underway to domesticate the tree for medicinal purposes (*Economist*, 15 April 2000, p. 88).

To relieve pressure on wild populations, two courses of action are necessary:

1. Domesticate the plant so demand is met from farms.
2. Protect wild populations even if the plant is domesticated because the wild genepools usually possess potentially useful traits and because they are part of “non-tamed” ecosystems.

Questions about the efficacy of some herbal medicines:

According to *The Wall Street Journal* (29 August 2002, p. D3), some research has recently questioned the alleged value of certain herbal remedies including:

Plant	Used for	Issue
St John’s Wort	Depression	One or more scientific studies have not confirmed its usefulness
Ginkgo	Boosting memory	One or more scientific studies have not confirmed its usefulness
Echinacea	Treating colds	One or more scientific studies have not

		confirmed its usefulness
Ephedra	Weight loss	Dangerous side effects possible, especially heart attacks and strokes
Kava	Stress relief	Dangerous side effects possible, especially harm to the liver

The Relevance of Biodiversity to Medicine

One quarter of today's prescription drugs have plant compounds, but they are based on just 95 species. We have hardly begun to tap the great chemical wealth of the plant world.

The forests of Amazonia, for example, are veritable living laboratories of complex chemicals, but only a tiny fraction of the wild plants have been screened for use in modern medicine. For Brazil as a whole, one of the most biologically rich nations on earth, only 1.4% of the flora has been prospected for useful chemical properties.

Amazonia has about 85,000 plant species.

From northwestern Amazonia, aboriginal populations use 2,000 species in cures, to induce trances, and to poison fish and game.

From the mid-1970s to mid-1980s, 278 new alkaloids alone were discovered in Amazonian plants: 78 plants are involved in the preparation of arrow poisons, 42 species are used as piscicides.

Some recent discoveries of Amazonian plants of proven pharmaceutical value:

- Lapachol obtained from the bark of *Tabebuia* (Bignoniaceae), patented as an anticancer agent by Pfizer. Several species of *Tabebuia* called pau d'arco or ipê in the Brazilian Amazon, are important timber trees.
- Pilocarpine from *Pilocarpus jaborandi* (Rutaceae), used to treat glaucoma and incorporated in some anti-dandruff shampoos. Jaborandi is a small tree of the understory forest in eastern Amazonia. The trees are cut down to obtain the leaves, and many have thus been destroyed.

The Relevance of Indigenous Knowledge to Medicine

Not all plants of pharmaceutical value are used for medicinal or supernatural purposes in the Amazon.

Curare, for example, is a muscle relaxant used to tip blowgun darts in tropical South America.

Curare is obtained from a gigantic vine (*Chondrodendron tomentosum*) and has been employed for decades in hospital performing surgery on skeletal muscles and as a relaxant for treating myasthenia (abnormal muscle fatigue) and certain neuropsychiatric conditions.

Curare is prepared from 75 plant species in many genera and families. Practically every tribe and every medicine man has his own curare formula. Some curares are prepared from a single plant species, whereas others are prepared from several plants.

Curare compounds include bis-benzylisoquinoline, bis-strychnine, and ditrimethylammonium-5-a-pregnane.

A vine, *Derris urucu*, called timbó in Brazil, is used by indigenous groups as a piscicide; it contains a rotenoid, now in demand as an environmentally-benign insecticide.

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Shamans are “gatekeepers” of ethnobotanical knowledge concerning a wide range of plants of potential pharmaceutical value.

Modern-day healers are also highly knowledgeable about the purported therapeutic value of a wide range of wild plants and animals.

Traditional healers have discovered many useful medicinal plants including:

- *Cephaelis ipecacuanha* (Rubiaceae) which contains emetine, used as an emetic and as an expectorant. Mothers of infants in the U.S. generally keep a bottle of ipecac on hand in case their child has swallowed a poison.
- *Chenopodium ambrosioides* (Chenopodiaceae) with ascaridole, a vermifuge.

Issue of intellectual property rights of indigenous and other rural people regarding medicinal and other plant knowledge is still being worked out on a case-by-case basis.

At present few satisfactory arrangements for compensation are in place.

Current model is to provide a royalty on sales of a pharmaceutical product to an indigenous group.

But what about other non-Indian rural people?

Attaching monetary value to biodiversity can be a double-edge sword:

On the one hand, biodiversity that is valued is likely to be saved.

But if adequate compensation mechanisms are not in place, then individuals and communities may prevent any bioprospecting or removal of material for testing.

Overselling of Ethnobotany: The Case of Shaman Pharmaceuticals

Shaman Pharmaceuticals was founded in 1989 by Lisa Conte in San Carlos, California and declared bankruptcy in 1998. The main cause: after almost a decade in existence, it still did not have a product to market.

The startup company was unable to overcome two major obstacles:

1. It is very time consuming and costly to bring a drug to market. A new must receive approval from government authorities before it can be prescribed. The numerous tests are costly, and it may take tens of millions of dollars to test a drug for adverse reactions and to prove its efficacy.
2. The cost of mass screening of plants for pharmaceutically useful compounds has plunged with advances in laboratory techniques. Major pharmaceutical companies are thus increasingly resorting to such techniques rather than the time consuming process of canvassing traditional healers.

Before folding, Shaman Pharmaceuticals sent scientists into rainforests, primarily Latin America, to interview traditional healers.

By using this ethnobotanical technique, Shaman Pharmaceuticals argued that it would avoid the high cost of massive, random screening (but when the company started it did not foresee the rapid changes in lab screening techniques).

By 1993, Shaman Pharmaceuticals had 2 drugs in clinical trials:

- A weed which contains an extract, SP-303, that shows promise for treating RSV, a deadly virus disease that attacks children.
- A related compound is being tested for treating herpes.

Shaman pharmaceuticals raised \$41 million in an initial public offering in January 1993 but was unable to raise sufficient capital to keep the trials going.

Shaman Pharmaceuticals folded into Shaman Botanicals and is now focusing research on products for the health food/cosmetic industry which are less regulated and therefore cheaper to bring products to market. However, the potential for profits is also much smaller than with prescription drugs.

Healers and Hedonistic Drugs

Healers have identified a wide range of plants with pharmaceutically beneficial affects as well as mood altering properties, some of which are now cultivated on a

large scale to supply legal and illegal markets. Examples include: tobacco, chili peppers, coca and ayahuasca.

Many of these plants and their products have been uprooted from their cultural contexts and transformed into mood altering, recreational drugs. In indigenous societies powerful mood altering and hallucinogenic plants were used for spiritual purposes rather than for “fun”. In other words, they were used to communicate with the spirit world to help sick people get better or to negotiate with supernatural entities that look after game and fish. In their traditional setting, hallucinogenic plants are generally used exclusively by healers and for the most part are not taken by youngsters or women. The only exception to this is ayahuasca and perhaps peyote in which women (but not teenagers) may participate.

It seems that just about every culture has located plants in their environment that alter moods. In indigenous cultures in Latin America, such plants can be broadly divided into two categories: those used to make alcohol and those with hallucinogenic properties.

To “party” indigenous peoples in Latin America make alcohol by fermenting maize (*chicha*) or manioc. Maize beer is made and consumed mostly in highland areas, especially the Andes. Manioc beer is prepared by women chewing cooked tubers of manioc and spitting the masticate into clay pots. Enzymes in saliva help ferment the manioc. Alcohol from maize or manioc is consumed liberally during certain festivities, but alcoholism is not a public health issue in traditional societies. Only when indigenous societies have contact with the outside world and have access to sugarcane alcohol (*aguardiente* in Spanish, and *cachaça* in Brazil), does alcoholism become an issue. In urban areas in developing countries and in industrial nations, youth often combine the consumption of alcohol with hallucinogenic drugs, an often dangerous practice not seen in traditional cultures.

The War on Drugs: Time for a Re-Assessment

Responsible voices with respect to the war on drugs are beginning to make some headway now that doubts are increasingly raised that we are winning the war on drugs in industrial countries. One way to gauge the success or failure of a campaign to combat drug use is to monitor the street price for drugs. If prices are falling, it usually signals that the supply is plentiful. The other explanation for falling prices would be that consumption has declined leading to an oversupply. One of the main targets in the war on drugs is cocaine. The price per gram for pure cocaine (in constant 1996 dollars) has fallen from \$400 in 1982 to \$135 in 1996.

Emphasis in the future is likely to be more on education and treatment programs (the demand side) rather than on trying to eradicate coca fields or go after groups and individuals involved in trafficking the substance (supply side).

One of the best defenses against abuse of mood altering drugs is to understand their origins, how they are used in traditional settings, and what happens to one's body if they are used in ways never intended. Some argue that various non-invasive techniques can be taught for people to achieve altered states-of-consciousness, such as meditation and fasting, as practiced in some religions (see *The Natural Mind* by Andrew Weil).

Consider the following facts:

- In 2000, the U.S. federal government spent \$18.5 billion on drug control (mostly for fighting drug dealers and growers). States contributed another \$22 billion, for a U.S. total of about \$40 billion. That is double the entire budget for the Department of Justice (*The Economist*, 2 September 2000, p. 26).
- Of the 2 million people imprisoned in the U.S., roughly two-thirds are in jail because of drug transgressions (Warf, Barney, 2004. *Troubled leviathan: the contemporary U.S. versus Brian Berry's U.S. Professional Geographer* 56(1): 85-90). Furthermore, African Americans are imprisoned on drug charges at a rate 13 times greater than whites (*The Economist*, 2 September 2000, p. 26).
- The jail population in the U.S. has tripled since 1980, mainly in response to the "war on drugs" (Warf, Barney, 2004. *Troubled leviathan: the contemporary U.S. versus Brian Berry's U.S. Professional Geographer* 56(1): 85-90).

A case study: Syracuse, New York (*Gainesville Sun*, 1-1-05, p. 9A):

The city council of Syracuse held hearings in 2005 to review policies related to enforcement of drug laws which revealed some disturbing statistics and patterns such as:

22 % of arrests by the Syracuse police department were for drug-related offenses. 2,000 people charged with possession of marijuana, which some citizens argue is less harmful than alcohol.

Most arrests were in poor, African-American neighborhoods.

Government regulations stipulate the people charged with drug infractions cannot live in subsidized housing; drug arrests were found to be contributing to the break up of families as the offenders had to move out.