CORDAGE FIBER PLANTS OVERVIEW

with Tamara Wilder © 2010

The world is full of plant species which yield fiber strong enough to be used by people as an aid to their survival and living. The knowledge of how to ply these fibers into cordage is one of the most basic of human skills. We literally have "tied our world together" for a very long time.

Fiber does not, however, always have to be plied into cordage to be made useful. Strips of bark, supple twigs, cattails, reeds, roots, and long leaves like those from palms and yuccas can be used to wrap, tie or lash together shelters, bundles and packages. Even a relatively weak material can make a strong lashing as long as it is wrapped many times and not subjected to much movement. Knots stress fibers greatly; therefore, unless these materials are especially strong and flexible, it is more advisable to wrap and tuck them several times rather than tying off with a knot.

Plants that yield high quality fibers that can be extracted, cleaned and plied in to cordage provide a medium wherein the individual fibers are made to take a more equal stress load. This increases tensile strength and flexibility. Also, because additional fiber can be spliced in indefinitely, the cord can be made as long as desired. This cordage (or string) can be repeatedly tied and untied and is the basis for ropes and nets.

This article & discussion focuses on which plants yield these all important fibers, where in the plant the fiber is located, how it is removed or processed and which families repeatedly tend to yield good fibers around the world.

Fiber bearing plants occur all around the world but tend to be relatively rare in number. In Dicotyledon plants, the fibers occur in the cambium layer of the stalk or trunk. In Monocotyledon plants, the fibers occur in the long straight leaves. My best understanding as to why this is so universally true is that their development is directly tied to the development of the "circulatory system" of the plant. All plants require some sort of system of pathways to move energy, nutrients and water. In the case of fiber bearing plants, these pathways (usually already fairly long & straight) are constructed of materials both strong and cohesive enough to be extracted as fiber and flexible enought to be twisted into cord.

The variety of plants and materials listed here is extensive, but it is far from complete, and does not include full descriptions of each plant. Hopefully it will best serve to give participants a framework on which to take notes during the discussion. A current ongoing project is to compile all of the details to be discussed in the workshop into a booklet of fiber plant information.

The PLANT FIBER world is divided into 4 types

These different types of plant fibers also have corresponding QUALITIES

Each type of fiber is usually harvested & processed using a similar BASIC PROCESS

(see Terminology Definitions for detailed descriptions)

I) BAST FIBERS *(Soft, Inner Bark or Cambium Fibers of **Dicotyledon** Plants)*

Small interwoven fibers, swell when wet, usually can be bleached safely & take dye/color easily.

BAST FIBERS are divided into TWO subcategories:

a)STALK or STEM Bast Fibers

Stalks tend to bear the finer and higher quality fibers.

*(**Stalk Bast Fiber Plants** are either **Perennial** or **Annual**)*

i) PERENNIAL STALK *BAST FIBER PROCESS*

HARVEST: *If the dead dry stalks are harvested when the plant is dormant in autumn/early winter; then a retting process is unnecessary because the roots have drawn all the saps down into themselves in preparation for the next years growth. Store in a dry place. All of the stalks may usually be harvested without adversely affecting the plant as it does not intend to use that growth again.*

In dry areas, previous years growth may be used but in wetter climates, mold sets in by mid-Winter and the fiber gets decomposed if left exposed to the elements.

PROCESS: ***Scrape*** *off the outer bark (if advised)**:** stalks with a smooth surface are best scraped before cracking off but if the stalk has bumps or ridges, it is best to skip the scraping and move straight to cracking off.* ***Crack off*** *the innner bark and* ***buff*** *the raw fiber.*

ii) ANNUAL STALK *BAST FIBER PROCESS*

HARVEST: *The dead stalks are cut at the end of the growing season.*

PROCESS: *Annual bast fibers must be* ***retted*** *which is accomplished by leaving whole stalks in field (field retted) or soaked either the whole stalks or cracked of bark in water to ret out the saps so that the fiber can be liberated.*

Outer bark is sometimes scraped first, inner bark cracked off and raw fiber buffed or hackled.

b)TREE or TRUNK Bast Fibers

Trees tend to bear larger and slightly more course & brittle fibers.

TREE *BAST FIBER PROCESS*

HARVEST *by* ***peeling*** *bark from live branches or trunks when the sap is up (plant is growing).*

Inner barks can also be stripped from weathered dead wood but will be of lesser quality and strength.

PROCESS *Outer bark is* ***cracked off*** *& then the inner bark is rolled into circles &* ***retted*** *until bark layers separate easily (several weeks). The retted bark is* ***washed***, ***pounded***, ***buffed***, ***scraped*** *and then stored dry until needed. (Many barks will twist more easily when wetted first. More brittle barks are generally used in their ribbonlike form instead of splitting them into smaller pieces).*

II) LEAF FIBERS *(Hard Fibers of **Monocotyledon** Plants)*

Single monofilament threads, do no swell when wet, are harmed by bleach & do not dye/take color well.

LEAF *FIBER PROCESS*

HARVEST*green leaves by cutting as close to base of leaf as possible.*

PROCESS *green leaves by either* ***pounding & rinsing*** *fresh or* ***retting/cooking*** *to break down the fleshy material in the leaves before* ***washing, scraping & pounding*** *to free the fibers from the rest of the leaf material. Don't bend or bruise leaves before baking or retting. Store dry. (Most hard fibers are easier to twist when wetted first.)*

III) ROOT FIBERS

Root fibers are not super common and tend to be simply fibrous sections roots.

ROOT *FIBER PROCESS*

HARVEST *live roots of about pencil to finger size diameter by selective digging*.

PROCESS *Peel off outer layer and pound lightly to loosen fibers. Repeatedly divide the piece of root lengthwise until you get fibers fine enough to use. Store dry. (May work more easily if slightly wet).*

IV) SEED or HUSK FIBERS

Seed fibers are relatively rare, shorter & are often also used as a fill material.

This list is divided into 4 groups:

1) Local Native Plants

2) Other North American Native Plants

3) Ornamental, Cultivated or Naturalized Plants

4) Animal Fibers

LOCAL NATIVE PLANTS

LOCAL STALK BAST FIBERS

DOGBANE, Indian Hemp

Apocynum cannabinum **Dogbane Family *(Apocynaceae)***

Widespread & preferred of native fiber plants. Grows in dense patches widespread across US but hard to find. Prefers wettish rich soil. Poisonous to livestock; so, has been eradicated in Western US. White milky sap like milkweed. Bright yellow foliage and deep red stalk in fall.

PERENNIAL STALK BAST FIBER PROCESS

Premier & easy to process fiber. Thorough scraping of the outer bark is highly recommended.

MILKWEED

Asclepias spp. **Milkweed Family *(Asclepiadaceae)***

Excellent white fiber, although sometimes can be a bit course and/or brittle.

Harvest dead dry stalks late summer through winter.

PERENNIAL STALK BAST FIBER PROCESS

If the stalk is not smooth and round, do not scrape. Dry pound if brittle.

STINGING NETTLES

Urtica dioica **Nettle Family *(Urticaceae)***

Some species excellent, others nearly worthless. The taller varieties seem to be better. Tends to rot quickly. Used in World War 2 as a linen (flax) substitute.

Harvest at peak height or end of growth season when dormant but not rotten.

PERENNIAL STALK BAST FIBER PROCESS

Bark not scraped. Dry pounding usually recommended. Wear gloves as wood is very splintery. Formic acid is deactivated by drying but the hairs can still cause skin irritation. If gathered green, ret.

FIREWEED

Epilobium spp. *Evening Primrose Family* ***(Onagraceae)***

PERENNIAL STALK BAST FIBER PROCESS

PRIMROSE

Primila spp **Primrose family *(Primulaceae)***

PERENNIAL STALK BAST FIBER PROCESS

LOCAL TREE BAST FIBERS

FREMONTIA BARK, Flannel Bush

Fremontodendron californica **Mallow family *(Malvaceae)***

Northern California Native shrub commonly grown ornamentally for its showy flowers, the bark of which which also contains a high quality fiber.

This shrub has many branches which can easily be pruned and stripped of their bark without injury to the plant.

TREE BAST FIBER PROCESS

This bark contains a very large amount of mucilage and takes a long time to rinse clean, however the result is large hanks of suprisingly soft and beautiful fiber. The bark ribbons are so soft that they can easily be spun into high quality strings and ropes.

REDWOOD BARK

Sequoia sempervirens **Bald Cyrus family *(Taxodiaceae)***

TREE BAST FIBER PROCESS

MAPLE BARK

Acer spp. **Maple family *(Aceraceae)***

The fiber from this tree is not very durable as a cordage material but was used as loose fiber material.

TREE BAST FIBER PROCESS

NINE BARK

Physocarpus capitatus **Rose family *(Rosaceae)***

TREE BAST FIBER PROCESS

WILLOW BARK

Salix spp **Willow family *(Salicaceae)***

TREE BAST FIBER PROCESS

COTTONWOOD BARK

Populus spp **Willow family *(Salicaceae)***

TREE BAST FIBER PROCESS

MOUNTIAN MAHOGANY BARK

Cercocarpus spp. **Rose family *(Rosaceae)***

TREE BAST FIBER PROCESS

SAGEBRUSH BARK

Artemesia tridentata **Aster family *(Asteraceae)***

Sagebrush bark is continually shedding its outer bark which can easily be pulled off the trunks and branches without damaging the shrub. That closer to the wood is newer and of higher quality.

Shredded bark ready to use with minimal processing, except maybe some light pounding and buffing.

LOCAL LEAF FIBERS

GROUND IRIS

Iris macrosiphon, I. Tenax **Iris Family *(Iridaceae)***

Low growing Iris in coast ranges from Central California north to Central Oregon. Along with nettles is the main fiber in Northern California and Southern Oregon. Very high quality hard fiber.

Green leaves pulled from the clumps of plants in such a fashion as to leave the root intact after July of each year (when the tips have begun to sear). Properly harvesting (taking no more that 1-2 leaves from each plant) has no negative impact and the same areas can be repeatedly harvested annually.

IRIS LEAVES ARE PROCESSED USING A UNIQUE METHOD

To extract the fibers, the leaves are wilted for a day or so and then (using either your thumbnail or a mussel shell tied to the thumb) split in half and each side scraped to clean the fiber from the green pulp. There is a single fiber on each outside edge of the leaf so each leaf yields two very fine but strong fibers.

CATTAILS

Typha spp. **Catttail family *(Typhaceae)***

Whole leaves are best after fully grown but before starting to turn brown and die back.

Leaves are best dried in the shade and then soaked in water and reconstituted before splitting into lengths and twisting into cord. This plant does not actually contain an "extractable" fiber, using instead the whole or split leaf. Cordage is used for lashing and tying.

TULES

Scirpus spp **Sedge family *(Cyperaceae)***

Whole leaves are best after fully grown but before starting to turn brown and die back.

Leaves are best dried in the shade and then soaked in water and reconstituted before splitting into lengths and twisting into cord. This plant does not actually contain an "extractable" fiber, using instead the whole or split leaf. Cordage is used for lashing and tying.

LOCAL ROOT FIBERS

BEACH LUPINE ROOT, Bush Lupine

Lupinus arboreus, L. chamissonis **Pea family *(Fabaceae)***

ROOT FIBER PROCESS

LEATHERROOT

Psoralea macrostachya **Pea family *(Fabaceae)***

Pungent and traditionally used for snares because it apparently covers up the smell from your hands.

ROOT FIBER PROCESS

OTHER NORTH AMERICAN NATIVE PLANTS

OTHER NATIVE TREE BAST FIBERS

MESQUITE BARK

Prosopis juliflora **Pea family *(Fabaceae)***

TREE BAST FIBER PROCESS

WESTERN RED CEDAR BARK

Thuja spp. **Cypress family *(Cupressaceae)***

TREE BAST FIBER PROCESS

(See CEDAR by Hillary Stewart for detailed processing method)

BASSWOOD BARK

Tilia spp. **Basswood family *(Tiliaceae)***

TREE BAST FIBER PROCESS

Apparently a stronger fiber is made by boiling retted fibers in a mixture of ashes and water for 24 hours

MULBERRY BARK

Morus spp **Mulberry family *(Moraceae)***

TREE BAST FIBER PROCESS

RIBBONWOOD BARK

Adenostoma sparsifolium **Rose family *(Rosaceae)***

Native to southern California.

TREE BAST FIBER PROCESS

SLIPPERY ELM BARK

Ulmus fulva **Elm family *(Ulmaceae)***

TREE BAST FIBER PROCESS

OTHER NATIVE LEAF FIBERS

YUCCA

Yucca spp **Lily family *(Liliaceae)***

Widely used and preferred in desert areas for nets, ropes, sandals, and fiber skirts.

Harvest green leaves, being careful not to get stuck by sharp needle like tips of leaves.

LEAF FIBER PROCESS

Bake, ret, or pound & wash fresh leaves; then, buff and scrape for final cleaning.

AGAVE, Sisal

Sisal spp. **Lily family *(Liliaceae)***

Large widespread plant with lots of succulent basal leaves. Often grown ornamentally.

Harvest green leaves by cutting as close to base of leaf as possible. Watch out for sharp tips. Process before leaves dry out. Agave and yucca are either pitbaked or retted, and then washed, scraped & pounded to free the fibers from the rest of the leaf material. Don't bend or bruise leaves before baking or retting. Store dry.

LEAF FIBER PROCESS

Agave leaves are usually baked or can be retted (but due to their highly succulent nature this process gets very stinky). Fresh pounding is not recommended as agave sap can cause a severe rash.

ORNAMENTAL, CULTIVATED or NATURALIZED

OTHER STALK BAST FIBERS

FLAX

Linum usitatissimum **Flax family *(Linaceae)***

Possibly the most renowned fiber in the world, also the source of linen, flax seeds & linseed oil. Other species of Linum all have useful fibers but they are usually fairly short.

Traditional processing methods from Europe are very efficient and detailed.

ANNUAL STALK BAST FIBER PROCESS

HEMP

Cannibus spp **Hemp family *(Canabaceae)***

Varieties grown for the fiber in their stalk are very tall and slender and grown in dense patches.

ANNUAL STALK BAST FIBER PROCESS

RAMIE

Boehmeria nivea **Nettle family *(Urticaceae)***

One of the "big four". High quality fiber plant, native to China a cultivated throughout Asia.

ANNUAL STALK BAST FIBER PROCESS

The fibers of this stalk are reputed to be very difficult to extract due to its very "gummy" nature, which is apparently why it has not acheived widespread use commercially.

Perennial but is usually cut several times a year so needs to undergo and extensive retting process.

JUTE

Corchorus capsularis & olitorius **Basswood family *(Tiliaceae)***

One of the "big four" commercial bast fibers that has been cultivated in India since 800 B.C.

ANNUAL STALK BAST FIBER PROCESS

KENAF

Hibiscus spp **Mallow family *(Malvaceae)***

This commercial fiber plant was apparently domesticated in Western Africa but is now grown chiefly in India, Thailand and China.

ANNUAL STALK BAST FIBER PROCESS

SUNN HEMP

Crotalaria juncea **Pea family *(Fabaceae)***

Common fiber plant in India

ANNUAL STALK BAST FIBER PROCESS

URENA

Urena lobata **Mallow family *(Malvaceae)***

Common fiber plant in India

ANNUAL STALK BAST FIBER PROCESS

OTHER TREE BAST FIBERS

PAPER MULBERRY

Broussonetia papyrifera **Mulberry family *(Moraceae)***

Famous tree with fiber bark from the South Seas Islands. Also used to make Tapa cloth.

TREE BAST FIBER PROCESS

HAU

Hibiscus tiliaceus **Mallow family *(Malvaceae)***

Native Hawaiian tree who's bark is used extensively for ropes & nets. The characteristics of this bark are remarkably similar to Fremontia Bark.

TREE BAST FIBER PROCESS

OTHER LEAF FIBERS

ABACA HEMP

Musa textilis **Banana family *(Musaceae)***

Close relative of banana, native to the Philippine Islands.

LEAF FIBER PROCESS

NEW ZEALAND FLAX

Phormium tenax **Lily family *(Liliaceae)***

Premier fiber native to New Zealand and still used widely by Maori people for their traditional capes, string, ropes, baskets, etc.... A very common ornamental which can be easily found in most California towns.

LEAF FIBER PROCESS

Traditional Maori processing in New Zealand uses a specific technique of scraping the fresh leaves with a mussel shell to extract the fiber.

HUSK OR SEED FIBERS

COCONUT

Cocos nucifera **Palm family *(Palmae)***

Outer husk provides fiber that provides a rough fiber for cordage and ropes have long been of great important to Polynesian and Micronesian island communities.

COTTON

Gossypium spp **Mallow family *(Malvaceae)***

KAPOK

Ceiba pentandra **Mallow family *(Malvaceae)***

Seed pod fiber native to tropical America. Mostly for stuffing.

ANIMAL FIBERS

SINEW

Leg (Achilles) tendons *from large animals like deer, elk, moose, etc…*
Backstrap sinews *lie on either side of the spine of these same animals - threadlike fiber.*
Very strong but slippery when wet. Excellent material for bowstrings and also glued to the backs of bows to make them stronger and more powerful. Fine threads are moistened in the mouth and used for hafting arrowheads and fletching and for sewing holes in buckskin.

Remove from fresh animal, clean of all meat and fat and dry in sun. Store dried.

Pound & shred leg tendons into manageable pieces. Separate backstrap threads with fingers.

HAIR & WOOL

SILK

RAWHIDE & LEATHER

INTESTINE

TERMINOLOGY OF PREPARATION METHODS

Fibers may be cleaned and separated by a variety of methods, depending on the condition and growth habits of the plant, season of harvest, and personal preference. The most commonly used techniques are defined here. Some plants also have very specific processing methods or variations which are further described in each plant's description.

-**PEELING** refers to the method of removing the green bark from a tree. If the sap is risen, then the bark can be easily pulled off. It can either be removed in strips or larger sections. This fresh bark then usually needs to be retted to obtain good quality fiber. Most tree barks are harvested fresh.

-**SCRAPING THE OUTER BARK** is a technique used for stem bast fibers with a thin outer bark and smooth surface. Starting at the bottom and working towards the top, gently scrape the surface of the stick with a sharp tool held at a 90 degree angle. Only the very outer layer should be removed so if you see fibers rising up under the knife you are going too deep! Be especially careful around the stem nodes and scrape less rather than more as you develop a sense of the process. Any remaining outer bark can be removed by buffing later.

-**CRACKING OFF** is a method of removing the wood of stalk bast fibers and the outer bark from bark strips of trunk bast fibers.

Stalks should be cracked lengthwise in two dimensions in order to break it into quarters, which are separated along one split so that the stalk rolls out flat (with all the bark on one side and all the interior wood on the other side). Then, the large end of the stalk is placed, bark side down, over the right pointer finger, with a few inches of the stalk protruding forward and the rest of the stalk hanging free under the right arm with the right thumb holding the stalk securely against the right pointer finger. The pressure between the right pointer finger an thumb will act a "roller" and allow for the clean release of the fibers from the woody portion of the stalk. The following motion is best learned by seeing someone else do it, but I am going to attempt to describe it here: take the left hand and strike the protruding section of the stalk in a "karate chop" motion so that the wood is broken over the right hand. Then grasp the woody section where it broke and pull it away from you so that it separates from the underlaying fiber. Cast it aside and, grasping the newly exposed fibers with your left hand, pull down and away (always maintaining

pressure between your right pointer finger and thumb) so that the fibers are pulled down and off the woody portion of the stalk for a few inches. THEN (repeating the first processs) karate chop and pull away the woody portion to catch any fibers that would have otherwise been lost. Repeat this sequence until the end of the stalk is reached.

Bark strips are cracked in opposing directions every few inches so that the brittle outer bark breaks away from the more supple ribbon of inner bark.

-**BAKING** is a method for extracting the fiber from agave and yucca. The fresh leaves are pitbaked in a stone lined hole in the ground in which a fire has been burned. They are then covered over and allowed to bake in the heat of the pit for at least 6 hours or more.

-**RETTING** involves subjecting the plant to some sort of decomposition (either by soaking in water or letting sit out in the dew) to hasten the separation of the fiber from the glues holding it together. Especially important with annual plants and tree barks. If the retting is carried on too long, the strength of the fiber can be compromised. Retting fibers can smell horrible so keep them away from your house. The retting process also takes oxygen out of the water so don't ret large amounts of materials in a small pond or you may end up with a lot of dead fish.

-**POUNDING & WASHING** is a method used for cleaning pulpy fibers like yucca leaves or some roots, or as a second step after retting or baking trunk bast fibers and hard fibers. Use a smooth mallet on a smooth peeled log or smooth corner and rinse, scrape, and comb the fiber repeatedly between poundings.

-**DRY POUNDING** refers to a technique of twisting the hank of fiber into a loose rope and then pounding it lightly with a smooth mallet. The hank is then re-twisted and pounded again repeatedly. This method works well on more brittle and rough fibers like nettle and milkweed.

-**BUFFING THE RAW FIBER** is done in one of two fashions: 1)holding in the teeth and rubbing with both hands or 2)holding in one hand and rubbing the other hand on the leg. In either case, grasp the hand of fiber in the middle and move down each half towards the ends of the fiber. This way the fibers stay taut, tangle less easily, and are subjected to more friction. Periodically **scrape** the fiber from the center out to each end with a fingernail or other edge of bone, shell or piece of metal in order to remove excess chaff and straighten out any fibers which are in danger of tangling. Avoid using the thumbnail for large amounts of cleaning or with any sharp or splintery material. The main goals are to remove most of the chaff and outer bark and break up the ribbonlike structure of the bark so that the fibers are separate and look hairlike. Unscraped fiber takes much longer to buff and more fiber is usually lost in the process.

-**HACKLING** refers to using a tool made of many spikes (a hackle) to comb, clean and separate the fibers. Hackles are traditionally used for cleaning fibers like hemp and flax. Ethnologies from California mention running a bone awl repeatedly through a bundle of fiber which would produce a similar effect.

Bibliography & Recommended Reading

-***CEDAR*** by Hilary Stewart

Extensive account of all things Cedar.

-***PLANTS FOR MAN*** by Robert W. Schery

Great economic botany book from the 50's with extensive fiber section.

-***SURVIVAL SKILLS OF NATIVE CALIFORNIA*** by Paul Campbell

Lots of accounts of variety of fiber plants and uses.

-***WEAVING A KAKAHU*** by Diggeress Te Kanawa

Wonderfully detailed (complete with pictures) account of *Phormium* processing and lots more.