STRINGMAKING

by Tamara Wilder and Steven Edholm ©1995

FIBER & CORDAGE

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.

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.

When cleaned and plied in to cordage 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. Many fiber uses require these advantages.

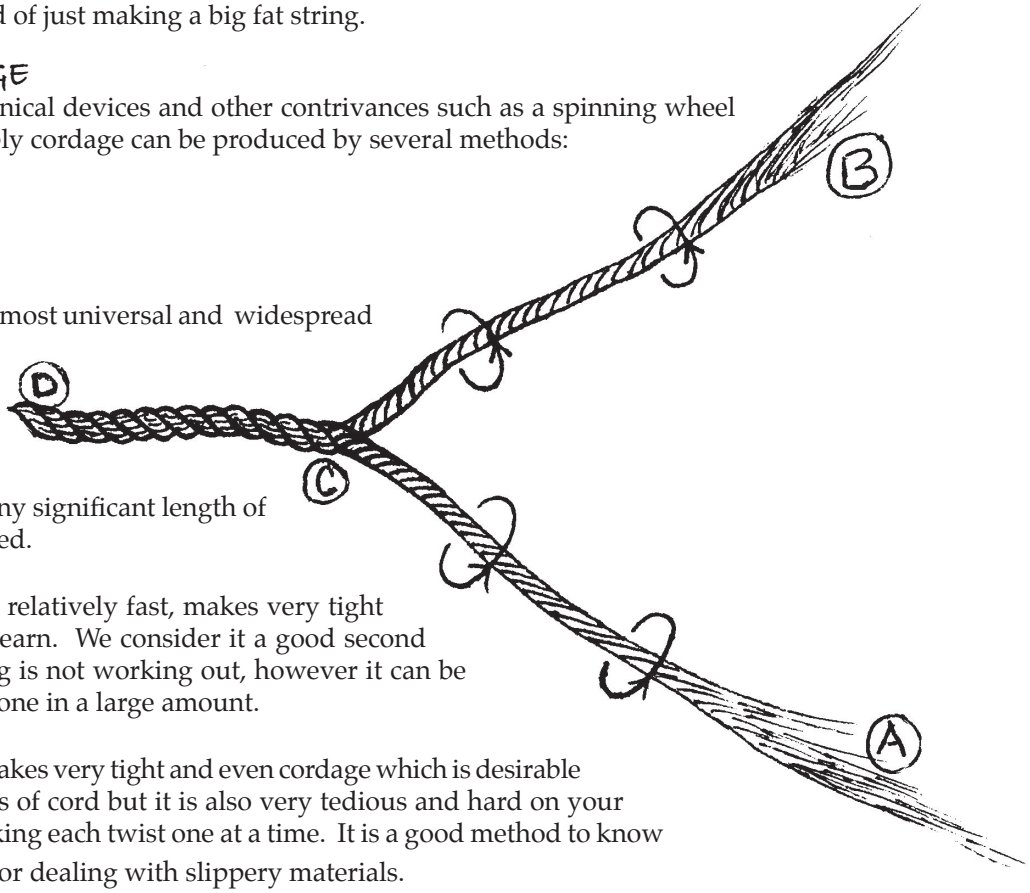
Normal three ply cordage is stronger and smoother than two ply but is more difficult to make and is usually only used where it adds some benefit. Bowstrings are commonly multiplied. Three ply cordage is not too difficult to make by the leg roll method.

Cordage can be made as thick or thin as desired, although at a certain point it is better to ply many cords into a rope instead of just making a big fat string.

MAKING CORDAGE

Aside from mechanical devices and other contrivances such as a spinning wheel and drop spindle, two ply cordage can be produced by several methods:

-**leg rolling**
-mouth rolling
-hand twisting



Leg rolling is the most universal and widespread method of making cordage and is very fast. However, it can take a lot of practice to master and in general makes a slightly looser string. Any significant length of string should be leg rolled.

Mouth rolling is relatively fast, makes very tight cordage and is easy to learn. We consider it a good second method when leg rolling is not working out, however it can be hard on your hands if done in a large amount.

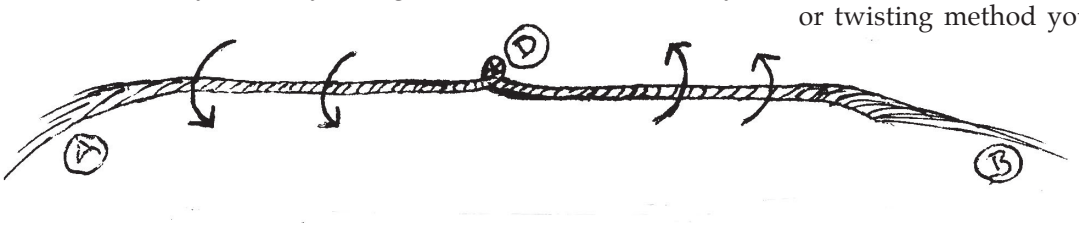
Hand twisting makes very tight and even cordage which is desirable for more aesthetic pieces of cord but it is also very tedious and hard on your wrists as it involves making each twist one at a time. It is a good method to know as an aid in splicing or for dealing with slippery materials.

THE START (same for all methods)

First, you need to have a length of prepared fiber ready. The thickness is variable depending upon what you are making but keep in mind that the thickness of the string will be double that of the hank of fiber. If the hank is either too thick or too thin, the rolling process will be more difficult but there is a wide variation in between. If the length of your intended string is more than half the length of your prepared fiber, you should stagger the parts of the hank of fiber so that the different pieces end at slightly different places. This preparation will make subsequent splices more even and strong.

Next, take your piece of prepared fiber and grasp it near the middle with your hands about two inches apart. Twist the fibers away from you with your right hand **(B)** and towards you with your left hand **(A)**. These twists are best achieved by rolling the fiber between your thumbs and forefingers. As you twist the fibers tight, they will want to buckle in the middle and curl upon themselves, forming a little curlicue **(D)**, which will be your start. If you are having trouble getting enough twist, try periodically grasping the fiber with your ring and pinky fingers at a point outside of the parts you are twisting so that you can adjust the grip of your thumbs and pointer fingers without losing any twist.

If you are left handed, you may want to reverse this process by twisting away from you with your left hand and towards you with your right. It will then be necessary to reverse the twist in whichever rolling or twisting method you choose to use.



LEG ROLLING

The vast majority of cordage made by "real" primitive people, both modern and ancient, is leg rolled, probably because leg rolling is so much faster and easier than other non-mechanical methods. This speed of manufacture is particularly important when a vast amount of cordage is required like in making a net or rope.

-Leg rolling is best done on the naked thigh. Pants are usually problematic but if they are tight fitting and the top of the thigh area is wetted down, can usually be made to work. Leather or buckskin pants work great and a piece of leather or buckskin wrapped tightly around the thigh makes a passable substitute for real skin.

-In leg rolling, the cordage is always grasped at point **(C)** (point **(D)** at the beginning only). Right handers grasp the cordage with the left hand and roll with the right hand on the right thigh. (Left handers who reversed their starting twist should hold the cordage in the right hand and roll with the left hand on the left thigh.)

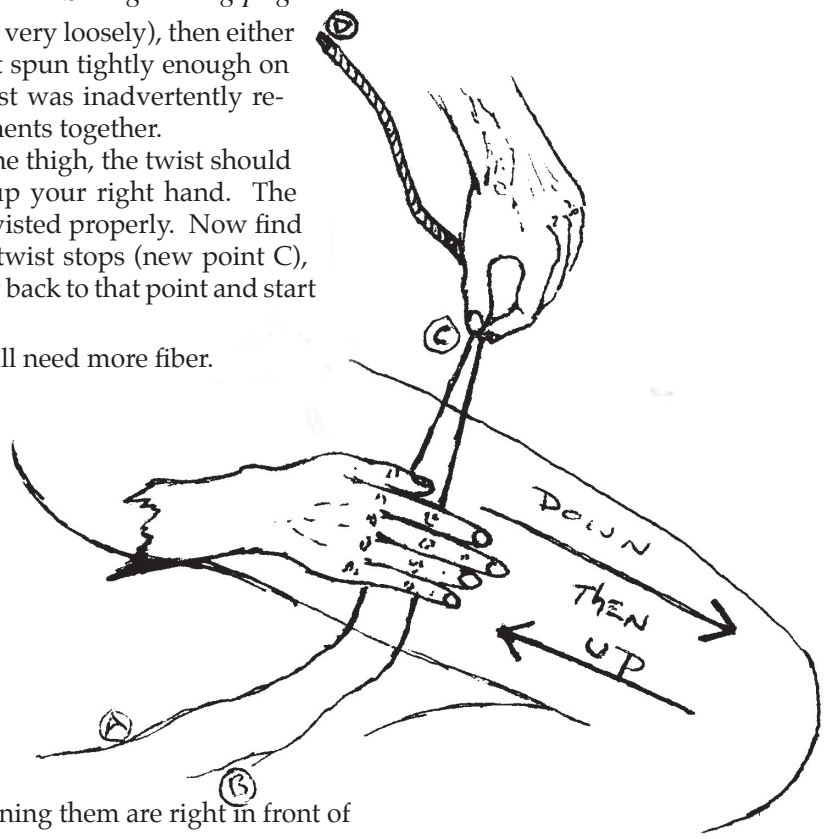
-The rolling hand needs to be wetted or spat into to improve the grip. It may also help to wet or rub spit on the rolling leg as well.

1) The two elements **(A)** & **(B)** are placed draping over the top of the right thigh with the ends dangling freely off to the right. They should be about an inch apart. The left hand **(C)** grasps the junction of the curlicue start between the thumb and forefinger and pulls with slight tension against the right rolling hand which is placed over the two elements. Now, pressing tightly into the thigh, roll the right hand down the right thigh so that the two elements spin tight, without twisting around one another. The left hand should follow parallel to the right hand and should keep the fibers between the two hands pulled taut. If the elements are not spinning, release and try again until they do.
2) At the end of the leg, slide or shove the two tightly spun elements snugly together so that they lie parallel and touch but do not twist around one another. This manipulation can be difficult at first but practice and attention paid to the subtle movements in the muscles of the palm and fingers can make a big difference. Often you need to slightly release the pressure and use the butt of the palm to slide the elements together.
3) The rolling hand now rolls back up the thigh, twisting the two elements around one another into a cord. The left hand follows parallel, keeping the area between the two hands taut. If the two elements do not twist around one another, then they were not slid together snugly enough at the end of the downward

stroke. If they twist together (but very loosely), then either the individual elements were not spun tightly enough on the downward stroke or the twist was inadvertently released when sliding the two elements together.

4) When you are back at the top of the thigh, the twist should be completed and you can lift up your right hand. The string will not come undone if twisted properly. Now find the place in the fiber where the twist stops (new point C), separate the two elements cleanly back to that point and start again with step #1.

Soon, one or both of the elements will need more fiber. Go to the splicing section.



In places like Micronesia and Central/South America people leg roll miles of cord for nets, hammocks, and ropes and can roll over 6 inches per stroke of tight even cordage.

Leg rolling can be a difficult skill to learn but we cannot overstate its importance to those serious about primitive technology or wilderness survival. Hand twisting string for a net when you could be leg rolling it would be like carving a boat with dull tools when the means of sharpening them are right in front of you.

MOUTH ROLLING

1) Hold the start **(D)** between your teeth. Try not to suck on the fiber.
2) Grasp each element **(A)** & **(B)** with each hand between the thumbs and forefingers and pull the fiber between your mouth and hands taut.
3) Simultaneously spin each element counterclockwise (or to your left). This spinning motion should make the two elements begin to twist around one another near the top **(D)**. You should however, hold them apart slightly so that each spins up tightly before you allow them to twist around one another. Practice will allow you to feed them together evenly and tightly. Play around until you have at least an inch of something resembling cordage.
4) Now, grasp the place where the cordage stops **(C)**, remove the string from between your teeth, and look at your results.
5) Now twist the already completed cord (between point C & D) up tightly like a spring. You are storing tension which will release itself on the next cycle by spinning the two elements into string.
6) Holding the tension thus produced, put point **(D)** back in your teeth and start again with step #2.

You won't get very far this time before you will need to take the end from your teeth and twist the completed cord tight again, but as the distance between C & D gets longer (i.e. more string completed) and more tension is stored, the length of cord made in each cycle will increase.

As the string gets really long, Point D (the point which you hold in your teeth) will move down the string. You should soon discover the optimum amount of cord for storing the tension (usually about 7-8 inches).

Soon, one or both elements will need fiber. Go to the splicing section.

HAND TWISTING

We do not recommend using this method for making string, but it is good to understand what is happening, twist by twist. Sometimes, especially when splicing slippery materials, it can be helpful to hand twist a few times to hold everything tight.

1) Hold point**(C)** (or **(D)** if just starting) between the thumb and forefinger of your left hand. The pressure

of your fingers should be separating the two elements.

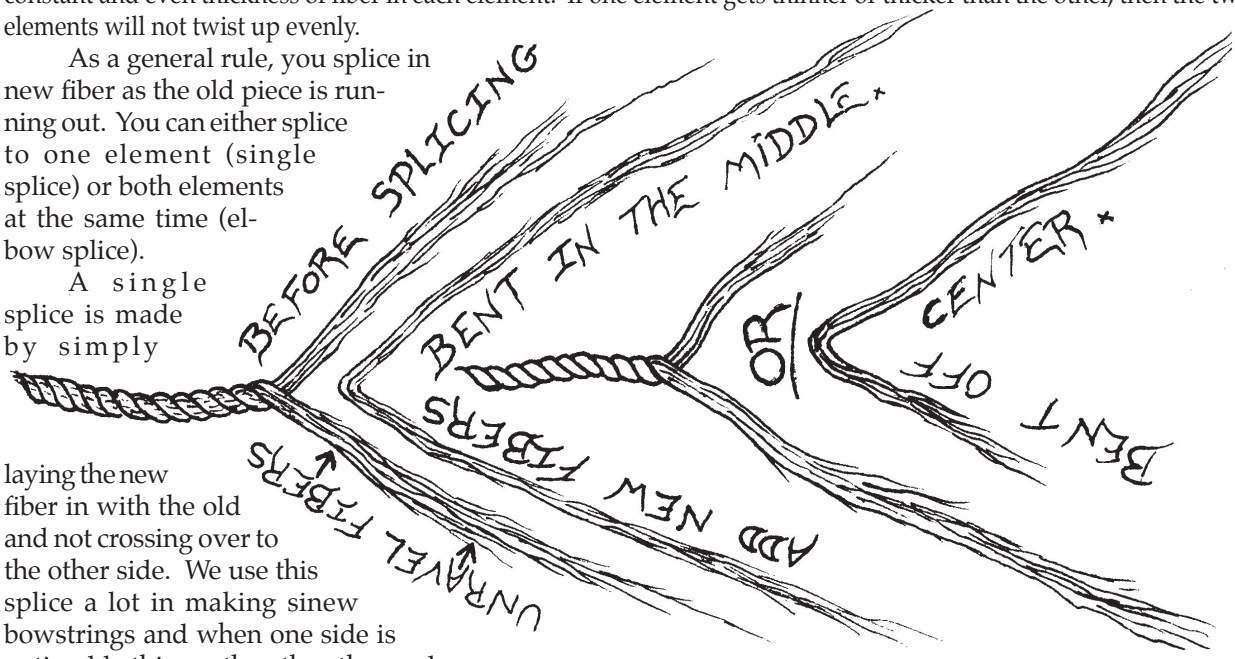
2) Grasp the topmost of the elements **(B)** between the thumb and forefinger of your right hand at a point about an inch from your left hand and pull the fiber taut.
3) Spin the fiber of element **(B)** away from you and rotate your right hand away from you so that you can reach around and grasp the lower element **(A)** between your forefinger and middle finger.
4) Now rotate your hand back to how it was originally, bringing the lower element **(A)** around with it. This motion should put a twist into the cord by reversing the two elements.
5) Move the left hand over slightly to grasp the new twist, release the right hand and start again at step #2. This time you will be spinning the other element **(A)**, which is now on top. Always spin the top element.

SPLICING

As the existing fibers get thin and run out, you will need to add new ones. If you add big wads of fiber at one time or wait until you are almost out of fiber before splicing, your cordage will be lumpy and weak. It is important to add fiber frequently and in small amounts, so that they will then run out gradually instead of all at once. By preparing your original fiber by staggering the pieces, you set the whole string up for good splicing. It is also important to maintain a constant and even thickness of fiber in each element. If one element gets thinner or thicker than the other, then the two elements will not twist up evenly.

As a general rule, you splice in new fiber as the old piece is running out. You can either splice to one element (single splice) or both elements at the same time (elbow splice).

A single splice is made by simply laying the new fiber in with the old and not crossing over to the other side. We use this splice a lot in making sinew bowstrings and when one side is noticeably thinner than the other and needs additional fiber.



An elbow splice involves folding the fiber at some point so that is lays next to both elements. Elbow splices are stronger and do not leave frayed ends which need to be cleaned up later, however, they can also be more difficult to get tight. We usually use the bend in the middle elbow splice but try to stagger the ends slightly. If your single splices are weak, you can try the bent off center elbow splice.

1) The first thing to do is have prepared fiber ready to use. We like to separate the fiber into small lengths which are easy to grab when the time is right.
2) Thoroughly untwist any of the elements which you are going to add to. Already twisted fiber will not mesh with new fiber.
3) For a single splice, lay the new fiber parallel to the old so that a tag end passes through the "V" and hangs out the other side. For an elbow splice, bring the fiber back down parallel to the other element as well. The important thing is that the new fiber is tightly snug into the "V".

Now grasp the "V" containing the new fiber and continue with whatever twisting method being used. If the splice continually pulls out, try doing a few twists of hand twisting before moving on. If there is a loop of fiber in the finished string at the splice it means that there was excess fiber in the "V". Things should be kept clean and tight.

PREPARATION OF MATERIALS

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 on the listed techniques. The general processes for each main type of fiber which are listed on the next page are meant to be general guidelines and need to be adapted to each different plant and situation.

-PEELING refers to the method of removing the green bark from a tree. If the sap is risen, then the bark should 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 bast fibers with a thick outer bark and smooth surface (like dogbane). Starting at the bottom and working towards the top, gently scrape the surface of the stick with a sharp knife of stone flake 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 what is happening. Any remaining outer bark is removed by buffing and scraping later.

-CRACKING OFF is the method used to remove the bark of bast fibers from their inner woody core. Squeeze the stalk up and down its length to crack it into four sections and then roll it out flat so that the bark is all on one side and wood on the other. Then, the wood is cracked into many small sections and remove them carefully, leaving as much of the fiber in tact as possible. There is also a very specific way of separating the bark as you crack off the woody sections but it needs to be learned in person. If possible find someone to show it to you.

-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. Use a smooth mallet on a smooth peeled log 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 BETWEEN THE PALMS is most efficiently accomplished by holding the middle of the hank of fiber in the teeth as the hands move down each half towards the ends of the fiber in a rubbing motion. This way the fibers stay taut, tangle less easily, and are subjected to more friction. An alternative is to hold the middle of the hank in the left hand and rub each half on the right thigh with the right hand. 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 (especially Nettle). This cleaning process can be carried on to whatever extent you wish. The more you clean, the finer and more silky the fiber, but there will also be a lot less of it. If the bark was not previously scraped, the cleaning will take a lot longer. 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.

-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.

DOGBANE, Indian Hemp *Apocynum cannabinum* ***Stem bast fibers (process SF)***

The most widespread and preferred of native fiber plants. Perennial which grows all over the United States and Canada but which can be hard to find. Prefers wettish rich soil. Can be poisonous to livestock. Has a white milky sap and is often recognized in the fall by its bright yellow foliage and red stalk.

Harvest dead dry stalks in autumn or early winter after plant goes completely dormant. Often find several years worth of stalks gathered in a clump around the plant. The current season's stalks are usually more reddish and less weathered. Snip the small stems and thin tips above the branches from each stalk and store in a dry place.
Annuals like *hemp* & *flax* are harvested and stored similarly, but need to be retted to extract the fiber.

The outer layer (outer bark) of each stalk can either be removed now by scraping or later by buffing and scraping. We usually scrape the bark first; then the inner bark is cracked off its inner core. Buff the hank of fiber between the palms and scrape with fingernail.
Milkweed & *nettles* are processed similarly except the outer bark is usually not scraped first and they often need to be dry pounded instead of buffed.
Nettles often need to be retted.

AGAVE, Century Plant *Sisal spp.* ***Leaf Fibers (process LF)***

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 fibers can also be pounded, scraped & washed repeatedly in a green state; however, agave sap can cause a severe rash and much caution should be taken if processed fresh.
Many hard fibers are easier to use when wetted.
Leaf fibers are *hard* fibers and do not swell when

FREMONTIA, Flannel Bush *Fremontodendron californica* ***Tree bast fibers (process TF)***

Native California shrub which is also grown ornamentally for its showy flowers.

Bark is stripped in ribbons from live branches or trunks when the sap is up (plant is growing). Outer bark is cracked off & then the inner bark is rolled into hanks & retted until bark layers separate easily. Retted bark is rinsed, buffed, scraped & pounded.

Store dry. Many barks will work more easily when wetted first. More brittle barks are generally used in their ribbonlike form instead of buffing them soft.
Inner barks can also be stripped from weathered dead wood but will be of lesser quality and strength.

LEATHERROOT *Psoralea macrostachya* ***Roots (process R)***

Member of the pea family which has very fibrous roots.

Selectively dig live roots of about pencil to finger size diameter. 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. Leatherroot is very pungent and is traditionally used for snares because it apparently covers up the smell from your hands.

OTHER FIBER BEARING PLANTS:

***(letters indicate basic process:* SF, LF, TF, R)**

BEACH LUPINE ROOT (*Lupinus arboreus*) (R)
BASSWOOD BARK (*Tilia spp.)* (TF)
CATTAILS (*Typha spp.*)
CEDAR BARK (*Thuja*) (TF)
COCONUT HUSK
COTTONWOOD BARK (*Populus spp.*) (TF)
ELM BARK (TF)
FIREWEED (*Epilobium) (SF)*
FLAX (*Linum usitatissimum) (SF)*
GROUND IRIS (*Iris macrosiphon, I. tenax*)
HEMP (*Cannibus spp.*) (SF)
MESQUITE BARK (*Prosopis juliflora*)
MILKWEED (*Asclepias spp.*) (SF)
MULBERRY BARK (TF)
NETTLES (*Urtica spp.*) (SF)
NEW ZEALAND FLAX (*Phormium tenax*) (LF)
NINEBARK (*Physocarpus capitatus*)
PRIMROSE
REDWOOD BARK (*Sequoia sempervirens*) (TF)
RIBBONWOOD BARK (*Adenostoma sparsifolium*)
SAGEBRUSH BARK (*Artemesia tridentata*)
TULES (*Scirpus spp.*)
WILLOW BARK (*Salix spp.*) (TF)
YUCCA (*Yucca spp.*) (LF)