ALASKA STATE MUSEUMS

CONCEPTS

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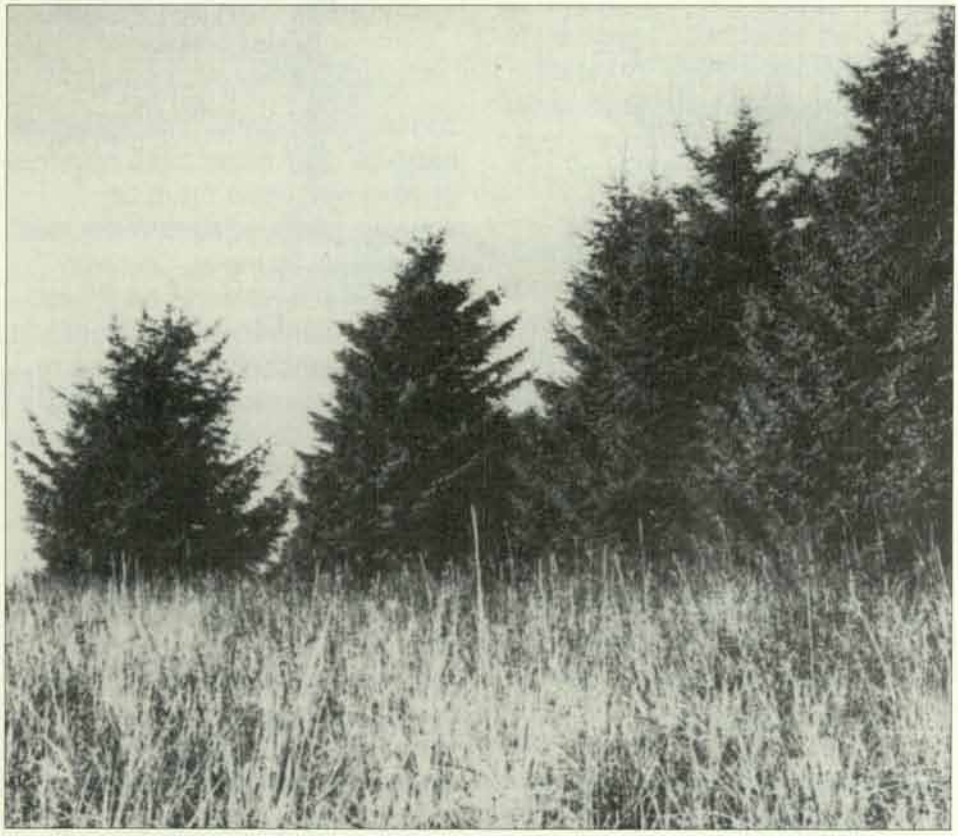
SITKA SPRUCE ROOTS USED IN BASKETRY

By A. S. Harris

Tlingit and Haida spruce root baskets inspire appreciation as works of art—for their beauty and diversity of form, weave, and pattern, and the individuality of each item. The raw materials used in making the baskets—the spruce roots for weaving, the grass, fern, and dyes for decoration—usually receive little notice. A close look at these materials, however, can help us to understand better the people who long ago began making the baskets, and may also interest those who are continuing the ancient tradition of spruce root basketry as an evolving art form. Here we will consider the roots of Sitka spruce *(Picea sitchensis (Bong.) Carr.)* as one of the raw materials used.

NATURAL RANGE OF SITKA SPRUCE

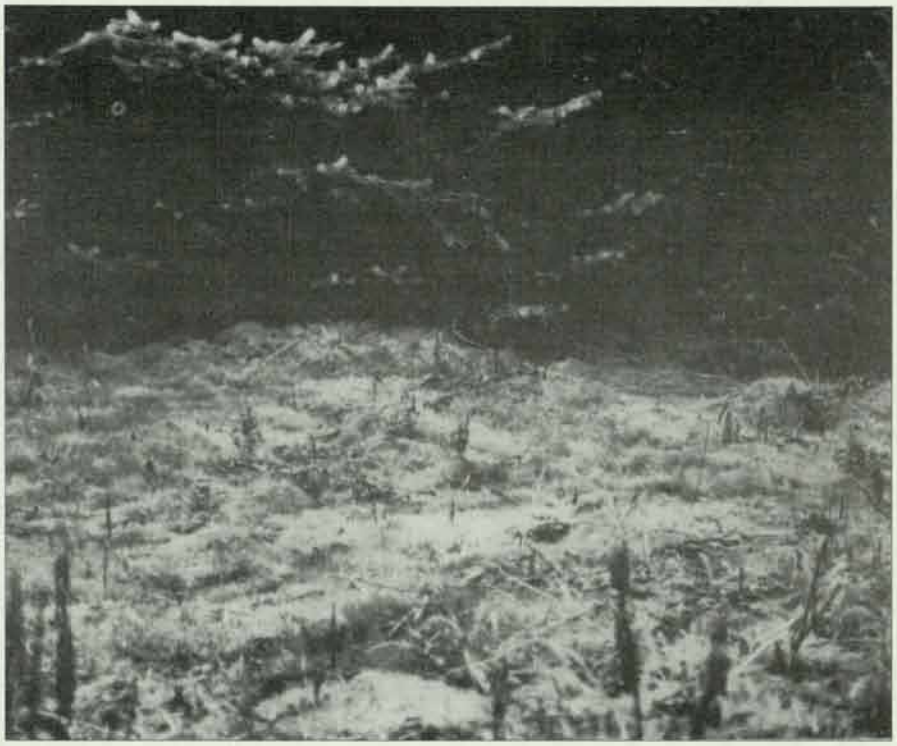
To begin, consider where Sitka spruce grows. A striking feature of the north Pacific coast is the dense temperate rain forest which dominates the landscape. Sitka spruce is found throughout the rain forest. It grows along the sea for 2,000 miles from Mendocino County in California north and west to beyond Cook Inlet, Alaska. Its range is determined by the tree's requirement for abundant moisture during the summer growing season. Toward the south, summer moisture is



A stand of young Sitka spruce growing on a sandy beach. Spruce is encroaching on beach ryegrass. The mossy zone at the edge of the stand is hidden by tall grass.

supplemented by frequent fogs. In coastal British Columbia and Alaska, frequent summer rain provides ample moisture.

Within its range, Sitka spruce grows in pure stands or mixed with western hemlock *(Tsuga heterophylla (Raf.) Sarg.)*, western redcedar *(Thuja plicata Donn)*, Alaska cedar (Chamaecyparis nootkatensis *(D Don) Spach)*, shore pine *(Pinus contorta Dougl. var. contorta)*, red alder *(Alnus rubra Bong.)*, black cottonwood *(Populus trichocarpa Torr. & Gray)* and other trees important to Native life and culture. None of these associated trees is as wide-ranging as spruce, however, and the local availability of this tree species has affected Native life.



A mossy zone along the edge of a stand of young Sitka spruce. An ideal site for digging spruce roots.

Spruce is fairly tolerant of salt, so it can grow on rocky headlands or along beaches exposed to salt spray. Common names such as Tideland Spruce, or Coast Spruce, emphasize the tree's close affinity with the sea.

Ecologically speaking, Sitka spruce is a "pioneer" species — one of the first trees able to colonize disturbed or newly exposed sites, and so it often grows on land exposed to glacial recession, land recently uplifted from the sea, and on alluvial soils along streams. Western hemlock and the cedars, on the other hand, are seldom found in these disturbed situations.

HABITATS THAT PRODUCE ROOTS SUITABLE FOR BASKETRY

Although Sitka spruce is common and grows in a variety of habitats, only those trees growing in certain habitats produce shallow, lateral surface roots most suitable for basketry. One may describe good sites in ecological terms. A site should have: uniform, sandy soil; open growing conditions; young, fast-growing spruce. These conditions are most often met on sites undergoing primary plant succession, where young spruce are invading treeless land. Species vary, but in Southeast Alaska plant succession usually begins with beach ryegrass *(Elymus mollis Trin)*, and herbaceous plants such as fireweed *(Epilobium angustifolium L.)*, lupine *(Lupinus nootkatensis Donn)*, beach strawberry *(Fragaria chiloensis (L.) Duchesne)*, beach pea *(Lathyrus maritimus L.)*, and a variety of other grass and herbaceous plants, followed by Sitka spruce.

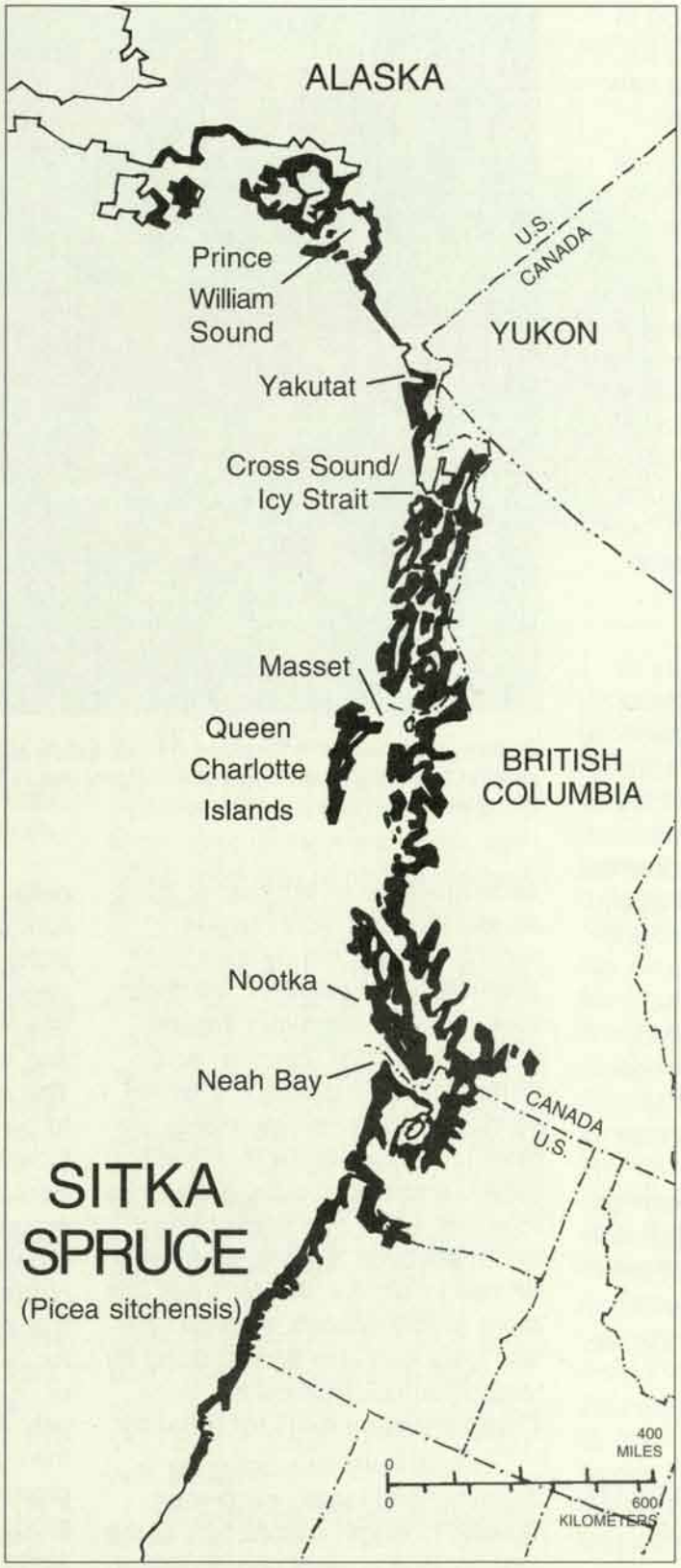
Once established, spruce grows rapidly, extending its roots into the area occupied by grass or herbaceous vegetation. As spruce overtops this vegetation, it shades out competing plants, and needles shed from crowns further suppress their growth. Mosses are least affected and so a zone dominated by feather mosses such as *Ptilium crista—castrensis (Hedw.) De Not.), Brachythecium asperinum (Mitt.) Sull.), Hyloconium splendens (Hedw.) B.S.G.)* forms around the trees. Long, vice-like lateral roots of Sitka spruce grow a few inches below the surface in the moss or grass roots or in the mixed sand-humus layer beneath. The roots often extend far beyond the crown of the nearest spruce. It is common to find roots well over 50 feet long with lengths of 3 to 20 feet between branching. These roots can be easily pulled or dug up, the main obstacles being other spruce roots, or beyond the zone of moss, the sod formed by grass-herbaceous vegetation.

The site should also have soil of uniform, sandy texture that is free of rocks and other obstacles to root growth. Typical areas are found along the larger streams, along the sandy beaches of the

outside coast, or on land built up by deposition of sand from dredging operations. In these locations, the absence of rocks or large roots and the uniform texture of sandy soil promote the development of long, straight surface roots.

Lieutenant George T. Emmons, whose duties as a naval officer first brought him to Alaska in 1882, described the trees most sought for their roots. He did not mention age, but in terms of diameter, trees from six inches to two feet were considered acceptable. Recently, I made tree corings in the vicinity of Icy Strait and found that typical trees of this size range in age from 14 to 60 years. Within this range, tree age appears to make little difference in the character or quality of the small surface roots, as most roots of a size used for basketry appear to be less than 10 years old.

Trees having the best roots are spaced singly, in clumps, or along a stand edge, so that roots extend beyond the crown of trees, thus avoiding the dense network of tree roots beneath crowns. Young, open-grown trees have full crowns with branches that extend to the ground, giving the site a distinctive appearance. With age, trees growing within stands gradually lose their lower branches as these are shaded out and die.



Natural range of Sitka spruce along the north Pacific coast. (Courtesy U.S.D.A. Forest Service)

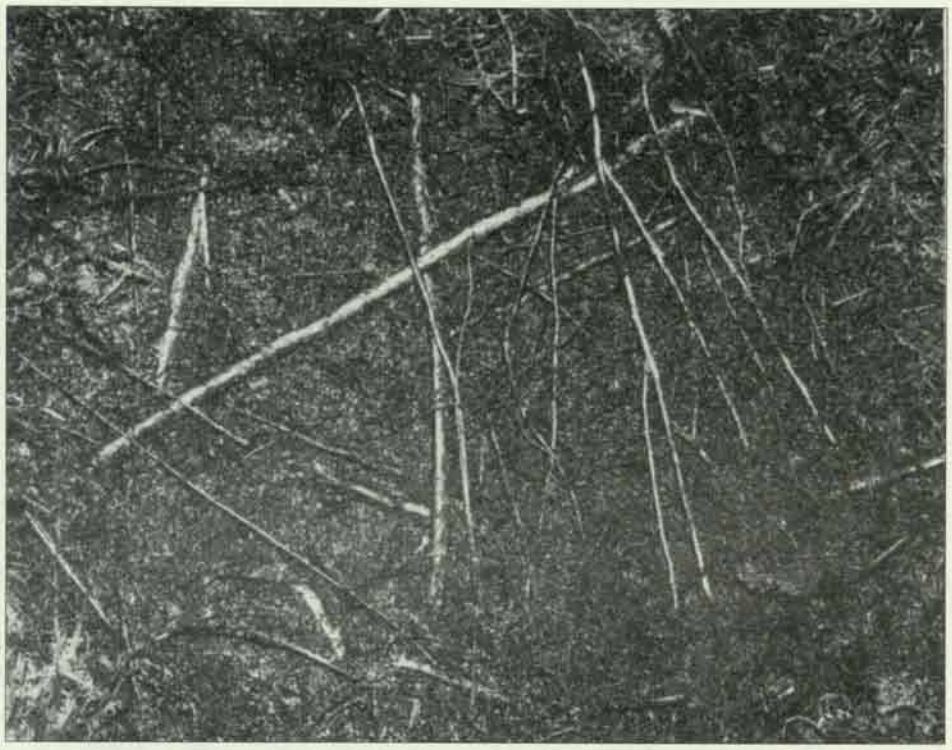
Spruce roots suitable for basketry can be gathered on many sites along the northwest coast, and are an important basket material among coastal peoples. In British Columbia, a notable location used by the Haida is located near Masset, on Graham Island, northernmost of the Queen Charlottes. Here the sandy soil favors production of excellent roots. Nearby Rose Spit is an example of a headland being extended by the deposition of sand by ocean waves and currents. As new land builds up, it is being colonized by Sitka spruce.

In Alaska, the best and most extensive locations are found along sandy beaches that are associated with dynamic changes in landform. This is most apparent in the northern part of Southeast Alaska, especially along the section of outside coast between Cross Sound/Icy Strait and Prince William Sound. Here the land is rebounding following large-scale melting of the great icefields and glaciers of the Fairweather and Saint Elias Mountains. The rapid emergence of land from the sea, the vast amounts of sand ground out by glaciers,

and the sorting and transport of sand by ocean waves and currents, combine to create new land surfaces that are soon colonized by Sitka spruce.

In contrast, farther south in Alaska, the land is relatively stable and is not undergoing rapid uplift. The coastline is rocky and clifflike and broken up by numerous bays, inlets, and straits. Sandy beaches are relatively rare. One need only look at a map to note the contrast in land forms between the broken coastline south of Cross Sound and the smooth coastline of nearly continuous beaches sweeping northwest to Prince William Sound.

A second notable feature of the section of coast from Cross Sound to Prince William Sound to Prince William Sound is the lack of cedar. Western red cedar is found northwestward only as far as Frederick Sound. Alaska cedar is common on Baranof, Chichagof, and adjacent islands as far north as Cross Sound, and again around Prince William Sound; however, with the exception of Lituya Bay, Alaska cedar is not plentiful. Along this section of coast, the abundance of spruce roots suitable for basketry, together with the lack of cedar as an alternative material, suggests that these ecological factors are important reasons why spruce root basketry came to be most closely associated with this area.



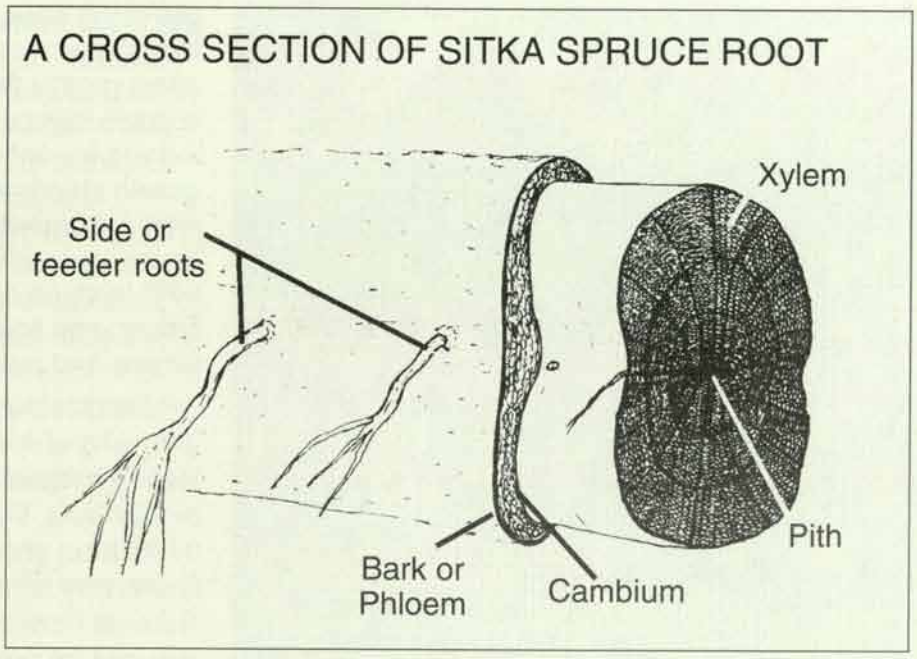
Surface moss has been removed to show typical surface roots of Sitka spruce growing at the sand-moss interface. Largest roots shown are about one-half inch in diameter.

STRUCTURE AND GROWTH OF ROOTS USED IN BASKETRY

Sitka spruce does not have a single large taproot; instead many smaller roots incline outward and downward in a diffuse pattern, penetrating up to five feet or more on well-drained sites. Where rooting is restricted by rock, poor drainage, or impervious soil layers, roots grow outward in a shallow plate-like pattern. Even on well-drained sites, a network of lateral surface roots develops. Roots are most numerous close to a tree's crown, and where trees grow close together, roots of adjacent trees are interwoven, making them very difficult to dig out. Where trees are more widely spaced, shallow vine-like roots with little taper extend for long distances beyond the trees. These are ideal roots for basketry.

Lateral surface roots grow in diameter and length each year. Growth in length occurs only at the root tip, in a zone of growth called a meristem. Here cells divide and enlarge, pushing ahead and renewing a tough root cap and extending the root by forming new cells. The tip of a lateral surface root is usually about 2.5mm (1/8 inch) in diameter. During the period of active growth, the first few inches are white, translucent, and easily broken or damaged. The root cap is blunt and appears to be equally fragile, yet it is able to worm its way between soil particles, through moss and around obstacles, its direction of growth guided by gravity, nutrients, and moisture. Behind this zone, a secondary meristem forms a cylinder of growing tissue or cambium, encircling a spongy pith. As cells divide, those toward the inside produce xylem or woody growth, those to the outside produce phloem* or bark, in the same way as does the cambium of the tree's stem. The cells or wood fibers that make up the xylem of the root are up to several millimeters in length, tapered at their ends, hollow, and inter-

connected by tiny perforations in their walls that allow them to conduct water and nutrients. The fibers are easily separated lengthwise, allowing the root to be split. These fibers are strong and their thin walls give the root great flexibility when wet. Tests have shown the average tensile strength of fresh, wet roots of Sitka spruce to be about 360 Kg/cm″, or about six-tenths that of red cedar. When roots become dry, tensile strength increases, but they become brittle and are easily broken.



Surface roots vary greatly in shape but tend to be generally oval in cross section. Diameter growth is greater on the upper and lower sides of roots, and the pith is flattened horizontally so that the root often resembles a dumb-bell or hourglass in cross section. In young roots, this eccentricity appears as an indentation or groove running along one or both sides of the root. Side branches occur along both sides of the root within the grooves along a midline coinciding with the horizontal pith. Debarking removes most of these side branches, leaving behind tiny stubs. In splitting the root for weaving, the groove and branch stubs mark the root's center and provide a convenient guide for making the first split.

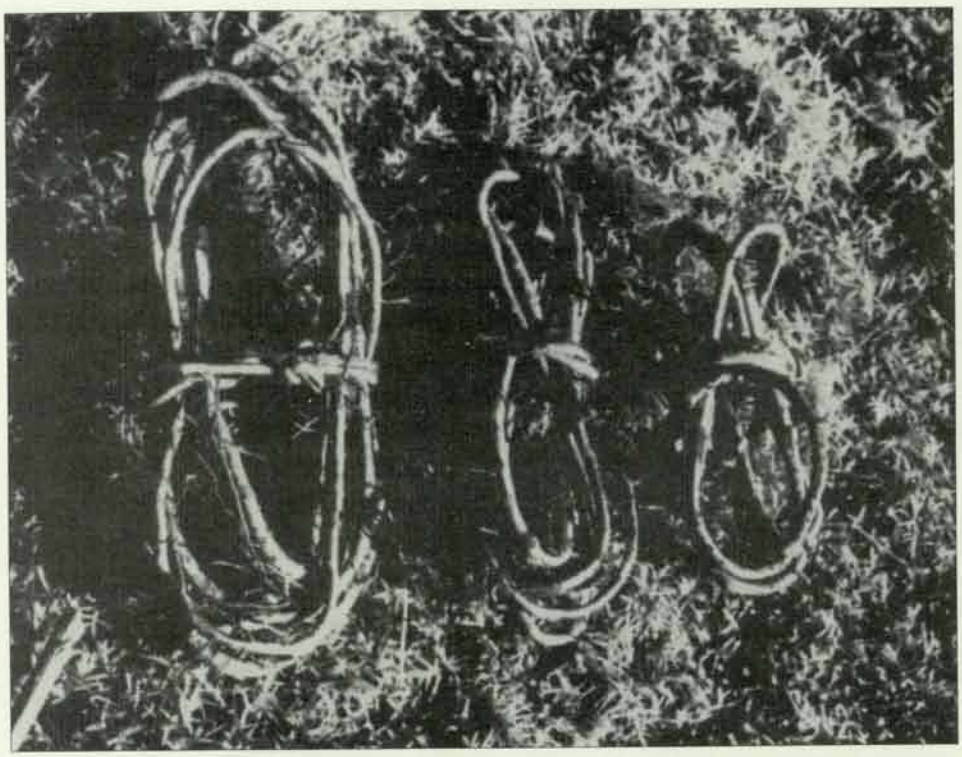
During the spring and early summer when growth is at its peak, fibers tend to have thin walls, but fibers produced late in the season, as growth slows, tend to have thicker walls. If a root is cut and viewed in cross section, these thick walled fibers appear to form a ring which can be used to estimate the root's age. Additional growth rings may also form during the growing season if root growth is interrupted by unfavorable growing conditions, and at times "annual" rings may fail to form entirely. Such anomalies make exact aging difficult. By counting rings at measured intervals along a root, I have found that average growth of surface roots is about two to three feet per year and that rates of five feet are not uncommon.

Side-branch-ing roots form in the zone of growth near the root tip, as tiny hair-like roots that extract moisture and nutrients from the soil. Most die and disappear within a short time and most of those that remain are small in comparison with the main lateral root. A few develop as lateral branching roots at irregular intervals of from 3 to 20 feet.

Injury to roots stimulates formation of new lateral roots. These roots, known as wound roots, originate in the callus tissue that develops at a wound or cut surface. Loss of the growing tip of a major lateral root may also trigger rapid growth and elongation of tiny feeder roots, to the extent that they begin to function as new laterals. It is therefore likely that gathering of roots causes many more to form, in the same way that pruning a tree results in the formation of new branches. Patterns of root regeneration differ by species, and little detailed information is available for Sitka spruce.

The question often comes up, will gathering of roots damage trees? The answer to date is — probably not, if roots are gathered in moderation. The chance of fungal infection of the broken root is small because vigorous young trees soon seal the wound with

* The term, "phloem" is used to demote the conducting system within the bark that conducts sugars, starches, and other complex chemicals produced in the leaves to the stem and roots for use by developing cells and for storage. The cells making up the phloem are more varied than those of the xylem, and include various types of "soft" cells as well as tough fibrous cells. The phloem cells of some tree species, for example, western red cedar, form strong strands that have many uses. This fibrous tissue has been known since early days as "bast" or "bass."

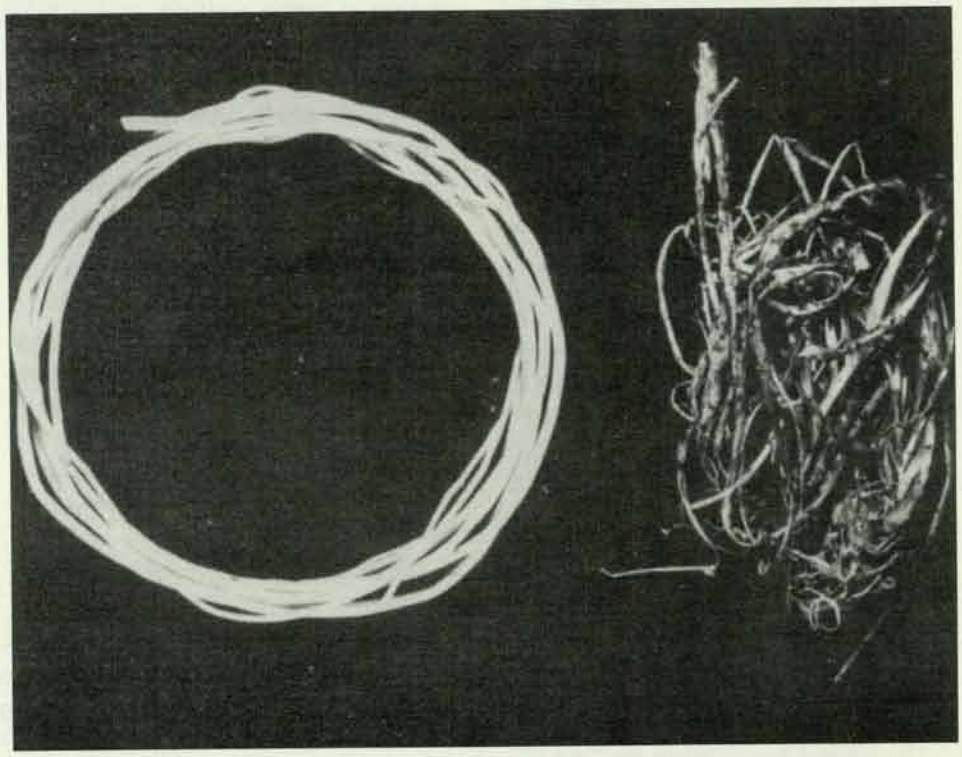


Freshly gathered roots of Sitka spruce. The largest coiled root is about one-third inch in diameter, outside the bark, and 13 feet long.

pitch. If infection does occur, it usually affects only a portion of root but does not reach the tree itself. Because only the small surface roots are taken, stability of the tree is not greatly reduced. Oral tradition passed down from the days when basket making was common, recognized a need to gather roots in moderation. Most modern weavers also feel a need for conservation and gather only a few roots at a time from any one tree, spacing visits several years apart. With the small demand for roots today, it appears unlikely that this gathering of roots will result in permanent damage to trees. If demand for roots increased greatly, excessive gathering could conceivably damage the more accessible trees.

Weavers sometimes complain of the scarcity of spruce roots for basketry, citing logging and restrictions on land use as causes. Logging and road building along streams, especially in estuarine situations could damage good root gathering sites. Logging done today, however, is not likely to affect greatly the availability of suitable spruce roots, as most logging is confined to dense old-growth stands whose roots are not ideal for basketry. Young, open-grown trees which produce the best roots do not yield good timber, and so are not sought for lumber and pulp.

Land ownership can limit gathering of roots, and it is a good idea to enquire before digging. On private land, the owner's permission should be obtained. Rules vary on public land. In the National Forests, a permit is not required for personal use except in some recreational areas. In Alaska State Parks, a free permit is required. In National Parks, rules prohibit gathering of roots. In general, most State and Federal land management agencies try to encourage Native arts by allowing use of traditional materials.



Spruce root and bark. The debarked root is ready to be split into strands for weaving.

In Southeast Alaska, especially the northern portion, the apparent scarcity of roots is likely the result of modern cultural habits. In times past, the seasonal dispersal of people to scattered camps, common travel by canoe, and a more relaxed sense of time made good root-producing sites more accessible. Today, the roots are still there, but are often not close to population centers. Unless one has the time and means to reach them, good spruce roots remain a scarce material.

A.S. Harris came to Alaska in 1955 after receiving his degree in forestry from the University of California, and since then has been active in forest research in coastal Alaska. In 1985, he retired from the Forestry Sciences Laboratory, Juneau, where he held the position of principal Research Silviculturist. His home is in Juneau.

Twined split spruce root basket. Alaska State Museum II-B-419.

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