ESTES' ARTEMISIA

JOHN REUTER

By HOWIE BROUNSTEIN

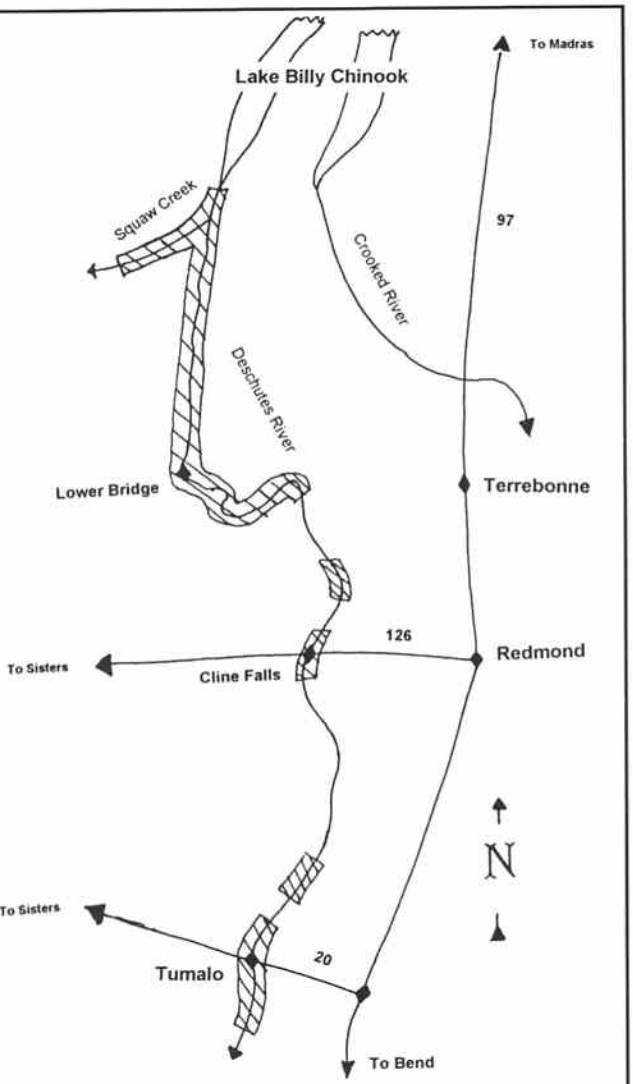
From the rim of the Deschutes canyon, the Three Sisters and other snow-capped peaks loom on the western horizon. The scent of desert shrubs fills my lungs. Looking across the rim I see circling ravens. Hundreds of feet below me, along the Deschutes River, is the silvery white hue of the plant I am seeking. Slowly I work my way down around large boulders covered with crustose lichens and past bones of an unfortunate deer who stepped too close to the edge during the winter. I finally reach the bottom of the canyon. The cries of coyotes echo in the distance as I find a trail through the thick bushes, carefully avoiding the stinging nettle, *Urtica dioica*. When the ground becomes moist and the river's edge is close enough to touch, I can smell the endemic Estes' artemisia.

Estes' artemisia, *Artemisia ludoviciana* Nutt. ssp. *estesii nom. ined.*, is an herbaceous plant in the sunflower family (Asteraceae). It is a relative of the common desert sagebrushes, *Artemisia tridentata* and *A. tripartata*, armoatic shrubs ubiquitous in desert ecosystems of the American West. Wormwood, *Artemisia absinthium*, is another aromatic shrub of the genus infamous when brewed into the narcotic alcoholic liquor, absinthe. Sagewort and mugwort are the common names for the herbaceous members of the genus. "Wort" is an archaic term for any herbaceous plant. (*Artemisia vulgaris* was the mainstay for brewing beer in medieval Europe, hence the name, mug plant.) The leaves of the Eurasian dragon sagewort, *Artemisia dranunculus*, provide the household herb, tarragon. According to Hitchcock and Cronquist, there are greater than one hundred species of artemisia found throughout the northern hemisphere and South America.

Estes' artemisia is a sweet smelling herb found only on the Deschutes River of Central Oregon's high desert steppes. It is on the Oregon Natural Heritage Program List 1 of taxa threatened or endangered throughout their range. Previously, the only known vouchered location was from Dr. James Estes' 1966 sighting of a small population near a falls on the Deschutes River east of Redmond.

It seemed reasonable that the achenes of the plant could be spread by water; so in 1990 I started searching the Deschutes River near the original population and a few adjacent tributary creeks for additional stands. I found that subspecies *estesii* was the most common artemisia along some stretches of the Deschutes. The largest of these populations was located near Lower Bridge. This spot had easy access to the river, so I started the study area there, moving both up and down stream until populations of artemisia were no longer found, or the canyon became inaccessible. From 1990 until 1994 students would descend into the study area with me, measuring plots, counting stems, and recording associations. We found significant numbers of this local endemic only on the Deschutes River. Population sighting reports are filed in the Oregon Natural Heritage Program's database of sensitive plants.

Identifying herbaceous artemisias can require a discerning eye. The different species and subspecies are extremely variable and interbreed freely. Plants can exhibit leaf shape and size, plant height, pubescence, and aroma of neighboring species. New spring and fall growth is usually atypical, appearing to be of a different species. This is not a problem in many areas of California, where there is often one species of herbaceous artemisia in a given area. On the Columbia River Gorge, on the other hand, numerous species can occur along a single



Approximate *Artemisia ludoviciana* ssp. *estesii* Study Area. Subspecies *estesii* was not found at all these sites. Map not to scale.

river drainage. The key to deciphering this problem is to look at many mature plants in a stand during flowering and generalize from the most common characteristics. If you find more than one generalized type, for example many tall artemisias with a medium amount of leaf lobing, and many short artemisias with generally very lobed leaves, then there may be two types of artemisias in one stand.

At present, my students and I have located millions of stems of this plant over 20.5 miles of riverbank, and I can come to some fairly reliable generalizations, especially about habitat. The relationship to the high water mark can be an important identifying characteristic with herbaceous artemisias. At the original site, the habitat description is "gravelly areas next to streams, *above* the high water mark.. (Hopkins and Garrett 1990). I have seen this habitat described for subspecies *estesii* in a number of sources. Although I have often noticed small subpopulations around falls and on isolated rock outcrops at the river's edge, I consider this the fringe of its habitat. These scattered populations of seventy-five stems or fewer are

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common in the study area, but account for no more than five percent of the population. The large, thick stands (often 20 feet or more in diameter) always occur on planar to slightly undulating, moist riverbanks *below* the high water mark. These very dense stands can contain as many as 65,000 stems in a 300 square foot plot. In wet years this perennial can reach heights of over 12 feet, and taking population counts in these large stands can be very pleasant as the air is laden with the plants' fragrance. Similar herbaceous artemisias are said to promote dreams in folklore. Plants at these sites often form thick rhizomatous mats that appear to interconnect the numerous stems. I have found that the rhizomes smell stronger than the aboveground parts. This field characteristic helped me to distinguish subspecies *estesii* from other *A. ludoviciana* subspecies found on the Deschutes.

The plant associations are also very consistent. The herb layer generally consists of bittersweet nightshade, *Solanum dulcamara*, the escaped European yellow iris, *Iris pseudacorus*, and the cattail, *Typha latifolia*. Occasionally the stands are solid artemisia with little herbaceous competition. The shrub layer consists of spirea and willow. These shrubs are not usually in the stand itself, but often between subspecies *estesii* and the high water mark. This makes locating and counting the plant very difficult at times, since these shrubs have a tendency to becomes very thick. The canyon wall is over 500 feet high in some places, and often boulders from the cliff obscure any trail among these shrubs. The best way to get an accurate count of this artemisia is by boat from the river itself. My students and I did our searching by foot, so the population counts may be lower than the actual numbers.

In late September the plants on the river begin to die back. Estes' artemisia will often start some fall vegetative growth. Most herbaceous artemisias have a distinctive conspicuously green leaf color with a white tomentose pubescence. This creates the characteristic silvery green color when seen from a distance. The senescent stems of this plant also retain this unique color. In the fall, it may be difficult to positively identify which artemisia it is, but if one is sure of the subspecies, it is a good time of year to see populations. Artemisia patches stand out, easily seen among the other vegetation. It is even possible in some areas to walk above the river basin at the base of the cliffs, or on the rim itself, and spy the populations with binoculars. Searching for autumn populations in this manner is even easier than searching by boat. At this time of year the water level is at its lowest. In some places

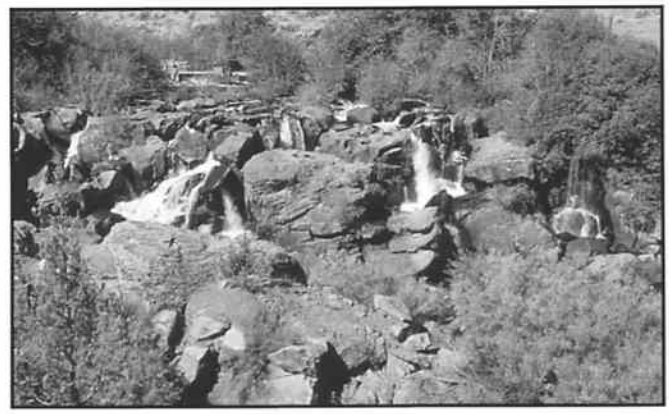
it may be possible to walk along the river's edge, or hop from rock to rock, and gain entry to the more inaccessible stands.

During this field work, the history of the study area often left an impression on us. Old deserted barns and roads which today seem to lead nowhere remain from decades ago. Obsidian arrowheads and faded rock paintings hint that an even more ancient group of people had wandered this basin before us. We see the ruins of stone walls near the canyon rim. Hunters from a time long past crouched behind these walls to hide from approaching deer herds. These archaeological deer blinds assure me that the deer populations wintered here long ago, as they do today. Carefully working our way down the steep canyon slopes towards the cliff bottom, the colored stains, numerous caves, and rock outcrops form odd shapes on the wall across from us. This reminds me of how I watched the shapes of clouds as a young child. We see images of faces, animals, giant creeping rhizomes, and everything we can imagine on the rock walls; our group is distracted from population counts.

The Cascade Mountain range runs north and south dividing Oregon geographically and floristically. Much of the west side of the Cascades is a temperate rainforest, dominated by Pacific hemlock, *Tsuga heterophylla*, and Douglas fir, *Pseudotsuga menziesii*. In that ecosystem, Douglas's mugwort, *Artemisia douglasiana*, is the most common herbaceous artemisia. The east side of the Cascades is of course much drier. In our study area the Deschutes River runs through sagebrush steppes consisting of mixed junipers, *Juniperus* sp., and sagebrush, *Artemisia tridentata*. The most common herbaceous artemisia on this river is *Artemisia ludoviciana*. The Columbia River forms the border of Oregon and Washington at the bottom of a scenic gorge. This gorge is ecologically unique with many sensitive endemic plants. The Columbia also provides a pathway for plant species movement between the ecological "halves" of the state. Here the range of *Artemisia douglasiana* overlaps with numerous other species of artemisia.

When I originally keyed out Estes' artemisia in Hitchcock's *Flora of the Pacific Northwest*, it appeared to be a cross between *A. douglasiana* (the common western Cascade species) and *A. ludoviciana* (the common eastern Cascade species). Hitchcock mentions that the *Artemisia douglasiana* passes into the *A. ludoviciana* ssp. *latiloba*, meaning that characteristics intergrade at the region of contact. After determining the true name of the plant, I realized that the *A. ludoviciana* ssp. *estesii* had more characteristics that matched the *A. douglasiana* than the ssp. *latiloba*. At that point I assumed that the two plants (*A. douglasiana* and subspecies *estesii*) must be closely related, and that subspecies *estesii* was probably a cross between the eastern and western artemisias as Hitchcock implied.

Strangely enough these two plants are the farthest apart of all northwestern species in their chromosomal makeup. Subspecies *estesii* is most closely related chromosomally to the coastal mugwort, *A. suksdorfii*. This proves again that our plant classification system is artificial and only approximates reality. Taxonomists strive to order the multitude of plantlife into a system that reflects evolutionary reality, yet our ideas of that reality are constantly changing. The relationships among different plants are "real," but the keys seldom are. New floras like *The Jepson Manual* and *The Flora of North America North of Mexico* rename and reorder families, genera, and species to incorporate current research, but it is still a forced arrangement. Two species may be close to each other in a taxonomic key, but this does not necessarily reflect a true biological or evolutionary relationship as most keys are artificial.



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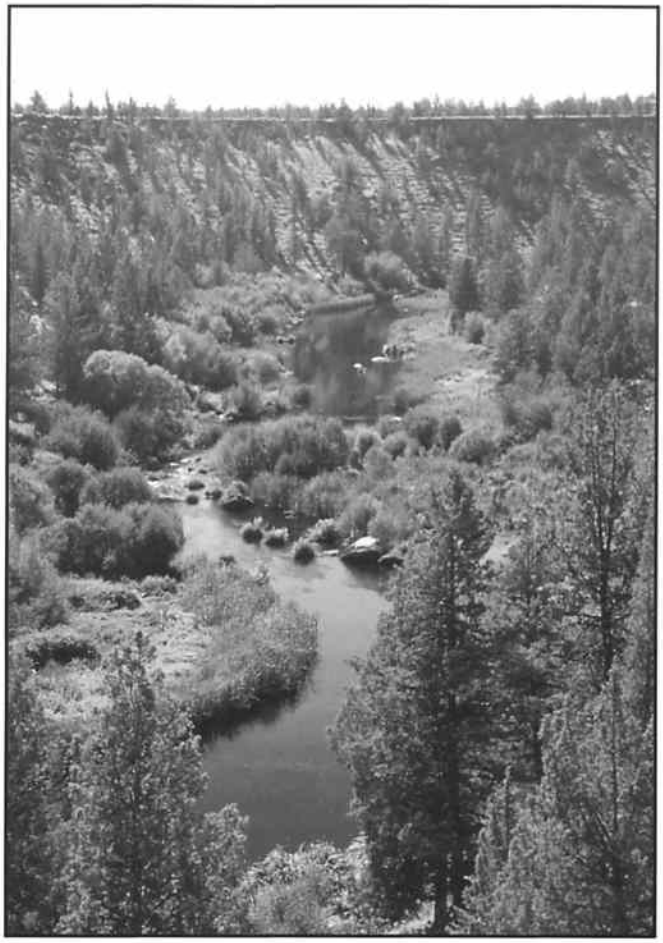
The genetic makeup of subspecies *estesii* and its relationship to other artemisia species was the focus for the doctoral thesis of Dr. James Estes at Oregon State University (1968). It appears that both *A. suksdorfii* and subspecies *estesii* are diploids, having two sets of chromosomes. *A. ludoviciana* is tetraploid, having four sets of chromosomes, and *A douglasiana* is hexaploid, having six sets of chromosomes. Clausen, Keck, and Hiesey (1940) believed that *A. douglasiana* (2n=27, west side) was a hybrid between *A. ludoviciana* (2n=18, east side) and *A. suksdorfii* (2n=9, coastal). Unfortunately, since many of the herbaceous species of artemisia have compatible chromosomes that pair up regularly, this can be quite tricky to confirm or disprove by chromosomal analysis alone. Dr. Estes (1968) writes, "Evidence was gathered in this study... that casts doubt on Clausen, Keck, and Heisey's explanation of the origin of *A. douglasiana*." One of these pieces of evidence was, "The discovery of another diploid, (subspecies *estesii*), that is closely related to *A. suksdorfii* but that varies from it in the direction of *A. douglasiana*."

With the easy interchange of chromosomes, it is biologically significant to find a diploid subspecies in an area where the other races are tetraploid. How did this arrangement evolve? Is there some present reproductive advantage to this arrangement? Plants with more than two sets of chromosomes, polyploids, are believed to have evolved from diploid plants. When a polyploid is formed from diploids that have different habitats, often the polyploid will begin to compete with the original diploids in their own habitats. The polyploid may also occupy sites that are intermediate between the two parents, and often extend into ecological niches that neither parent can survive in.

Stebbins (1956) described the possible evolution of a polyploid complex, such as artemisia. At first there are polyploids and many successful diploid taxa. Later the polyploids are successful and common, and the diploids are mostly extinct, limited in range to local endemics. Eventually the diploids become extinct, and secondary series of polyploids with a different chromosome number arises. Finally these polyploids evolve into taxa with very high chromosome numbers.

Artemisias in the Northwest consist of numerous polyploids with only a handful of diploid taxa. Subspecies *estesii* is a geographically isolated endemic with a narrow range. Estes concludes that more research is necessary, "However it is quite possible that the two diploid taxa, *A. suksdorfii* and (subspecies *estesii*), are relicts of a once larger, continuous population in the Northwest." Should other diploid races similar to this one be found on river drainages not connected to the Deschutes, it would raise interesting evolutionary questions for herbaceous artemisias. The stage is set for further research concerning artemisias in Central Oregon.



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George Sturtz is an artemisia farmer in the Willamette Valley researching alternative oil crops. He has analyzed the constituents from the oils of subspecies *estesii* and other native species of this genus. Subspecies *estesii* oil is unique among the Northwest artemisias. It is very high in thujones, comparable to the oil from the European *A. absinthium*. All the other native herbaceous artemisias have insignificant amounts of thujones, except for *A. suksdorfii* which has a significant amount, though much less than subspecies *estesii*. This further confirms the close relationship of the two diploid taxa. This may also suggest that subspecies *estesii* is stronger than other native artemisias physiologically as a narcotic, antifungal, anti-bacterial, anti-parasitic, and insect repellent.

Estes' artemisia is not under legal protection despite its current classification because its name, proposed by Dr. Kenton Chambers of Oregon State University, is as yet unpublished.

The study area is undergoing drastic transformations. River access across private land is being restricted as development occurs. The largest verified population of Estes' artemisia is the site of a new county park, and trails are already replacing some stands. A portion of the river is set aside for a Wilderness Study Area; however, this designation could change at any time if local policies change. The dry weather and irrigation laws also have an impact on these riparian plants. Property owners lose their water rights unless they can demonstrate via aerial photographs that they have used their water to make the desert green. Many owners who have no wish to farm plant cover crops to protect their investment. This waste of resources together with the 1994 drought caused the river in the study area to stop flowing in August, and fill with algae. Estes' artemisia generally grows shoulder high and above when blooming; however, in 1994 it averaged knee high.

Now that subspecies *estesii* has been shown to be more than a genetic anomaly from a single location, and with conservation issues at hand, Dr. Chambers has agreed to formally publish his proposed name. The description of its morphological characteristics will be a difficult task with its extreme variability. This is not a problem along the Deschutes River, but will become very important when identifying artemisias in other parts of Oregon. Unfortunately for field workers, a chromosome count is the most accurate means of identification.

This spring, when *Iris pseudacorus* shows its yellow flowers in great profusion along the banks of the Deschutes, you may find me squatting around the high water mark. I'll be taking in the fragrance, pondering how every river has its scent. This one, rising from the Estes' artemisia, is indeed unique.

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