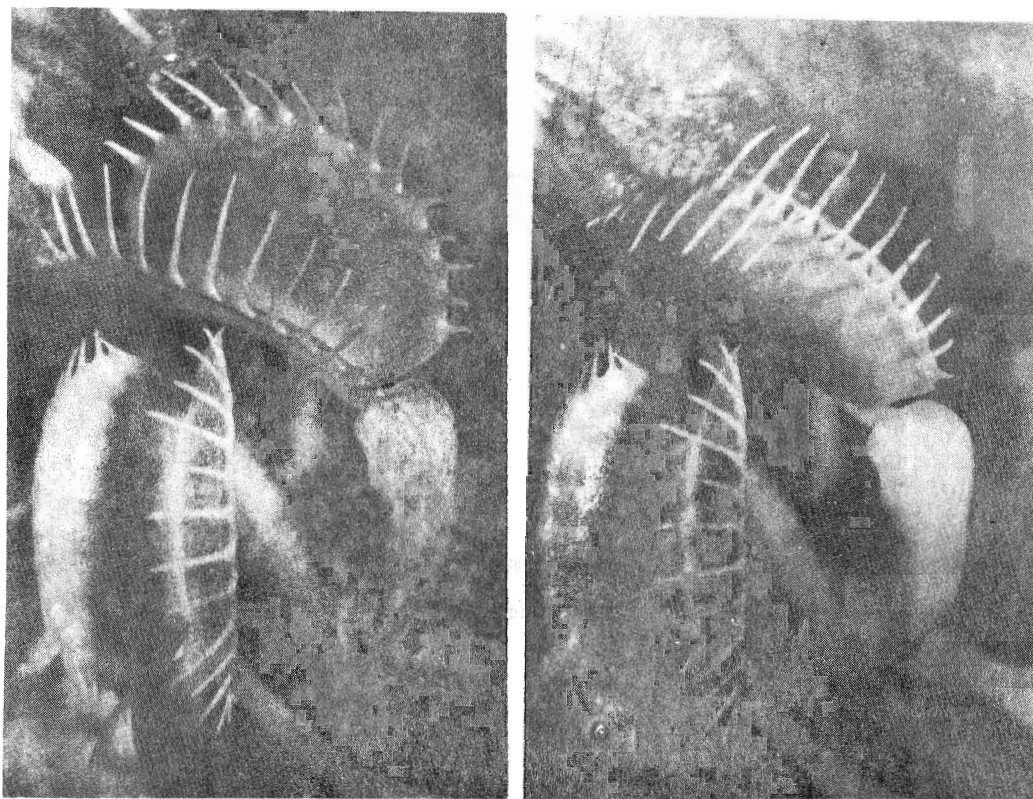


pushing against the inner epidermis. This would cause the slight increase in length of the outer surface of the lobe needed to flip it inward. Data gathered earlier by William Brown in 1916\*\* indicates that the inner surface of Dionaea does not shrink significantly during the closure but that parts of the outer surface of the lobe expand as much as 8% in length. Although Brown interpreted his data in another way it is consistent with Asheda's ideas about how the trap moves. Although Asheda's papers are well reviewed in Lloyd's monograph, they are in English and it is worth taking the time to read the original work.

It would appear that the flytrap closes by a loss of water from cells on its inner surface which allows the cells on its outer surface to expand to their full size resulting in a slight curvature of the lobe which is able to flip it from its outward curving position to an inward curving position. The result of this movement is the creation of a prison with a barred opening that prevents the escape of the creature ensnared within. This trapping mechanism bears little resemblance to a bear trap if all the particulars are considered.

\* J. Asheda: Mem. Coll. Sci., Kyoto Imp. Univ., Ser. B. 9, 141-244 (1934)

\*\* W. Brown: Amer. J. Bot. 3 68-90 (1916)



Leaves of Dionaea x 4. When the trap is open the outer surface of its lobes are concave. When the trap closes the outer surface of its lobes are convex. The movement occurs in the lobes not in the midrib. Photographs were taken with equipment which was kindly provided by Dr. Natalie W. Uhl of the L. H. Bailey Hortorium, Cornell University.

#### THE DISTRIBUTION OF DARLINGTONIA CALIFORNICA

by Larry DeBuhr

Mr. Ziemer in Volume II, No. 2 of CPN wrote a very interesting note and discussed the local ecological conditions at several Darlingtonia bogs in Del Norte Co., California. I would like, as a follow-up to Mr. Ziemer's note, to discuss the total distribution of Darlingtonia. As background information for a study of various aspects of the biology of Darlingtonia, I felt it was important to familiarize myself with the total distribution of the species. I did this by studying labels on specimens of Darlingtonia that have been deposited in various herbaria, particularly those in California and Oregon. Some of the older collections lacked detailed information, and the exact location was not indicated.

Space restrictions do not allow me to list the locations of the Darlingtonia bogs, but I will supply this information to anyone who wants the details. Figure 1 is a map of the known distribution of Darlingtonia californica. The dots do not, in every case, represent a single station, but may represent several close locations as in Plumas and Nevada Counties, the two dots farthest south in California.

Darlingtonia is a long-lived, perennial plant that vegetatively reproduces by the production of a single, small plant at the end of each of a number of stolons. The abundance and the density of Darlingtonia in a bog attests to the importance of vegetative reproduction in the maintenance of the species. The long-lived nature of the plant and the high rate of vegetative reproduction are indications of the stability of the individual populations, and the stability of a population is an advantage when exacting ecological and geological conditions are required for growth. A Darlingtonia bog can be hundreds, even thousands, of years old, and will continue to exist until the conditions for growth are altered, either by natural means (long-term drought, volcanic or other geological activities, etc.) or by man-caused destruction. Certainly, Darlingtonia does not grow in every area that could sustain a bog. But, with time, a seed blown by the wind, carried by an animal, or washed downstream will land in a suitable habitat and a new bog will develop. Over long periods of time, thousands of years, the locations of Darlingtonia bogs will shift, but viewed in a narrow time period (recorded botanical history) the locations of the bogs remain unchanged.

In California, Darlingtonia occurs in the Sierra Nevada in Plumas and Nevada Counties. As yet, Darlingtonia has not been found in Sierra County, between Plumas and Nevada Counties. Farther northwest in the Klamath Mountains many populations occur in southwest Siskiyou, northwest Shasta, and northeast Trinity Counties and in northwest California in Del Norte and Siskiyou Counties. In Oregon there are locations in the Klamath Mountains in Josephine and Curry Counties, along the coast in Coos, Lane, and Lincoln, and Tillamook Counties, and inland in Yamhill, Linn, and Lincoln Counties. Specimens collected from three localities, the first from the west side of MacKenzie Pass in Lane County, the second from Linn County near Sutter Lake, and the third from a slough near McMinnville in Yamhill County, are of interest since they indicate Darlingtonia might be found quite a distance inland in Oregon. Only one specimen has been collected at each of these locations, and I have not been able to visit any of these locations to check the accuracy of the records. Verifications of the existence of Darlingtonia at these three localities is definitely needed.

The locations in the Klamath Mountains are concentrated in two areas, one in Siskiyou, Shasta, and Trinity Counties and the other in Del Norte and Siskiyou Counties and in Josephine and Curry Counties in Oregon. These two areas are geologically rich in ultramafic (ultrabasic) rocks (see Irwin, W.P., 1966, Geology of the Klamath Mountains Province,

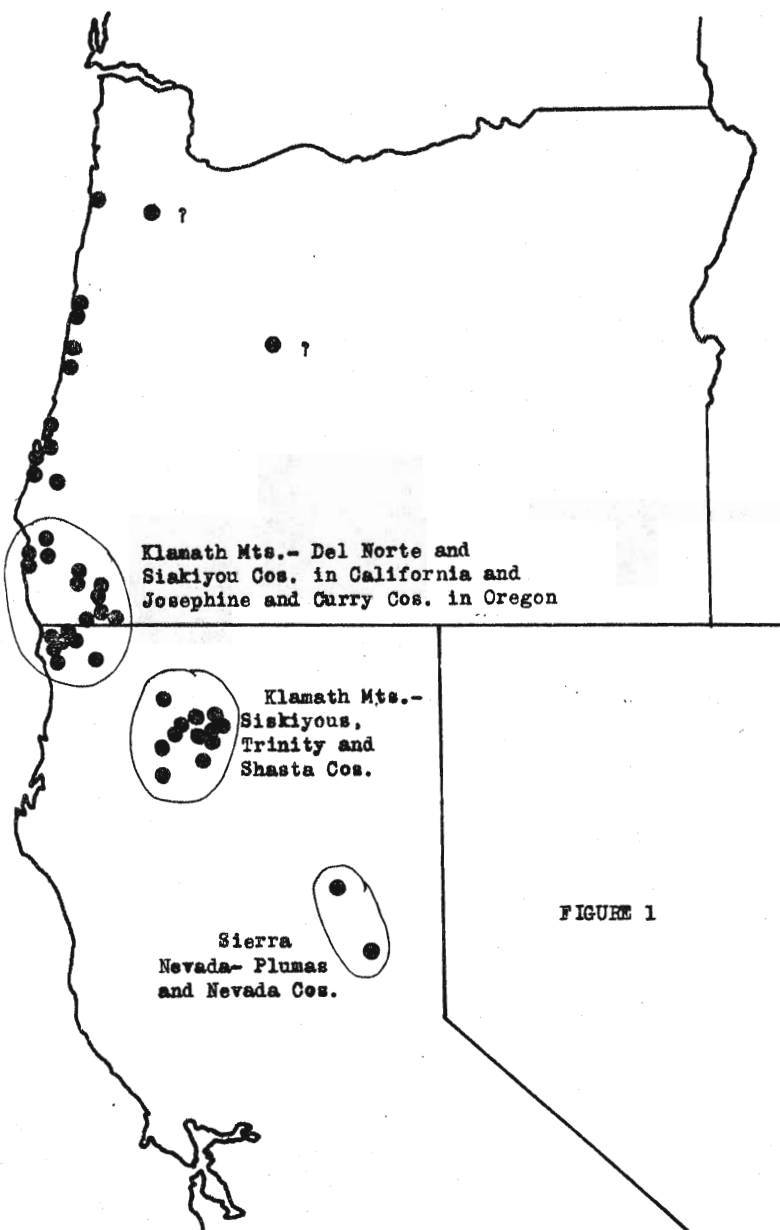


FIGURE 1

pages 19-38 in Geology of Northern California, ed. by E. H. Bailey, California Division of Mines and Geology Bulletin 190, San Francisco) which contain serpentine. In the Sierra Nevada, the locations in Plumas and Nevada Counties are associated with a major serpentine-belt fault bordering on a layer of greenstone. (See McMath, V.E., Geology of the Taylorsville Area, Northern Sierra Nevada, pages 173-183 in Geology of Northern California.) Greenstone consists of altered basic igneous rocks which contain serpentine minerals. I have not seen a geological map of coastal Oregon and do not know if any serpentine occurs in that area. I would not be surprised if the mineral composition of the soil along coastal Oregon is very similar to the composition of serpentine soils.

Whittaker (The vegetation response to serpentine soils. Ecology 35:275-288, 1954) listed Darlingtonia as a familiar species in bogs and marshes on serpentine soil. Walker (Factors effecting plant growth on serpentine soils. Ecology 35:259-266, 1954) and Kruckeberg (Plant species in relation to serpentine soil. Ecology 35: 267-274, 1954) concluded that plants growing well on a serpentine area, above all else, must tolerate low levels of calcium in the soil. In addition, high magnesium, nickel, and chromium, low available molybdenum and major nutrients (nitrogen and phosphorus), and unfavorable physical aspects of the shallow soil must be tolerated, depending on the particular location of the area. An important factor involved in the strong correlation between the distribution of Darlingtonia and the occurrence of serpentine is the low soil fertility that is characteristic of serpentine. Darlingtonia can tolerate the conditions that accompany serpentine soils.

There are other features, in addition to the geological correlations, that regulate the distribution of Darlingtonia. The main factor is the availability of water. The bogs are all located in areas that have a continuous or near continuous supply of running water from upslope seepage. Few bogs that I have visited had standing water. An often overlooked geological feature is the local rock formations which must allow seepage to occur. Related to the availability of water are correlations in rainfall. The mean annual precipitation in the Sierra Nevada and the Klamath Mountains in the area where Darlingtonia grows is more than 40 inches and commonly exceeds 60 inches (Oakeshott, G.B., 1971, California's Changing Landscape, McGraw-Hill, New York) and in coastal Oregon approaches and exceeds 80 inches. Temperature does not appear to be a critical factor in the distribution of the species. Variations in temperature occur across the range of Darlingtonia. The plants grow well both in areas that have subfreezing temperatures as well as along the much milder coast. Certainly excessive cold or heat would be detrimental to the plants.

In California two large gaps occur in the distribution of this species. In the Klamath Mountains the break between Del Norte-Siskiyou Counties and Shasta-Siskiyou-Trinity Counties can be explained in several ways. Possibly a lack of suitable habitat is involved. However, there are areas that contain ultramafic rocks and the whole region receives sufficient rainfall. It is also possible that this area has not been sufficiently collected and that populations of Darlingtonia remain to be discovered. Of more significance is the break between the Klamath Mountains and Plumas County. Geologically the area is mainly volcanic in origin and relatively recent. (See MacDonald, G.A., 1966, Geology of the Cascade Range and Modoc Plateau, pages 65-96 in Geology of Northern California.) The rocks do not contain serpentine, and much of the area receives less than 20 inches of rain on a yearly average. Lack of available habitat is presumably the reason for this gap.

In conclusion, I would like to mention briefly a few points concerning the conservation of Darlingtonia. Several factors favor the opinion that the Darlingtonia bogs are in no immediate or foreseeable danger. Darlingtonia grows on serpentine soils that have low soil fertility, and subsequently no value as farm land. The bogs are often associated with rocky hillsides that make farming and grazing unlikely. Trees growing on serpentine are often stunted and are not sought after as timber. The absence of valuable mineral ores in serpentines make the possibility of mining remote. There are two areas of concern. Large-scale commercial harvesting of this species could decimate a population of Darlingtonia. However, without knowing where or how the plants are gathered, it is difficult to evaluate the total effect of commercial collecting. Damage to a bog by visitors is also a possibility. Excessive trampling in bogs results in crushed plants, especially the smaller Droseras and Pinguiculas, as well as in damage to the bog habitat. Care must be taken when visiting any of our natural bog areas to see that overuse does not result.

#### FIELD OBSERVATIONS OF DROSERA ARCTURI AND D. SPATHULATA IN NEW ZEALAND

by Peter Muller

One Saturday morning right after I had just received my license to drive, my father and I set out for Lewis Pass on the South Island. It took a while to get there but when we did arrive, we tried to follow instructions given to us by the director of the Botanic Gardens and we finally had to resort to asking where we might find the local sphagnum bog. Unfortunately, this fellow was not familiar with the name of the moss but he did happen to mention a small plant which he and his friends called "the fly-catching plant." It became immediately apparent to me that the plant he was describing was Drosera. He