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NOTES ON SOME ROOTING CHARACTERISTICS OF ANTELOPE BITTERBRUSH

by

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Information on the root habits of native forage species is limited and the need for such data is keenly appreciated by most range managers. The lack of such information results mainly from the time and care required to obtain it. Consequently, when 24 antelope bitterbrush (Purshia tridentata) root systems were excavated during a study of seasonal carbohydrate reserves, 2 typical root systems were line diagramed and some of the more obvious rooting characteristics noted as items of general interest.

Holman and Robbins[1/] state that although the form of a root system is greatly influenced by different soil conditions, it is still to a considerable degree an inherent characteristic of the species. This viewpoint is apparently also shared by Dittmer,[2/] who concluded after examining 19 different angiosperm species from 14 families that heredity is more important than edaphic conditions in

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1/ Holman, Richard M., and Robbins, Wilfred W. A textbook of general botany. Ed. 4, 664 pp., illus. New York. 1947.

2/ Dittmer, H. J. A comparative study of the number and length of roots produced in nineteen angiosperm species. Bot. Gaz. 109: 354-358. 1948.

determining root type and degree of branching. Thus, although the following observations are fragmentary and severely restricted by being confined to a single soil situation, they should still be of interest.

DESCRIPTION AND TECHNIQUES

The observations were made along the lower part of a moderately sloping, south-facing drainage near Entiat, Wash., at an elevation of approximately 1,400 feet. The soils are medium-textured glacial drift overlying granite, with deep, relatively rock-free profiles and good internal drainage. When dry, however, they become quite hard. Approximately 2 inches of the 20- to 25-inch total annual precipitation falls during the growing season.

The vegetation consisted of an open stand of ponderosa pine with an understory of antelope bitterbrush and such herbaceous species as arrowleaf balsamroot (Balsamorhiza sagittata), hawkweed (Hieracium sp.), western yarrow (Achillea lanulosa), hawksbeard (Crepis sp.), bearded bluebunch wheatgrass (Agropyron spicatum), cheatgrass brome (Bromus tectorum), and sedges (Carex spp.).

Individual root systems were exposed by trenching below the plant and working carefully into the rooting zone with pointed screwdrivers. The hydraulic method was initially considered but quickly found impractical due to the deep penetration and extreme fragility of the roots. It is of interest to note that antelope bitterbrush roots were easily distinguished from the roots of associated species by their appearance and unique bitter taste.

OBSERVATIONS

Figures 1 and 2 show two typical examples of antelope bitterbrush root systems observed in the study area. Counts of annual growth rings indicate each of these plants is between 25 and 30 years of age. These plants had meandering but rather simple fibrous root systems with strong vertical growth and moderate lateral spread. In general, the primary roots extended downward one to several feet before separating into two and sometimes three major secondaries. Numerous other smaller secondary and adventitious roots also

occurred along the primary extension. Concentration of these roots near the soil surface seemingly allowed the plants to take advantage of fortuitous growing season precipitation which failed to percolate deep enough to be utilized by the main secondary system. Adventitious branching was rather restricted along main secondary roots and when present tended to be more or less associated with finer textured soil strata. Overall rooting depth would undoubtedly vary considerably between soils, but for the situations sampled penetrations of 15 to 18 feet were not uncommon.

Reverse geotropism was noted in a surprisingly large percentage of roots. In 6 of the 24 plants examined the degree of reaction was evidenced by strong upward curvatures of from 18 to 37 inches. The reaction occurred to a lesser extent in more than one-half of the roots excavated. Figure 2 illustrates a typical example of this type of root growth. An explanation for this reverse geotropism was not readily apparent, but some evidence suggested that it could have been stimulated by a soil-moisture gradient. There was an apparent tendency for roots to tap probable soil moisture accumulations under the few large solitary rocks which occurred throughout the soil profile. The concentration of roots along the finer textured soil strata previously mentioned was also suggestive.

If antelope bitterbrush roots are capable of responding to soil-moisture gradient by overcoming the normal geotropic habit in the manner suggested above, it could be an important adaptive characteristic for growth on droughty sites. The fact that such hydrotropic tendencies rarely occur under field conditions[3/] makes the possibility all the more intriguing. Limited laboratory tests were made to determine the effect of a sharp soil-moisture gradient on the direction of root elongation--i.e., hydrotropic response in antelope bitterbrush seedlings--but the results were inconclusive.

[3/] Loomis, W. E., and Ewan, L. M. Hydrotropic responses of roots in soil. Bot. Gaz. 97: 728-743. 1936.

Kramer, Paul J. Plant and soil water relationships. 347 pp., illus. New York. 1949.

Meyer, Bernard S., and Anderson, Donald B. Plant physiology. Ed. 2, 784 pp., illus. New York. 1952.

Interlacing between root systems of adjacent antelope bitterbrush shrubs was limited and no cases of root grafting were observed. However, antelope bitterbrush roots commonly entered

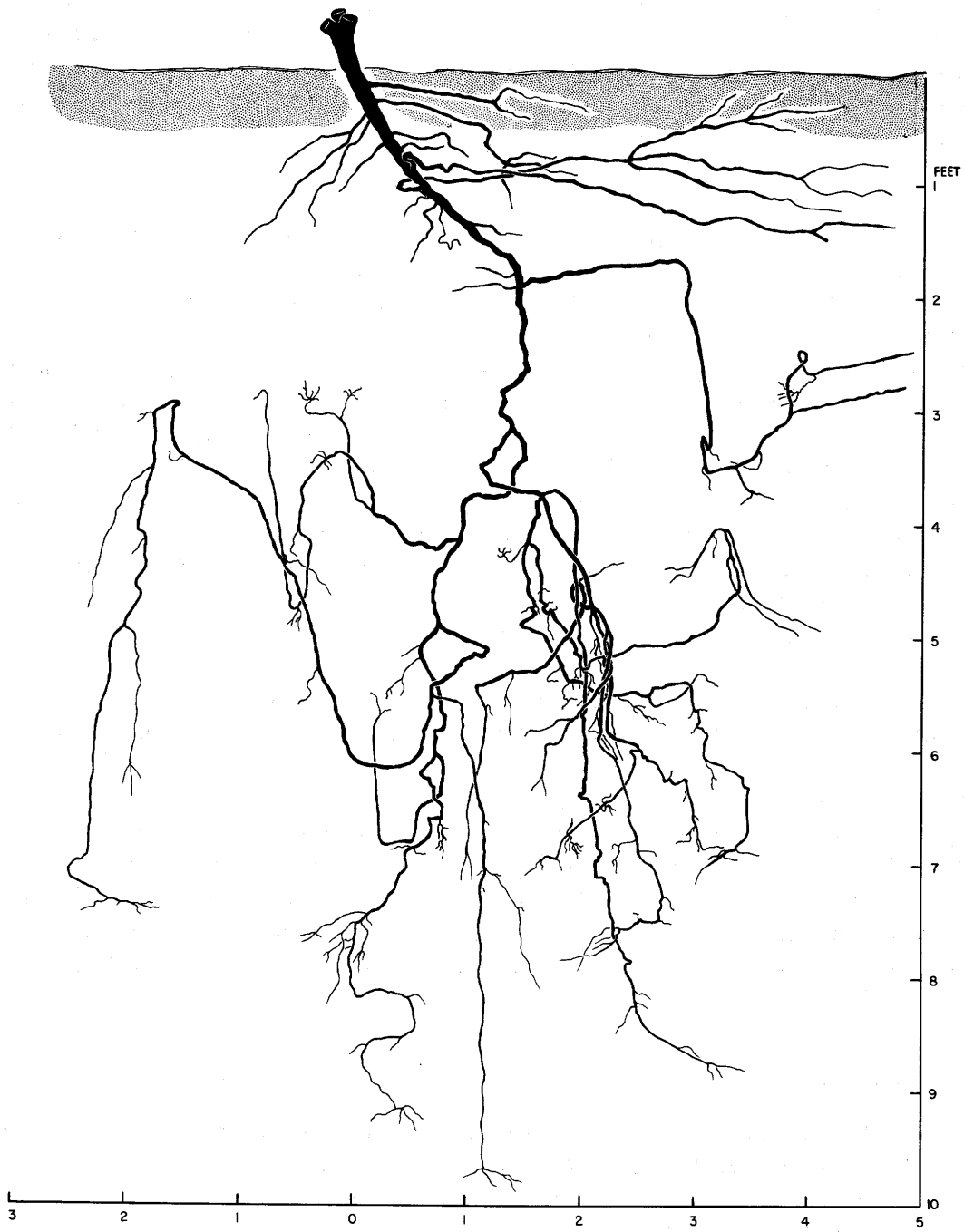

Figure 1.--Root system of an antelope bitterbrush plant between 25 and 30 years old, with strong upward curvatures of roots.

the dead and decaying roots of both bitterbrush and other species, such as ponderosa pine, and grew in and along them for distances of several feet.

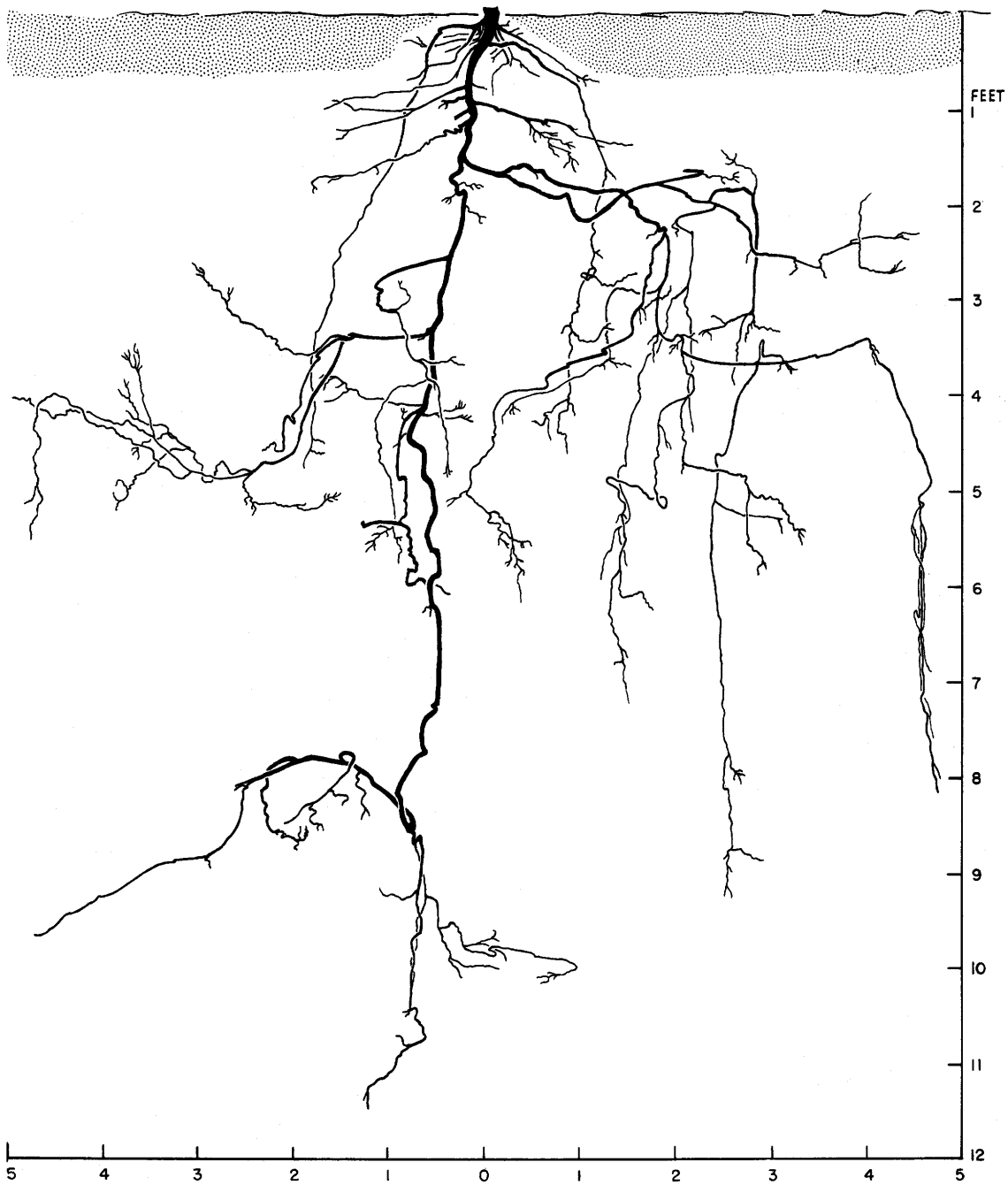

Figure 2.--Root system of an antelope bitterbrush plant between 25 and 30 years old, with moderate upward curvatures of roots.