Letters to the Editor

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The Redwoods of California

As one who once lived in the Redwood country, may I be allowed to thank the Master of Downing for his vivid pen picture in NATURE of November 12 of those inspiring monuments of the past, the Californian Redwoods ?

A few years ago, when camped in a Redwood grove, I was sleeping at night on the stump of a huge tree, felled perhaps in the early days of settlement. A ring of young coppice probably not less than 100 ft. high, growing out of the stump, formed a charming screen, among the branches of which the blue jays chattered and the Californian thrush poured out his cheerful evensong. Looking upward as we lay in bed, the stars could be seen twinkling through the openings of a sky-pattern akin to that shown in Dr. Cannon's excellent photograph. But at intervals of a few nights, the sky would be enveloped in a cold, grey fog ; this condensed in the foliage of the tall spires and fell in a shower so heavy and continuous that unless our beds had been covered with waterproof they would have been wet through.

The ground beneath the Redwood is normally clothed with a layer of decaying foliage three to five inches, and sometimes even a foot, in depth ; this is composed chiefly of Redwood leaves still attached to the branchlets on which they grew, for *Sequoia sempervirens* sheds its branchlets, though unlike the related swamp cypress (*Taxodium*) or the larch (*Larix*) it does not become leafless at any season.

An examination of the layer of dead leaves showed that although it was the 'dry' season of the year, the layer was wet through by the fog-drip from the branches above ; into this spongy mass the Redwood had developed a dense system of rootlets, many being obviously young and in vigorous growth, some of them definitely growing upwards from the horizontal roots into the mass of humus above ; doubtless the tree was drawing therefrom a supply of moisture and of plant food.

This constant renewal of food supply and moisture near to the base of the trunk, and the ability to renew, as it were, its root system at close range, may have something to do with the remarkable longevity of the tree. They explain, also, how the sea-fog compensates for lack of rainfall in the long, hot, rainless summer of California. But they suggest a serious menace to the continued existence of these magnificent relics of a former flora, in the treatment they are receiving—or were then receiving—at the hand of man. With a commendable desire to prevent forest fires, it was customary for the custodians of public camping grounds in the National, State, or County groves, to sweep the ground beneath the Redwoods quite clear of dead leaves. As these surface-rooting trees appear to depend for their water supply during a not inconsiderable part of the year on the moisture stored in the layer of decomposing foliage, it is probable that the sweeping bare, and subsequent consolidation, of the soil, checks the development of the superficial system of new roots, and causes too rapid evaporation of the much-needed summer moisture, from the soil surface. Though in some years the sea-fogs may continue for weeks at a time, they are often discontinuous, lasting about three days together, separated by more or less equal spells of hot, dry weather with almost cloudless skies, resulting in intense evaporation of moisture from a hard, bare, soil surface, though with comparatively little loss from a loose spongy mulch.

These facts explain the limitation of the Redwood to that narrow belt (averaging about twenty miles in width), which is watered by sea-fog in the rainless season, just as the evergreen rain-forest of Central and South Africa is limited to the 'mist-belt' of the eastern mountain chain. They may explain, also, the behaviour of the Redwood in certain parts of England, where it often has a shabby, unhealthy appearance though in other localities it is vigorous and apparently quite at home with its environment. In my garden there are both a young Redwood and a young "Big Tree" (*S. gigantea*) ; each has developed a set of rootlets near the soil surface. Noticing, last summer, that both trees showed signs of check in growth and some die-back of foliage, the Santa Cruz observations came to my mind, and treatment with a thick mulch of rotting grass and leaves (left on throughout the summer and renewed in winter) was tried ; the beneficial effect was quickly noticeable. Late last spring the gardener, when tidying up, cleared the mulch from the Sequoias ; during a warm dry period in early summer the trees again showed signs of suffering ; the prompt application of a fresh mulch had almost immediate effect, followed by a steady growth of new wood equalling that of trees of the same age in their native haunts.

From these observations it would seem likely that in the drier parts of England, on gravelly or sandy soils, the Redwood would benefit from a mulch of leaves or rotting grass, especially during the drier summer months, and that this treatment might be applied with advantage to old-established trees as well as to young ones. If this surface-rooting habit is of regular occurrence in the species, such a mulch would afford protection to the roots against frost also. In fact, the desirability of maintaining a constant mulch under Sequoias seems to be indicated.

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Heterogony and the Chemical Ground-Plan of Animal Growth

IN 1924 in this journal, Huxley[1] first considered the relation between the growth of parts in a living organism, when the parts increase or decrease in relative size. The equation

$$\log y = \log b + k \log x$$

describes the process, where y is the size of the part, x the size of the whole, and b and k are constants (the former giving the fraction of x which y occupies when x is unity, and the latter the ratio of the growth-rate of the part to the growth-rate of the whole). Thus on a double logarithmic grid, straight lines are obtained, the slope of which is determined by the constant k, and the absolute position of which relative to the axis values, by the constant b. Since Huxley's first paper, this simple relation has been abundantly verified for morphological magnitudes in a large number of