of weeds. While the wind was blowing twenty miles per hour a peck of mixed seeds was poured upon the snow crust, and ten minutes after 191 wheat grains, 53 flax seeds, 43 buckwheat and 91 rag weed seeds were found in a trench thirty rods from where they had been poured upon the crust.

BLACK KNOT OF PLUMS AND CHERRIES.

The Black Knot fungus (*Plowrightia morbosa* Schw.) is an old orchard enemy. Professor Lodeman, in Bulletin 81 (December, '94) Cornell Experiment Station, has given the long bibliography of the subject and shows, by means of cuts, how the spores of the fungus may find their way between the adjoining layers of bark in the forks of the small limbs. At these places the bark is thin and the growing layer (cambium) comes near to the surface, thus facilitating the inoculation. Lodgement is also produced at these angles between stems, and besides it is here that knots are most apt to form. Experiments in spraying knotty trees with Bordeaux mixture gave results that were decidedly encouraging.

RECENT APPLE FAILURES.

In another bulletin (No. 84) from the Cornell Experiment Station—and there are many and fine ones—'The Recent Apple Failures of Western New York' are considered by Professor Bailey. A glance at the cuts shows that failures may be due to imperfect pollination, injudicious application of fungicides, but more particularly to the ravages of the Apple Scab (*Fusicladium dendriticum* Fl.), of which Professor Bailey gives a full page colored plate showing the scab enemy in detail from the appearance of the young distorted fruit to the microscopic structure of the fungus shown in leaf sections. That the scab fungus is the leading cause of apple failures is demonstrated by the fact that thorough spraying to check it productiveness has been obtained. The essentials for success in apple culture, as given by the author as his concise summary, are: "till, feed, prune, spray."

DETASSELING CORN.

The removal of the male flowers from a large or small per cent. of the corn plants in a field has been experimented upon at various stations. Thus in Maryland where two-thirds of the tassels were removed the detasseled rows gave a decrease of nearly 10 per cent. At the Kansas Station by detasseling alternate rows of six varieties in every case there was a reduced yield averaging 22 per cent. Delaware obtained under similar circumstances an increase of 6.6 per cent.

Before us is the bulletin (No. 37 Feb., 1895) upon 'Corn Experiments' of the Illinois Experiment Station in which detasseling receives its share of consideration. "In eighteen out of twenty-three comparisons the yield of corn was greater for the rows (alternate) having the tassels removed. For tassels pulled we have an increase of twenty-seven per cent., and for those cut only six per cent. Removed before expanding gives an increase of eleven per cent. The average increase is thirteen per cent." At the Cornell Station one report (1890) gave an increase of fifty per cent. for detasseling, but the next year there was no difference. The results thus far obtained teach that the end of experimentation in this direction is not yet reached.

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LAGOA SANTA.

Such is the title of a memoir published in 1892 by Professor Eugene Warming, of the University of Copenhagen. It is also styled *Et Bidrag til den biologiske Plantegeografi*, and this sub-title sufficiently explains the aim of the work. Lagoa Santa is a small village about 835 meters above the sea and 200 miles north of Rio de Janeiro,

in the Brazilian campos, or hilly region beyond the great virgin forests of the coast mountains. Warming spent three years at this place, 1863–66, and made large collections of plants, which have been studied and described by various specialists. Now, after nearly thirty years, the author gives his general conclusions as to the flora of this region, which he considers typical of a great part of the interior of Brazil. The mean temperature is 20.5°C, with a range of 3.5° to 37°C. There are two seasons—*dry*, from April to September, corresponding to our winter, and *wet*, during the rest of the year. Spring opens in August. June is the coldest month, and December and January are the warmest months, but there is no winter in our meaning of the term, the means of the coldest month being only a few degrees below that of the warmest. The annual rainfall is not known, but it is considerable during part of the year, and there are heavy dews in the dry season. The heaviest rainfalls are in November, December and January. The soil is a red clay, very common in Brazil, resulting from the decomposition of the primary rocks. In places cavernous limestones occur.

There are no plains here, but only an interminable succession of hills with narrow valleys through which streams have cut gorges or in which there are lakes or ponds. Forests line the water courses and cover the calcareous rocks. These are a meager continuation of the luxuriant coast forests. The greater part of the country is, however, destitute of trees or bears only scrubby growths. These surfaces are the campos. They consist either of barren, pebbly plateaus and flanks of hills which are subject to washing, covered with scant herbage and often entirely destitute of trees, or of similar areas bearing deeper and more fertile clays and covered more or less densely with herbs, shrubs and small trees. The marsh and water plants form only an insignificant part of the vegetation, and may be left out of account in this synopsis. The contrast between the forest vegetation and that of the campos is very sharp, the plants of the latter resembling desert vegetation in many interesting particulars. Except in very rich parts of the campos the herbaceous vegetation is never dense enough to hide the hard red earth. Grasses are the most important part of the herbaceous covering. There are about sixty species, mostly Panicums, Paspalums and Andropogons. All are perennial and grow in thin scattered tufts, never forming a sod. The Cyperaceæ also grow in the same way. The composites are rich in species, especially the Vernonieæ and Eupatorieæ. The Leguminosæ come next in number of species. There are 554 species of herbs on the campos, but there are no biennials, and the number of annuals is very few, *i. e.*, less than 6%. There are also very few climbers or twiners although the campos bears many forms intermediate between erect herbs and climbing and twining plants. The great dearth of annuals is attributed to the great dryness and hardness of the soil at the time the seeds are shed, to the annual fires which consume seeds and seedings and may perhaps have transformed some annuals into perennials, and to the hard struggle for existence with tall herbs and bushes. Herbaceous shoots develop ordinarily in tufts and are not branched or but slightly, arising in great numbers from subterranean stems or roots. Exclusive of certain grasses, sedges and Bromeliaceæ, herbs with rosettes of basal leaves are almost entirely wanting. Horizontal rhizomes and stolons are absent and horizontal cauline organs always remain very short. Almost all of the perennial Dicotyledons have a short, thick, lignified, irregular, and more or less tuberous subterranean axis. Sometimes a delicate little shoot only ten to fifteen centimeters high arises from a tuberous axis as large as one's

fist. Juicy tubers and tender bulbs are very rare on the campos. Typical shrubs are not rare and in some places they form thickets. In other instances unbranched shoots arise in great numbers from a big, lignified, root-shaped axis and form tufts which are often very large. Generally, these tufts are only 0.35 to one meter high, but they cover a diameter of one to three meters and often more. This manner of growth resembles that of the herbaceous perennials, but the shoots are woody. The campos bears 170 to 180 shrubs. The families represented by most species are: Myrtaceæ 40–50, Malpighiaceæ 30, Melastomaceæ 20, Compositæ 15, Euphorbiaceæ and Lythraceæ 6–10, the rest of the species being scattered among twenty-five families. The tallest trees of the campos are three to eight meters high, and the densest growth forms a kind of forest, but this is never close enough to shade the earth. Sometimes the trunks rise obliquely, and both trunk and branches are twisted and stunted with thick, rough, channeled and cross-fissured bark. Many of them are also blackened and charred by the campos fires. There are eighty-six arborescent species on the campos, but many are only one to three meters high, and all resemble stunted fruit trees rather than ordinary arborescent vegetation. Phænogamic epiphytes and epiphytic mosses and lichens are very rare. Lianas are wanting, but some species show a tendency toward such types and these belong to genera which in the forest are developed largely or exclusively as lianas, *e. g.*, there are eighteen species of Serjania in the dense forest, all lianas, while on the campos the one species, S. erecta, is a shrub with lithe slender branches. Cactaceæ and all fleshy plants, exclusive of members of the orchidaceous genus Cyrtipodium, are also wanting and spiny plants are very rare. Certain families very common on the high mountains of Brazil, *e. g.*, Vellosaceæ and Ericaceæ, have no representatives on the campos. Finally the soil bears no mosses, lichens, algæ or fungi. This region is dry. The coast mountains and their virgin forests retain the moisture of the air, and the dryness is increased by the altitude. "The vegetation of the campos, properly speaking, is xerophilos. It is strange to see two forest growths developed side by side and often touching but differentiated in the sharpest possible manner, namely, the wooded campos and the forests. The latter accompany the water and streams everywhere. The trees are close together, tall and slender; lianas twine about them and epiphytes live upon them, and a coolness that is sometimes exquisite reigns in them. Proceeding from the streams the forests have invaded a certain territory on both sides to which, in course of time, they have brought a fertile humus. All at once, the forest stops and we find ourselves on the edge of the campos, where there is neither moisture nor shade, nor humus, and where the red clay earth cracks open in the dry season under the influence of the heat and desiccation. It is the soil conditions which have caused this antithesis. The difference in the quantity of water contained in the soil in the bottom of the valleys and on the summit and flanks of the hills of the campos has brought about these strong and curious contrasts between the two floras. It is certain that the geological formation exhibits no difference. In the campos and under the humus of the forests it is everywhere the same red clay."

The xerophilous character of the campos vegetation is manifest first of all in the shapes of the trees. On account of the dryness of the air these are small, stunted and twisted the same as in the high mountains of Brazil or in the maritime forests of "Restinga," along the sandy shores. Fires have also played a great rôle in developing stunted forms. The strong development

of the cortical system and the heavy suberization are due to the dryness of the air and probably also to the fires. The thick, irregular, ligneous, subterranean axial organs (it is often difficult to tell which part is stem and which is root) are also, both in herbs and shrubs, related to the aridity and to the fires. The absence of mosses and of hymenomycetous and other sayrophytic fungi is another indication of the dryness. The leaves show the dryness of the climate in numerous ways. An abundant hairy covering is very frequent, and the leaves of some species have both surfaces covered with a white or greyish felt, while others have only the lower surface felted. The leaves of other species are scabrous, hispid, glandular-hairy, or shining as if lacquered. A few have a waxy covering. Almost always, even in the herbs, the leaves are stiff and coriaceous, unless both surfaces are tomentose, and on some trees they are so stiff as almost to jingle in the breeze. Most of the grasses and sedges have narrow stiff leaves. The direction of the leaves also shows the aridity. Many are vertical or pointed upward, so as to receive the sun's rays at an acute angle. Some species are aphyllous and in others the leaves are much reduced. Usually, the leaves of the forest species are larger and especially broader than those of the campos species, even when of the same family or genus. "The most of the peculiarities which distinguish xerophytes are also found in the plants of the campos, although rarely to such a pronounced degree. The environment does not reach the excessive dryness of the deserts of Africa and Asia, of the high plateaux of Mexico, etc., and this explains the absence of cataceæ and other fleshy plants and the rarity or absence of succulent organs, such as tubers and bulbs. The dryness is never so great that vegetation is forced to disappear or dry up entirely for a longer or shorter period, as happens in the steppe or the desert, and the spring awakening is not so sudden as in these places. The dryness of the campos is also manifest in the fall of the leaves." Every year, when the sun has parched the herbage so that it is almost like hay, the campos are fired so as to get new growths for the cattle. These firings occur most frequently from July to September, but also earlier and later. The fires sweep everything that is close to the ground, including the lower branches of the trees, and cause the leaves to fall by thousands. When they are set too early, *i. e.*, in May or June, the succeeding vegetation is feeble, and when they are set too late in the spring, *i. e.*, after the spring vegetation has begun, they cause immense and lasting injury. When set at the proper time the campos are covered in a week or two with a rich carpet of green. Plants blossom earlier on the burned campos, and many species are seldom found in bloom elsewhere. The rarity of annuals has already been mentioned. The unbranched tufted habit of many shoots and the numerous swollen tuberous axial organs also seem to be due to the fires, and the numerous big underground stubs of trees and shrubs are undoubtedly due solely to this cause.

The forests of Lagoa Santa are not as imposing, as dense or as moist as those of the coast mountains. Those on the calcareous rocks in particular are quite open, dry and light. Tropical forests sometimes pass for being poor in flowers, but this is only an appearance, the blossoms being concealed in the tops of the trees. Most of the trees have small flowers. Like tropical forests in general the ground between the trunks is densely covered, in places impenetrably tangled, with bushes, small trees and lianas. The author observed nearly 400 arborescent species in the forest and thinks the actual number much exceeds this. These trees

belong to sixty-seven families, the leading ones including nearly one-half of the species, being Papillionaceæ, Myrtaceæ, Rubiaceæ, Lauraceæ, Artocarpaceæ, Cesalpinaceæ, Euphorbiaceæ, Meliaceæ, Mimosaceæ and Anonaceæ. The individuals of a species are widely scattered and it is often difficult to find more than one or two of a kind. The great number of species is attributed to the uninterrupted development of the forest during many geological ages, the campo-growths being a derived and more recent flora. The height of the trees is rarely more than 20 to 25 meters. The trunks are not scraggy like those of the campos, and the bark is smoother and less corky. The well lighted forests have a dense undergrowth of shrubs 1–3 meters high, most of which bear small white flowers. The soil of the forests is poor in herbaceous and suffrutescent species. There is no carpet of mosses or lichens. Agarics are small and very rare. Grasses form no part of the covering of the soil, and if any exist in the forest they are tall perennials such as Olyra and Bambusa. The forest is rich in climbing and twining plants, in striking contrast to the campos. The big woody lianas belong principally to Bignoniaceæ, Convolvulaceæ, etc., and the herbaceous climbers to Cucurbitaceæ, Passifloraceæ, etc. The Convolvulaceæ of the forests are generally voluble, while those of the campos are erect under-shrubs. The numerous Aristolochias of the forest are also all voluble, while the single species of the campos is an under-shrub with stems 15–30 centimeters high from a woody, tuberous, subterranean axis. The air is so dry that even in the forests there are but few Epiphytes. Cactaceæ and other fleshy plants, and numerous hairy, thorny and stinging plants grow in the more open forests on the calcareous rocks.

Only the forest lands are used for agricultural purposes. The trees are felled, and after the clearing has been subject to the heat of the dry season for some months it is fired and then planted—sometimes to sugar cane and rice, but more generally to Indian corn, with castor bean, perennial cotton, beans, cucumbers, pumpkins, etc., between the hills. After the second year the clearing is abandoned. These neglected clearings are soon covered with a dense growth of weeds, which are quickly crowded out by various shrubs—felted leaved and spiny Solanums, hispid Lantanas, dirty green or brown hairy Crotons, numerous Sidas and other Malvaceæ, dull composites often sticky, tall grasses with large leaves and many other plants, mingled with which are shoots from the tree stumps. Gradually the area becomes once more a forest, twenty or thirty years sufficing. It is said that after the forest has been cleared away three or four times it will not return, its place being taken by bushes, thickets of Pteris aquilina var. esculenta and dense masses of the glandular hairy Panicum Melinis; 43% of the weeds of the gardens and clearings are annuals, and a few of these weeds are old acquaintances, *e. g.*, Chenopodium ambrosioides, Gnaphalium purpureum, Xanthium Strumarium, Erechthites hieracifolia, Sonchus oleraceus, Panicum sanguinale, Eleusine Indica, Argemone Mexicana, Phytolacca decandra, Portulacca oleracea, Physalis pubescens, Datura Stramonium and Solanum nigrum.

The flora of the forest is twice as rich in species as that of the campos. Of the 755 genera observed at Lagoa Santa 82 belong exclusively to the campos, 61 are tributary to the water and 364 belong to the forests, although the latter only occupy a small part of the country. The forest flora is probably much more ancient than that of the campos. Compositæ and Papilionaceæ form about one-quarter of the entire flora of the campos. The flora of the forest is made up chiefly of Compositæ, Polypodiaceæ, Orchidaceæ, Rubiaceæ and Euphorbiaceæ. A large num-

ber of genera are common to both campo and forest, but often the species are not nearly related. In other cases the species resemble each other so closely that some botanists regard one as a variety of the others. The Brazilians have also noticed this in case of certain trees and designate one form as *do campo* and the other as *do mato*. Woody species are more common in the forest than on the campos, *i. e.*, 800 to 250. The number of herbaceous species on the campo and in the forest is about the same. Hygrometric conditions determine essentially the anatomy and the morphology of plants. This causes the difference in form and in thickness of bark of the trees of the campos and of the forest. In the campo plants there is a marked reduction of foliar surface to prevent excessive transpiration, and pilosity is most frequent in these species, although common in the forest, where it occurs most abundantly on the foliage of the trees and lianas, the glabrous plants of the forest being the lower and shaded species. A great many of the weeds are abundantly hairy. These grow principally in the clearings in narrow valleys exposed to a burning sun. Plants with lacquered leaves occur both on the campos and in the forest. Spiny plants are rare on the campos, more frequent in the forest, especially on the calcareous rocks, and most common in the clearings. Waxy leaved plants occur in various situations, but are not frequent. Coriaceous leaves occur on the woody plants of the campos and also frequently on the forest trees. They are not so common on the forest shrubs and are still rarer on the marsh plants. Many plants of the forest have large thin leaves, entirely unsuited for the campos. The fall of leaves is brought about by the increasing dryness of the air and soil rather than by any change of temperature. This is much more decided in the trees of the campos than in those of the forest and is most noticeable in the woody plants on the calcareous rocks. Some trees shed their leaves in winter and remain bare for several months, but most of the leaves fall in the spring (August to October) simultaneously with the appearing of new leaves, so that the forest is always green and retains about the same coolness and depth of shade. The trees of the campos as well as of the forest show annual rings, and the author thinks that the same periodicity of growth takes place everywhere, even in the trees on the Amazon. Buds are not generally protected by budscales, although some of the woody plants of Lagoa Santa bear as characteristic buds and budscales as any forest trees in Denmark. The author's principal collections were made from the small area of 170 sq. kilometers, from which he obtained about 2,600 species of vascular plants.

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THE PROGRESS OF PARONYMY.

TEN years ago* I urged the desirability of the general employment of technical anatomic terms consisting, so far as practicable, of one word each (mononyms), and derived directly or indirectly from the Latin, constituting *paronyms* of the originals. Such paronyms might be either identical with the original, *e. g.*, English *pons*, or changed in various ways in conformity with the custom of each language, *e. g.*, French *pont*, Italian *ponte*. The subject was further discussed in connection with Prof. S. H. Gage in 1886† and in 1889,‡ and the principle of

* Paronymy *versus* heteronymy as neuronymic principles. Presidential address at the 11th annual meeting of the American Neurological Association, 1885. *Transactions of the Association*, pp. 21. Also *Journal of Nervous and Mental Disease*, Vol. XII.

† Anatomical technology: an introduction to human, veterinary and comparative anatomy. Second ed., 1886, O., pp. 600, 120 figs., 4 plates.

‡ Anatomical terminology. Reference Handbook of the medical sciences. A. H. Buck, editor, VIII., pp. 24. 1889.