dominance of Palmaceæ Lauraceæ, Magnoliaceæ, Cedrelaceæ, Sapindaceæ, and arborescent Leguminosæ; in the presence of such genera as Engelhardtia, Ailanthus, Bauhinia, Lygodium, and Chrysodium; and in the frequency of Cinnamomum, Persea, and species of Myricaceæ, Cesalpineæ, and Mimoseæ we are introduced to a vegetation which is certainly very different from that now existing in southern France, and the contrast would be complete were it not that these types are associated with genera still indigenous, such as Alnus, Betula, Carpinus, Ostrya, Populus, Salix, Ulmus, and Acer. The tropical and sub-tropical types were eliminated during the course of the Pliocene, and the other types became variously modified, as shown by a series of intermediate forms extending from the Aquitanian down to recent Pliocene. Another fact of interest is that the greater number of the European descendants of these ancient floras belong exclusively to the Mediterranean flora, while many occur only in isolated localities and seem to have but a slender hold upon the region. The absence of certain species which form an integral part of the present flora lead to the belief that they appeared later than the period represented by the Aquitanian of Manosque. Toward the mio-Pliocene a new alluvion containing vegetable forms was superposed on the preceding, and this was correlative with a partial elimination of species which Europe had possessed until then. Up to and including the Aquitanian there are no vestiges in southeastern France of any of the following types: Alnus glutinosa, Coryllus Avellana, Carpinus betula; the Robur, Toza and Infectoria sections of Quercus; Platanus, Liquidambar and Liriodendron; Ficus carica; Tillia, Carya, and Pterocarya; Ilex aquilifolium, Acer Pseudoplatinus, A. platanoides, Sorbus torminalis. These came in at a later date and in most cases apparently from the north, appearing lower down in formations further to the north. In the Swiss Helvetian there is a Pterocarya which nothing distinguishes from a living species of the Caucasus, and a Liriodendron scarcely distinct from that of America. The Platanus aceroides seems to have followed the same course as the Tertiary tulip tree, both species growing together in mio-Pliocene times in the valley of the Rhone. The last part of the paper is taken up with a critical consideration of the southern European oaks based on a study of material from the mio-Pliocene beds of Italy and France, in which there are species of the following sections of the genus Quercus,—Cerris, Ilex, Toza, Robur, and Infectoria. The paper is accompanied by three lithographic plates and two figures in the text.

THE BOTANICAL LANDSCAPE.

BY J. W. CHICKERING, NATIONAL DEAF-MUTE COLLEGE, WASHINGTON, D. C.

IF there be among either the older or the younger botanists of our country any who, in these days, when so much attention is paid to laboratory work, microscopic investigation, discussion of the laws of nomenclature and other theoretical inquiries, still retain interest in field work, and are not afraid of being considered "mere collectors," I should like to suggest one direction in which there is still opportunity for observation and record.

Distributive botany has always had its fair share of attention. We are familiar with the change in the vegetation, as we go from the equator to the poles, or from sea level to the snow line on our loftier mountains. Our catalogues present us with the percentage of change in the flora, as we pass from New England either west or south. But little has been said in either manuals or local catalogues about what might be called the botanical landscape of different localities. By this is meant a recognition of those species occurring so in mass as to give color and character to the whole landscape, even when seen from a carriage or a railway train.

Our ordinary idea of a local flora is the whole number of species detected by the careful and skilled botanist, in the narrow ravine, or underneath the dark shadows of over-hanging cliffs, or over-arching forests. But I wish now to suggest, especially to those who may edit future manuals or local catalogues, the desirability of noting those plants which thus form a conspicuous part of the landscape, and moreover of noting and recording the gradual change of species, as, for instance, among the *Solidagus* and *Asters* in passing from one section to another.

As an example, I will give a few notes of such social and colonizing species as attracted attention during two or three summers in eastern Maine and Nova Scotia. Many of our sub-Alpine plants here descend from the mountains and take possession of the soil near the level of the sea. Notably is this the case with *Empetrum nigrum*, covering the swamps, intermixed with *Ledum latifolium*, and *Rhododendron rhodora*, and in a few localities *Rubus chamaemorns*, the cloud-berry, sufficiently abundant to have its fruit brought to market, under the name of baked-apple, though, according to Mr. Kennan, much inferior in flavor and juiciness to the same species as found so abundantly on the Siberian steppes.

Along the valley of the Cornwallis River, for miles on either side the railroad, are masses of *Corema conradi*, and all through eastern Maine *Vaccinium vitis-idaea* is the most abundant, as it is the most aromatic in flavor of all the cranberries.

In eastern Nova Scotia a European species, *Senecio jacobaeus*, the ragwort, was noticed as replacing and exterminating the native *Solidagos*, and likely to become a troublesome weed, if it holds on its westward way.

In eastern Massachusetts are seen occasionally patches of *Genista tinctoria*, wonderfully brilliant on Salem hills, and less abundantly *Galium verum*.

In some parts of western Massachusetts, *Potentilla fruticosa* is similarly conspicuous, but a most pestilent invader, over-running and ruining hundreds of acres of good pasture land.

Down in the Shenandoah Valley, in Viginia, the traveller's attention is arrested by the great masses of *Echium vulgare*, known as blue thistle, not only diversifying the landscape with its cerulean hue, but supplying honey to millions of bees.

Perhaps the most beautiful sight I ever beheld of this sort, was along the banks of the Carrabasset River, in Maine, where for four miles *Epilobium angustifolium*, one of the many plants known as fire-weed, covered the ground, reaching a height of three or four feet, and rising and falling with every inequality of the surface, suggesting the idea of a fall of pink snow to that depth.

That was on August 14, and on June 8 fire had devastated that section, lasting for some two weeks, apparently destroying all possibility of vitality remaining in any seeds. And yet less than two months after there was this profusion of inflorescence.

Whence did that growth originate? Our driver said that it had never been very abundant in previous years, and that it began to start about three weeks after the fire.

But it is of course the *Asters* and *Solidagos*, with a few other *Compositae*, that in the autumn give color to the landscape almost to the exclusion of all the other species.

In eastern Maine by far the most abundant and conspicuous of these is *Solidago* nemoralis, covering the dry rolling uplands with a yellow carpet of great beauty for mile after mile. Along roadsides partly shaded *S. serotina*, var. *gigantea* is the most common.

In moister ground *S. puberula* prevails, and in the extensive swamps *S. uliginosa* is very abundant, vigorous and beautiful.

This region, especially where it is a little swampy, is the paradise of *Asters*, *A. punicens* being the most abundant and showy. The earliest of all is *A. radula*, which is gradually replaced in southern Massachusetts by *A. spectabilis*, and again in New Jersey by *A. surculosus*. In a few localities *A. Novae Angliae* is very showy and abundant.

In Massachusetts, as autumn approaches, the fields and roadsides are whitened with low, bushy species, which are mainly *A. multiflorus* and *A. vimineus*, which, as we move southward, we find largely replaced by *A. ericoides*.

In the vicinity of Washington, D.C., *Aster tradescanti*, *diffusus*, *patens*, *simplex*, *undulatus*, *paniculatus* and *tenuifolius* are often seen in sufficient quantity to give character to the landscape, which *A. linariifolius* is very abundant, and among the pines *A. concolor* is occasionally found in mass, as is its congener, *A. Curtisin*, among the North Carolina mountains.

Among the golden rods which color extended areas are *Solidago bicolor*, with its var. *concolor*, *erecta*, *arguta*, *rugosa*, *nemoralis*, *Canadensis* and *lancolata*, while *S. sempervirens* is found in mass, bordering salt marshes from Maine to Virginia.

But perhaps this article is already sufficiently extended to call attention to the point desired to be emphasized, and to suggest to botanists the habit of observing and putting down in their note-books those species which by their abundance give color and character to the landscape, and then occasionally sending to scientific journals the results of such observations, so that future editors of manuals and local floras may be able to give some accurate and reliable notes respecting this long neglected department of botanical research.

BOTANY IN THE SCHOOLS.

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THERE has been a great deal published in *Science* upon the subject of biology in the colleges, but little or nothing has been said relative to the teaching of the subject in the common schools. This point was impressed upon me more forcibly upon receipt of some school reports. In the reports, which are prepared by the superintendent of instruction mainly for the benefit of the tax-payers, a statement is made in regard to the various subjects taught, and for those subjects not in the ordinary curricula reasons are given showing their desirability for the pupils.

From the fact that reasons are considered necessary, it would seem to imply that the subjects in question are considered not entirely essential, this being especially true of the subjects that come under the heading "nature study," these usually being botany and a very little zoölogy. There is given usually a tabulated statement of the benefits the pupils derive from their study, the tabulated statement consisting in many cases of the pedagogical principles that a normal school student is crammed with before an examination, or that one hears rattled off so glibly at a teachers' institute.

And yet behind the reasoning and the tabulated statement there is usually a dense ignorance of the subjects. For if the subjects were understood, no person of ordinary intelligence would feel called upon to give apologetic reasons, or would expect that teachers without any previous training in those subjects would be competent to teach them. Trained teachers are provided for music, drawing, physical culture, sewing, cooking, and manual training, who, besides teaching the pupils, meet the teachers at stated times to coach them in the work, so that they also may be fitted to help the pupils. But in "nature study" it is not considered necessary to have a special teacher, any ordinary teacher being supposed capable of mastering the subjects embraced under that head.

Here is an extract from one report:—"Truly it is said that this work must be done in such a way that it shall lead to the love of nature. Here the task-master has no place. Only they who can lead in the spirit of the student have the power that will inspire in the children the needed zeal." This reads beautifully from the rhetorical point of view, but in the connection in which it was used it was the veriest rot, for the writer knew that the teachers, being for the most part graduates of his own high school, in which neither botany nor zoölogy was taught, knew nothing of the subjects. The writer closed his statements by saying that elementary botany had been taught the previous year, and that, when directed by a teacher in sympathy with it, always interested the young.

Botany is the favorite "nature study," because the teacher can make selections of such pretty flowers, with beautifully long names. Then the flower can be separated into its constituent parts, and the name of each part learned by the pupils; this same process can be gone over with other flowers, and all on pedagogical principles of the latest date, for is not the pupil using natural objects, and finding out things for himself by an analytic process?

Now, if instead of frittering away the children's time by "object lessons" of the James Whitcomb Riley "peanut" variety, a competent specialist were to be put in charge of the work, one who would have a scheme of work that was consecutive, and who could instruct the teachers, just as the specialist does in music, drawing, etc., a minimum amount of time devoted to the work in school would give good results, besides taking a burden off the shoulders of the teachers. For the public school teachers are much imposed upon in having to teach subjects of this kind for which they are not prepared, and in many cases do not know how to set about making up for the deficiency. A subject of this kind is sprung on them, so to speak, by the superintendent, who sometimes does not realize what its teaching involves.

It is said that the public schools are overburdened with work, and that they cost too much already; well, if that be so, then drop the subject altogether from the curriculum. If this statement as to overburdenment and cost be not true, then the subject should be taught in a proper manner. And to teach it in a proper manner means to pay for a specialist who knows the work and who can direct it properly. Not an "object lesson" specialist, but a botanist. And it cannot be expected in this work that a cheap teacher will do, for nearly invariably a forty-dollar man does forty-dollar work. False economy in teaching always involves more or less waste of time and money.