Maryland Academy of Sciences and naturalist of the city parks. In 1885 he was appointed assistant in the Division of Entomology of the U. S. Department of Agriculture, remaining in Washington until 1888, when he was appointed entomologist to the State Agricultural Experiment Station of Minnesota, publishing his first bulletin in this new office July 3, 1888.

His first entomological experience in the State of Minnesota was one of great interest and importance, and his vigorous and intelligent action in the face of a great emergency fixed his standing as a most useful officer firmly in the minds of the Minnesota farmers. An enormous swarm of the Rocky Mountain locust or western migratory grasshopper had settled down in Ottertail County. By Lugger's advice and energetic field work, backed as he was by a public-spirited and intelligent governor (Hon. W. R. Merriam, now director of the U. S. Census) who personally guaranteed the funds necessary for the campaign, the hordes of destructive insects were annihilated and great damage was averted.

From that time to the time of his death, nearly thirteen years, Lugger's work was most active; his publications were frequent, and he gained the profound respect of his constituents and of the scientific men of the country. His bibliography, covering about thirty titles of record, comprises almost exclusively articles on economic entomology, but he was by no means a one-sided naturalist. He was a good botanist and published several papers concerning plant diseases, notably his article on the black rust or summer rust (Bulletin 64, Univ. Minn. Agric. Exp. Station).

Some years ago he began the publication of a series of large papers which when brought together would have formed an elaborate treatise on the entomology of Minnesota. The parts which had been published were an extensive paper on the parasites of man and domestic animals (Bul. 48, 1896, Minn. Agric. Exp. Sta., pp. 72–270, figs. 187, plates 16), the Orthoptera of Minnesota (Bul. 55, 1897, pp. 91–386, figs. 187), the Lepidoptera of Minnesota (Bul. 61, 1898, pp. 55–334, figs. 237, plates 24), the Coleoptera of Minnesota (Bul. 66, 1899, pp. 85–331, figs. 249, plates 6), and the Hemiptera of Minnesota (Bul. 69, 1900, pp. 1–259, figs. 200, plates 15). It is a great pity that Lugger did not live to complete this series, since the elaborate numbers were profusely illustrated and were prepared with great care and written in a most interesting style. At the time of his death he was preparing the part on Diptera, in which he intended possibly to include the Neuropteroids. It is greatly to be hoped that his manuscript was sufficiently advanced to permit its publication.

Aside from his scientific ability, Lugger was a man of admirable qualities. His wide information, his agreeable personality and his keen sense of humor made him one of the most delightful companions I have ever known. Many of his stories and humorous sayings are current among entomologists all over the United States, and his loss will be felt for many years to come. He leaves a widow and two children—a daughter, Mrs. Linnea Clarke, and a son, Humboldt Lugger, the latter now living in Kentucky.

L. O. HOWARD.

SCIENTIFIC BOOKS.

The Phytogeography of Nebraska. I. General Survey. 2d Ed. ROSCOE POUND and FREDK. E. CLEMENTS. Published by the Botanical Seminar, University of Nebraska, Lincoln, Neb. 1900. 8vo. Cloth. Pp. 442 and 4 maps.

To those who have not paid special attention to this branch of investigation this volume will prove to be both a revelation and an incentive to learn. It is a revision of the first edition, issued some three years ago, with additional material

acquired since that time, the larger part of the first edition having been destroyed by fire in the building of the publishers.

In its broadest conception the subject is happily defined as 'the study of vegetation,' or in other words, the study of the floral covering of any area in the aggregate. It deals with the plant groups rather than with individuals, and with the interrelations of species rather than with the species themselves, and discusses the reasons why certain plants have become established in certain areas, the effects of environment, etc.

The treatment of the subject begins with an historical review of the investigations which have been made in the flora of Nebraska, commencing with the expedition of Lewis and Clarke during the years 1803–1806, and continues through what may be called the era of exploration, to about 1870, up to which time the study of botany was merely incidental, in connection with general surveys and explorations. Botany as a distinct subject of investigation did not receive attention until 1871, and it was not until 1884 that it was prosecuted in earnest, under the direction of Dr. C. E. Bessey, who was elected to the then newly created chair of botany in the University of Nebraska. The botanical seminar of the University was organized, and for the first time a systematic investigation of the flora of the State was begun.

The preliminary work of cataloging the flora of the state was accomplished and then was commenced the study of the vegetation as a whole, in connection with topography, geology, meteorology, etc.

Four phytogeographical 'regions' are recognized, as follows:

I. Wooded-bluff and Meadow-land.
II. Prairie.
III. Sandhill.
IV. Foothill.

Regional limits, within a relatively small and artifically limited area such as the State of Nebraska, are primarily dependent upon physiography. Vegetation 'zones' and 'realms' are only applicable to more extended areas, with natural boundaries based on geographic or climatic conditions.

Following the system of Drude, the phytogeographic regions of Nebraska would all be included within the Middle North American Realm of the Northern Zone, and by a division of this realm into 'provinces' (Allegheny, Prairie, Rocky Mountain, Great Basin and California) the greater portion of the State would fall within the second of these, with a small strip along the eastern edge representing the first.

Lists of species peculiar to each region, those that are common to two of the regions, and those that are common to three or more of the regions, are given. The distribution of any species, or in other words the area over which it occurs, is of course a mere matter of more or less careful observation, but the abundance of a species can only be determined by careful investigation and calculation, the method of which is described, together with the formulæ adopted.

The terms employed are somewhat bewildering in their number and the fineness of their distinctions, and doubtless many who are not directly interested in the subject may become impatient at the necessity for mastering the differences between 'abundant,' 'frequent,' 'sub-frequent,' 'infrequent,' 'sparse,' 'rare,' 'solitary,' 'copious,' 'gregarious,' 'gregario-copious,' etc.

In the division of the plants into 'vegetation-forms' will be found another series of terms, popular and scientific, such as woody plants ('trees,' 'shrubs,' 'under-shrubs,' 'climbers and twiners'), half shrubs, herbs ('rosettes,' 'mats,' 'succulents,' 'sod-formers,' 'rootstock-plants,' etc.), water plants ('floating,' 'submerged' and 'amphibian'), saprophytes, parasites, mosses, fungi, algæ, etc., with discussion of habitat, foliage, protective devices, period of flowering, methods of dissemination, etc.

The factors concerned in the phenomena of phyto-geography are both physical and biological. They are connected with environment (topography, temperature, moisture, mechanical and chemical composition of the soil, etc.), and with the influence of animals, including man, as well as with the influence of plants upon each other, and each natural group of plants may be affected differently by the same factor or factors. In this connection each natural group is discussed in sequence.

The final part of the work deals with what is denominated 'plant formations,' and a plant formation is defined as 'a piece of the floral covering, the extent of which is determined by a characteristic correlation or association of vegetable organisms, *i. e.*, it is a stretch of land the limits of which are biological and not physiographical.' They may or may not, therefore, be coextensive with the regional distribution of the plants which compose them.

With respect to their origin they may be either primitive or recent. Primitive origin is necessarily more or less conjectural. It involves the study of the extinct flora of the region and the geologic changes which finally led up to the establishment of existing conditions. Recent formations may arise either from nascence or by modification. If by nascence they must originate upon areas previously destitute of any floral covering, while in the second case they are formed by the elaboration or modification of existing formations, often by the intrusion of foreign elements. Abandoned cultivated patches may represent the first, timber claims the second. Formations often disappear through the agency of fires, floods, mankind, etc., in which cases new formations may arise by nascence.

As an example of the latter is quoted the establishment of *Botrydium granulatum* or *Vaucheria sessilis*, with the cup fungi *Humaria* and *Scutellinia*, on muddy flats, formerly occupied by water plants, but subsequently exposed by the drying up of ponds or streams. A carpet-like layer may then supervene, composed of *Riccia glauca*, *Funaria hygrometrica*, etc., which in turn may be replaced by low-growing flowering plants, such as *Portulacca oleracea*, *Lepidium intermedium*, etc., and this in turn may yield to taller growing *Chenopodiums*, *Amaranths*, etc.

In the origination of formations by modification two sets of factors may be distinguished—natural and artificial. The first are either biological or physical, the second are due to the influence of man or other animals. An unusually wet season in the sandhill region or a dry one in the lowland will often modify the floral covering in a striking way, and modification through the agency of man is too obvious to require more than passing mention.

The various plant formations recognized are finally considered in detail and discussed under headings and sub-headings, physiographical and biological. For example, under the forest formations may be found the river-bluff formation, including (1) the red oak-hickory formation, (2) the bur oak-elm-walnut formation, etc.; under prairie formations, (1) prairie grass, (2) buffalo grass; under foothill formations, (1) under-shrub, (2) mat and rosette, (3) grass, etc., and many others.

The work as a whole is exceedingly valuable for the wealth of facts recorded, irrespective of any conclusions which may be deduced from them, and no one can fail to appreciate the immense amount of conscientious labor which it shows.

ARTHUR HOLLICK.

Synopsis of the Naiades, or Pearly Fresh-water Mussels. By C. T. SIMPSON. Proc. U. S. National Museum, XXII. 1900. Pp. 501–1044.

Some people think that the preparation of zoological catalogues and synopses is a low grade of work, which should be turned over to those who are not capable of doing anything better. Certainly one occasionally meets with examples of zoological bibliography bad enough to have been compiled by the most incompetent, but it is to be remarked that the authors of these works are often really skilled in anatomy or some other branch of the science. The fact is that the preparation of such a work as we have before us, with its orderly arrangement of innumerable references, requires not merely a high grade of intelligence, but a special kind of ability, which is none too common. We may therefore begin by thanking Mr. Simpson for a work which no other living man was equally competent to produce, and which will be invaluable to all students of the naiades. But to regard the work as merely a piece of good bibliography, would be extremely erroneous. Mr. Simpson has carefully studied a considerable majority of the species, and the arrangement of them is original with him. He has, by an examination of the soft anatomy, been able to show that the genus *Unio* of authors is in reality a heterogeneous mass of distinct genera, which