

Describes *Lituites Bickmoreanus* from Niagara limestones at Wabash City, Ind.

Whitley county, Geology of. R. Owen's Rep. 1859-60.

Whittlesey, Chas. Notes on the drift and alluvium of Ohio and the West. A. J. S. (new series) vol. 5 pp. 205-217.

Williams, H. S. Rep. of the subcommittee on the upper paleozoic (Devonic). Am. Geol. vol. 2 p. 232.

Describes the Devonian areas of North America.

Williams, Jesse L. Altitudes in Wayne county. E. T. Cox's Rep. 1876-77-78.

Winchell, A. Vegetable remains in the drift deposits of Indiana. A. A. S. (Proceedings) vol. 24, B. Nat. Hist. p. 49, 1875. Vegetable deposits were noted in the counties of Franklin, Vermillion, Clay, Dubois, Park, Ohio, Dearborn, Switzerland, Clarke, Warren and Knox.

Winchell, N. The surface geology of Ohio. A. A. S. vol. 21, p. 152. Surface deposits of Indiana are referred to, and a classification of such deposits suggested and the various forms described.

Wortman, J. L. (E. D. Cope.) Post-pliocene vertebrates of Ind. J. Collett's Rep. 1884.

Wright, G. F. The glacial boundary in Western Pennsylvania, Kentucky, Indiana and Illinois. Bull No. 58, U. S. G. S.

—————Man and the Glacial Period. (Published in book form.)

Contains references to the work of Mr. Cresson, who discovered in Jackson county "human works and remains under strata considered of glacial date, or in others ascribed to preglacial time." See "Some Recent Criticism." Am. Geol. vol. XI, p. 110.

Wyandotte Cave. E. T. Cox's Rep. 1872.

—————Fauna of. (See E. D. Cope.)

Young, A. H. Manual of Botany of Jefferson County. E. T. Cox's Rep. 1870.

SUGGESTIONS FOR THE BIOLOGICAL SURVEY.

BY JOHN M. COULTER.

[ABSTRACT.]

In studying the flowering plants of any region, they are naturally divided into two categories, namely, (1) those that are indigenous, and (2) those that are introduced. Each one of these groups presents its own special problems in addition to those which are common to both. In the modern study of collected material it has become more and more evident that collectors ought to be trained. It is not sufficient to merely collect specimens

and give an approximate station, for biological investigation demands far more accurate and complete information. In the development of this work by the Indiana Biological Survey it would be well to issue a circular of instruction to collectors, calling their attention definitely to the proper methods of work. It would be well in the training of collectors to definitely divide their work for the season into two parts, namely, (1) the work of collecting all the plants of their district, together with suitable field notes, and (2) the detailed study of one or more of their most interesting plants. In work of this kind the following points must be especially made out:

(1.) *Mass distribution.* It is not sufficient to know that a plant is to be found in this or that part of the county, but it must be known where it occurs in the greatest abundance, and where in the least, and where not at all. The most convenient way to make observations of this kind is to use outline maps as large as possible of the county and upon this jot the occurrence of the plant observed. At the end of the season's work with one or two plants in this fashion, it will be discovered whether one is dealing with a comparatively even distribution throughout the county, or one that follows certain lines, or is restricted to certain localities. It is also easily seen whether the plants mass together in certain places and thin out in others.

(2.) *Topographical distribution.* Under this head is to be considered whether plants are inhabitants of uplands, swamps, prairies, etc. If they occur in all situations, which do they seem most to affect and in what respect are their characters modified by such changes of surface?

(3.) *Geological distribution.* This must take into consideration the soils upon which the plant grows. This part of the study is one that takes considerable knowledge of geology, for it is not always easy to tell the real nature of a soil, whether it is one *in situ*, or an artificial soil. For instance, the soil of the valley may not at all represent the disintegration of rocks that border the valley, but may have been transported from some distance. Great care must be taken in the determination of this drifted soil.

(4.) *The effect of man's presence.* Indiana may be new enough for something to be done in the way of discovering the distribution of most plants before man's invasion. The former distribution of plants, which are now confined to uncultivated areas, should be made out as far as possible. It should also be distinctly noted what effect the presence of man has had upon the occurrence of plants and what plants are able to adapt them-

selves to cultivated ground and what must confine themselves to strictly wild lands.

These facts should be noted not only in reference to the indigenous plants, but so far as they are applicable to introduced plants also. In reference to this latter class, the following points ought to be noted in addition: (1.) The time and circumstances of introduction so far as this can be ascertained. Many of our most notable weeds have long been under the observation of farmers and it is often possible to obtain from them valuable information as to the invasion of certain weeds. (2.) The vigor of introduced plants as compared with native plants ought always to be noted. This, of course, will involve an investigation as to what foreigners have been able to successfully make their way against what natives. (3.) Under the head of economic importance, the introduced plants are to be considered in relation to their injury to crops.

In Indiana not only should these general features of native and introduced plants be studied, but also certain special problems which belong to the state in its relation to other states and to the general topography of the Mississippi valley. The biological survey should have in view some of these special problems whose answer will probably contribute more to real botanical knowledge than the more general study of the state flora. Certain problems are here suggested to which many more may be added:

- (1.) The eastward extension of the prairie flora.
- (2.) The southern extension of the flora of the Great Lakes.
- (3.) The northern extension of the southern flora.
- (4.) The "Knob" flora.
- (5.) Flora of the limestone cliffs.
- (6.) The floras of various soils.

Under the last head Dr. Scovell suggested the "sand-bar flora" along large streams, and W. P. Shannon suggested the flora of the "white clays."

THE PHANEROGAMIC FLORA OF INDIANA.

By STANLEY COULTER.

The knowledge of the phanerogamic flora of Indiana while somewhat extended is far from satisfactory. Many excellent and some few noteworthy regional lists have been published as well as a provisional state catalogue, yet all leave much to be desired. It is unnecessary in this connection to deal in detail with the bibliography, since it is treated in an