As we have seen, most of our forest trees are of a social character. With few exceptions, they keep company with other kinds than their own; they appear in mixed forests. Hence, where certain species, as the pines and spruces, become gregarious, and form unmixed, pure forests, the axe of the lumberer does not as a rule level the entire forest, but he selects the kinds which he wishes to use—he culls the forest. At first sight this would appear rather an advantage for the existence of the forest. So it is from a botanic, geographic, or landscape point of view, yet from an economic point it is exactly the reverse—it is disastrous.

In the well-managed forests of Germany the undeserving species are exterminated, and the most useful fostered, just as the agriculturist exterminates the weeds and cultivates the crop. Not only is the forest there confined to those soils and locations which cannot be used to better advantage, or which require a forest cover in order to protect the soil against detrimental displacement, but it is so managed as to become a more and more valuable resource, a crop of increasing importance, under the management of skilled foresters, of whom, in a late debate on the floor of the Landtag of Prussia, it was said that "While most other productive business has declined, the forest administration has steadily improved and yielded increasing revenues."

The battle of the forest in this country is now fought by man, the unintelligent and greedy carrying on a war of extermination, without the knowledge that victory may lead eventually to their own destitution; the intelligent and provident trying to defend the forest cover, and endeavouring to prevent its removal from such lands as cannot serve a better purpose, and to restrict the use of the balance to such rational harvest of its material, without injurious effects on soil and water conditions, as will insure an ever reproducing crop and a permanent national resource.

While man may study the geography of the earth as it exists, here is about the only opportunity for him to make geography, to shape the surface conditions of the earth, and even to some extent influence its climatic conditions.

The lecturer then referred to the Adirondacks in particular, showing views of forest destruction by fire, water storage, and lumbering, and claiming that they need especially conservative treatment, because the soil itself there is made by the forest, the duff covering the native rock formed at the rate of one foot in 300 to 500 years by the decay of foliage and litter, and hence its loss by washing of the rains is practically irremediable.

He showed the paramount interest which the State has in maintaining favourable forest conditions, and claimed that the private owners, being naturally interested mostly in the timber only, and not caring for the future generations or distant and indirect benefits to others, could not be expected to manage conservatively.

Let it not be overlooked, that the State is not only the representative of communal interests as against individual interests, but also of future interest as against the present; the private interest is not sufficient to protect this class of lands; that State ownership or, what is more objectionable and less effective, State supervision of private forest lands is indispensable in those regions where the forest subserves other functions than that of mere material supply.

Grant for once that the community is interested in the preservation of the forest cover and its rational use with proper regard to the maintenance of permanently beneficial conditions, that the community would suffer from a destructive policy in those watersheds, and you must come to the logical conclusion that the community alone can be expected to guard its interests, that the community, the State, must own and manage these woods.

This does not mean that the same should be kept in virgin condition and unused, that the timber should be left to rot, and the productive capacity of nature's forces be allowed to go to waste, but that a conservative management be instituted, keeping in view both the indirect and the direct benefits of the forest cover, utilising the crop without detriment to the forest conditions.

This, to be sure, is not done by such rules of thumb as a restriction to cutting trees of given diameter, nor can the legislator prescribe to the forest how to grow. He cannot be expected to legislate how many trees to cut, how many to leave, or to lay down rules of technical forest management, any more than he would attempt to prescribe the size of the pillars supporting the roof of the Capitol, or to legislate on the proportions of an arch. It requires the knowledge, the experience, the skill of a professional, technically educated engineer, just as an effective management of the forest requires the knowledge, the experience, the skill of professional foresters, and may not be left to the ignorance and carelessness of the wood-chopper.

May the wisdom of the people of New York, of their legislators and executive officers, be equal to the difficulties of solving the problem as a business proposition, and settling it in a common-sense, business-like manner. May their intelligence and business capacity at least equal that of other States and nations, and forestall the disastrous consequences that follow unavoidably from neutrality or improper partisanship in this battle of the forest.

THE RELATION OF ENERGY OF COMBINATION TO ELECTRICAL ENERGY.

THE problem of directly converting the stored-up energy of coal into available electrical energy is one of great importance; and as a first attempt to perform this operation, the experiments made by Dr. W. Borchers, of Duisburg, and which he described before the first annual meeting of the Deutsche Elektrochemische Gesellschaft, possess great interest. The author in the first place produced an electric current by the "combustion" of carbonic oxide gas. The original form of the apparatus used consisted of a glass vessel divided into three compartments by two glass plates which nearly reached to the bottom of the vessel. In the two exterior compartments copper tubes were placed, which served for the introduction of the carbonic oxide, while the middle compartment contained a bell-shaped mass of carbon. This carbon bell constituted one plate of the cell, and the oxygen was introduced by means of a tube within this bell. As electrolyte the author uses an ammoniacal or acid solution of cuprous chloride; this liquid readily absorbs both oxygen and carbonic oxide, and is therefore particularly well suited to form the electrolyte in a gas battery in which these gases are used. Coal gas which contains 5 per cent. of carbonic oxide was, after the first experiments, used in place of pure carbonic oxide. The copper tubes were weighed before and after each experiment, and no decrease in their weight was ever found. With such a cell working through an external resistance of 0·1 ohm a current of 0·5 ampere was obtained, while with an external resistance of 50 ohms the difference of potential between the terminals was 0·4 volt.

With a cell in which the outer compartments were filled with copper turnings, in order to increase the absorption of carbonic oxide by exposing a greater surface, and by using coal gas in place of pure carbonic oxide, a maximum current of 0·64 ampere was obtained, and by increasing the external resistance a maximum difference of potential of 0·56 volt was maintained. The E.M.F. obtained by calculation from the heat developed in the combination of CO and O is 1·47 volts, so that in the above experiment 27 per cent. of the energy of combination of the fuel is converted into electrical energy. Since a solution of cuprous chloride dissolves hydrocarbons, powdered coal was tried in place of carbonic oxide, when a maximum current of 0·4 ampere and a maximum E.M.F. of 0·3 volt were obtained. The above E.M.F. (0·3) corresponds to about 15 per cent. of the energy corresponding to the oxidation of carbon. In the case of the coal-dust, even when the liquid was kept in motion, there was always a considerable falling off in the current, while the pollution of the electrolyte by the coal would quite prevent its use. With the gases, however, there is no falling off of the E.M.F., and this pollution of the electrolyte does not occur.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. R. D. Roberts has been appointed chief secretary for the University Extension scheme, in the room of Mr. A. Berry, who retires at the beginning of the Lent Term 1895.

The General Board of Studies report in favour of steps being taken to establish a closer connection between Addenbrooke's Hospital and the University teachers in the departments of medicine, surgery, and therapeutics.

The Syndics for State Medicine report that in the past year fifty-six candidates presented themselves for examination in this

subject; of these thirty-two received the University's diploma in Public Health.

Mr. H. Yule Oldham, University Lecturer in Geography, has been admitted by incorporation to the degree of M.A.

The *University Reporter* of December 3 contains a full report of the speeches delivered at a meeting in King's College for the purpose of promoting the foundation of a memorial library of Oriental literature in honour of the late Prof. Robertson Smith, editor of the *Encyclopædia Britannica*.

SCIENTIFIC SERIAL.

American Meteorological Journal, November.—Cyclonic precipitation in New England, by Prof. W. Upton. A list of cyclones was made out, including nearly all in which the precipitation had been general over New England, and the amounts and distribution noted on maps, with regard to the track of the minimum pressure. The velocity with which the storms passed ranged from fifteen to sixty miles per hour. The tables show that the heaviest rainfall is rarely found along the central path of the storm. Of the cyclones which came from the west *across* New England, only ten out of sixty-nine had their heaviest precipitation on or near the storm-path, while forty-five had the maximum area on the right of the storm-track; similarly, out of eighty-four cyclones which moved from the west *near* New England, seventy-three had their maximum precipitation south of the storm-track. Further comments are reserved until the results of a study of the storms coming from the south are given.—The barometer at sea, by T. S. O'Leary. This paper deals with observations made chiefly by captains of American vessels. The author considers that a great step forward was made when the number of observations was reduced from twelve to one daily, the result being that the number of observers has increased nearly eight-fold. Another valuable feature is that the leaves of the log-books are forwarded to the central office as soon as opportunities are offered, so that the captains can see their observations made use of without delay. A simple plan for obtaining comparisons of the barometers has been adopted with very satisfactory results. The observers when in port record readings at certain hours, and forward them on post-cards to the central office; a copy of the "corrections" is immediately returned to them, and copies filed for use and future reference.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 15.—"The Pigments of the Pieridæ. A Contribution to the Study of Excretory Substances which function in Ornament." By F. Gowland Hopkins.

The wing-scales of the white Pieridæ are shown to contain uric acid, this substance practically acting as a white pigment in these insects. A yellow pigment, widely distributed in the group, is shown to be a derivative of uric acid, and its artificial production as a bye-product of the hydrolysis of uric acid is demonstrated. That this yellow pigment is an ordinary excretory product of the animal is indicated by the fact that an identical substance is voided from the rectum on emergence from the pupa.

These excretory pigments, which have well-marked reactions, are apparently confined to the Pieridæ, and are not found in other Rhopalocera. This fact enables the observation to be made that when a pierid mimics an insect belonging to another group, the pigments of the mimicked and mimicking insects, respectively, are chemically quite distinct.

Other pigments existing, not in the scales, but between the wing membranes, are described, and are shown sometimes to function in ornament. The analysis, and the properties of the yellow scale-pigment are fully discussed in the paper.

Physical Society, November 23.—Prof. Rücker, F.R.S., President, in the chair.—Mr. Womack read a paper on a modification of the ballistic galvanometer method of determining the electromagnetic capacity of a condenser. The condenser is placed in parallel with one arm (S) of a Wheatstone's bridge arrangement of non-inductive resistances. A balance for steady currents having been obtained, the condenser is placed in circuit, and the throw on depressing the battery key determined. The condenser is then thrown out of circuit, and the proportionality of the arms of the bridge disturbed by changing the value of S to S + dS. The steady deflection due to this change is then read. From these two readings and the known values of S and dS the capacity is immediately determined. In practice readings of deflection may be taken with equal positive and negative values of dS. To avoid changes of E.M.F. of the battery, the author finds it best to use a reversing key in the battery circuit, and to observe the throw on reversing the current instead of on simply breaking it. One advantage of the method is that there is no need to know the galvanometer- or battery-resistance, and the author points out that it may be of service in the simultaneous determination of the resistance and of the joint capacity and inductance of a submarine cable or of a telephone or telegraph line. Prof. Perry asked what were the advantages of the method as compared with the Rayleigh-Sumpner method. Mr. Blakesley thought that the correction for damping in the ballistic part of the experiment might be avoided if in the second part the disturbance of balance due to the increment dS were measured by half the first throw of the needle on making the galvanometer circuit, instead of by the steady deflection. He doubted whether reversing the current in the battery circuit would have just twice the effect of simply breaking the circuit. In reply, Mr. Womack said he had not tried the method of reading suggested by Mr. Blakesley, but with regard to the reversing of the battery circuit, that was found to give in practice as nearly as possible twice the deflection which resulted from simply breaking.—A paper, by Prof. S. P. Thompson and Mr. Miles Walker, on mirrors of magnetism, was read by Prof. Thompson. It was pointed out that, corresponding to the theory of electric images produced by insulated conductors, there is a theory of magnetic images produced by bodies of infinite magnetic permeability. A magnet pole in the latter theory is the analogue of an electric charge in the former, and a body of infinite magnetic permeability is the analogue of an insulated conductor (which is electrostatically indistinguishable from a body of infinite dielectric capacity). Experiments were made to determine how far the magnetic images due to thick sheets of iron accorded with those deduced by theory for the case of infinite permeability. The image of a north pole in an infinite plane sheet should consist of a south pole of the same strength at a point coinciding with the optical image of the north pole, together with an equal north pole distributed uniformly over the surface of the infinite sheet, as a free electrical charge would be, and so exerting no finite action. Working at distances of a few inches in front of the surface, a sheet of iron a few feet in length and breadth, and a couple of inches thick, was found to realise the theoretical conditions with very tolerable exactness. In a coil of wire placed on one side of the sheet a current was started or stopped, and the electromotive impulse produced in a subsidiary exploring coil was detected by means of a ballistic galvanometer. That the effect of the actual mirror was equivalent to that of the theoretical image, was verified by substituting for the iron a coil equal and similar to the first, and coinciding with its optical image. Sending the same primary current as before round the two coils (with due regard to its direction in the second coil), hardly any appreciable difference in the secondary impulse was observed. This was found to hold good whether the original primary coil had its axis perpendicular or oblique to the plane of the magnetic mirror. Some observations on spherical sheets were also recorded, but in this case the conclusions were less simple. The paper was followed by a discussion, in which Mr. Boys, Prof. Perry, Prof. Ayrton, Dr. Burton, Mr. W. Bailey, and Prof. Carey Foster took part.—Prof. Ayrton exhibited a student's apparatus for verifying Ohm's law, designed by himself and Mr. Mather. The current flowing through a circuit is to be measured (not necessarily in terms of any defined unit) by means of a galvanometer, while the potential-difference between two fixed points is measured by means of an idiostatic electrometer. Within small limits of experimental error, the current and potential-difference are found to vary in the same proportion; but the electrometer and its manner of use constituted the chief interest of the paper. The fixed and moving parts (inductors and needle) are alike cylindrical in form (the term being understood in its most unrestricted sense), and the generating lines are vertical. There is a vertical axis of symmetry, such that the disposition of these cylindrical parts would remain unchanged if the instrument were rotated through 180° about the axis. The needle is hung by a very thin phosphor-