

the section. After removing the superficial folded layer, the paper covering the lower bed was found to be covered with minute corrugations like those often seen on beds of mica-schist. On stripping off the paper, and again

stretching the elastic substratum, the clay adhering to it did not become smoothed down to its original form, but split along a multitude of vertical rents, transverse to the direction of pressure, each of which corresponded to one



Section at head of Loch Eriboll.

of the little ripples on the paper before it was removed. The sides of the cracks were observed to be covered with minute vertical striations like the slickensides of a fault-fissure.

This experiment, the author suggests, may explain the vertical cleavage and foliation found in the deep-seated parts of many old mountain-systems.

#### SWISS FOREST LAWS.

THE Report of Mr. Conway Thornton to the Foreign Office, on the Swiss Forest Laws, is a careful and interesting piece of work. He divides his subject into two parts: in the first he treats of the history of forestry prior to 1875, the year in which the Act now in force, the Forestry Act of 1875, was proposed; and in the second part he deals with that Act, its provisions and its effects, and the measures taken under the "Règlement d'Exécution," which followed the Act, for the advancement of technical education amongst foresters in Switzerland. It is evident that from a very early date the various cantons endeavoured to preserve the forests. Thus, in 1314 the authorities of Zurich forbade "the felling, floating, or selling" of timber from the Sihlwald; in 1339, Schwyz forbade charcoal-burning near the chief towns of the canton, and a similar decree was promulgated in Fribourg in 1438. Industries using wood were in various cantons restricted in their operations; the laying out of new vineyards was prohibited under heavy penalties for centuries; and finally, during last century, the use of uncloven vine-props was forbidden. The exportation of timber took place only under great difficulties, and even the removal of timber from one place to another in Switzerland was, until 1848, very much restricted. In 1376, Zurich forbade clearings to be laid down in pasture, and Fribourg would not allow sheep-pastures to be established in clearings. Goats were not permitted to be let loose in the woods; and rosin-scrapers were excluded from many of the forests. None of these numerous decrees appear to have had much effect, the very number of them testifying to their powerlessness to check the evil. In many cases the general prohibition against wood-cutting gave way to a partial permission, as, for example, in Zurich, where the number felled was not permitted to exceed a stated total. This instance of Zurich gives us the first scientific treatment of the question, when the felling of the Sihlwald and other woods in the fourteenth century was regulated both as to the amount and the system of cutting.

In 1702, prior to which date attention was paid solely to the maintenance and protection of the timber, the Government appointed a Commission to inquire how the forests might be best preserved, enlarged, and improved; and subsequently issued a decree carrying the recom-

mendations of the Commission into effect. In 1725, Berne followed the example of Zurich, and published forestry orders, which, like those of the latter, contained directions for the cultivation of timber and for permanent improvements. Similarly, in other cantons, improved systems were introduced; thus, in Fribourg, the compulsory planting of marshy meadow-land was decreed; in Lucerne a season was set apart for felling, the growth of oaks was recommended, and the formation of clearings was forbidden. In 1755 an excellent forestry code was drawn up by Joseph Wilhelm, Prince-Bishop of Bâle. About 1760, two scientific Societies—the Physical Society of Zurich and the Economical Society of Berne—made great efforts to introduce improved knowledge of woodcraft into Switzerland, and with this object they made strong representations to their respective Governments, and the Forestry Decrees of 1773 and 1786 were the results of their interference. The substance of these decrees may be stated to be the surveying of forests, the appointment of officials who would supervise planting, experiment on exotics, and help in teaching a more scientific system of wood-cutting. By means of these measures some real progress was made, which, however, was stopped by the general confusion during the beginning of this century; but, immediately peace was restored, the Helvetic Government turned their attention again to the forests, which by this time had suffered severely. Soleure was the first to start a system under which technical instruction, chiefly in forestry and geometrical surveying, was given to two citizens from each woodland district, the better qualified being chosen foresters. From this time until 1830, forest laws were drawn up universally, prescribing the modes in which timber was to be felled. Zug, in 1821, tried to give an increased value to her forests by endeavouring to extend scientific teaching among the people. In consequence of the disastrous floods in Switzerland in 1830, from this time we find that forest laws were more generally enacted and more rigidly enforced than they had ever been before. The number of officials was increased, and great attention was paid to their training. In fact, the spread of the science of forestry in Switzerland dates from this period. At first the people thwarted the officials in every way, but, becoming gradually enlightened as to the utility of the Government measures, they ceased from actual opposition. Even the most backward of the cantons began



to realize that their true interests lay in the preservation of the forests, both as a commercial speculation, having regard to the advancing price of timber, and as a support for precipitous ground, and on account of its domestic and national uses. With regard to the latter, it is worthy of note that the respective cantons, from the earliest times, supervised the numerous public woods; and that the frontier forests were always better looked after than any others, on account of their importance as a defence in time of war, and at the commencement of the eighteenth century woods were protected, as being safeguards against avalanches and landslips.

Hitherto the students trained in forestry had been sent to the schools in Germany, but in 1855 the Confederation took the matter up and established a Forestry School, in which henceforth Swiss students were educated in the art of wood-cutting and the kindred sciences. In 1858 a long and searching inquiry was made into the supposed connection of the forests and the course of the mountain torrents, and, as a consequence, the State aided the School of Forestry in their efforts to plant anew the ground where springs abounded, and officials were appointed for this purpose. With regard to these officials, mention of whom occurs in all the forest laws of Switzerland, we first hear of them in 1314, when, as in subsequent centuries, they were supposed to be aided by the inhabitants, every one of whom in a woodland district was sworn to disclose any breach of the decrees which came to his knowledge. For centuries these officials were mere guardians, commonly called *Bannwärter*; but the punishment of offenders rested with councils of magistrates, &c. The ordinary forest-keeper was generally nothing more than an intelligent wood-cutter; but when it was seen that some technical teaching was necessary, the skilled man, and, later still, the man with a knowledge of natural science and mathematics, was always preferred. In 1868 the disastrous floods gave a fresh impetus to the spirit of inquiry into the action of the forests on the rainfall and the course of the torrents; and we find in the revised Federal Constitution of 1874 an article inserted, giving the Federation control over the forests and waterways, and authority to interfere in any way they might think fit. Under this article two officials were appointed—the Federal Inspector of Forests, and also a Sub-Inspector. The Forestry Societies unanimously adopted a programme which, being presented to the Federal Council, was embodied in the Forest Law proposed by the Council in 1875. This proposed enactment led to much discussion in the Assembly, but was finally passed by both Houses on March 24, 1876. The district to be subject to the law included not only the high mountain ranges, but also the hills bordering on the plains, as sharing in the protection afforded against floods and avalanches by the works which were intended to be undertaken in the former. The district was bounded by a line starting from the east of Lake Lemán along the south of the plain between the Alps and Mount Jura, thence to the north of Lake Constance—that is, a tract of country in all about 60 per cent. of the whole of Switzerland, or 6,750,000 acres, about 15·8 per cent. of which was forest land. It was decided that the rights of private owners should not be infringed except in case of necessity—that is to say, where the woods of private owners were “protecting” woods; in other words, where, on account of their position, they might have an influence on the climate, avalanches, landslips, &c. Each canton was required to maintain an efficient staff of officials; and to each individual who had received technical training an area of about 17,500 acres was assigned if in the plains, and 25,000 acres on the mountains. All the woods under official supervision, including, of course, private woods which came under the class “protecting” woods, were to be demarcated, all clearings were to be immediately planted afresh, and where neces-

sary new forests were to be created, the Federal treasury bearing from 30 to 70 per cent. of the cost, or, in the case of replanting protecting woods, from 20 to 50 per cent., according to the difficulty and the importance of the works, which were always required to receive the approval of the Inspector-General before the Federal subvention was granted. All servitudes or easements in “protecting” woods were to be redeemed within ten years, and no new ones were permitted to be created. Anything which might endanger the utility of the forests was strictly forbidden; cattle were not allowed to graze, nor could leaves be collected except in fixed spots. To this enactment was added a “Règlement d’Exécution,” which provides, among other things, for the course of education to be given to each student of forestry by the canton to entitle it to the Federal subsidy. The time of the course is not to be less than two months, which may be divided into two half-courses of a month each, but the whole course must be taken within a year. Instruction must be given in the following subjects:—(1) Forest-surveying and measurement in detail; calculations of the dimensions and value of single trees, and of outlying tracts of wood; road-making; safeguards against avalanches, &c. (2) Study of the different kinds of timber and of noxious plants. (3) Elementary knowledge of soils, and of their component parts. (4) Fundamental notions of the laws of climate and meteorology. (5) Cultivation and care of forests. (6) Book-keeping and other general branches of instruction valuable for under-foresters. A preliminary and a final examination are prescribed, and no license is granted except on good answering in the latter. The Federal Government pay the teachers, who are appointed by the canton subject to the approval of the Federal Government.

At the outset there were great difficulties in carrying out this law. Some of the cantons had not their codes of regulations drawn up till 1881, and, with the exception of the cantons of Zurich, Fribourg, and Vaud, the survey was not quickly completed. In 1886, however, the Army Staff finished the triangular survey intrusted to them. In 1886 the redemption of servitudes prescribed by the Act was not ended, and up to that time £9150 had been thus expended. There is not in the cantons an uniform organization for carrying out the Forest Law, and Dr. Fankhauser, one of the highest officials of the Forest Department, does not think that such an organization is possible, having regard to the differences in position and ideas of the various cantons. At the present time each canton possesses in a measure its own scheme of forestry organization. There are, however, two main systems in existence in the Federal district, the first of which prevails in the central, eastern, and southern parts of Switzerland. Each canton is divided into districts of from 17,500 to 35,000 acres each, and over each district the canton places an officer who has received scientific training; under him are the keepers and deputy-foresters, chosen by the owners from among the students of the local forestry school, and paid by them. Each deputy has about 3000 acres to take care of, and has but to carry out the orders of his superior as to felling, clearing, and replanting. In the next, however, a different system obtains. Here the country is far less mountainous, and the inhabitants industrial rather than agricultural in their pursuits. In these cantons the district forester has from 7500 to 17,500 acres under him, and in this district he marks out all the fellings to be performed, and in fact does everything but the manual labour, which he leaves to his inferiors. This district includes, among other cantons, Zurich, Berne, Lucerne, and Neufchâtel, where timber being very high in price, and the opportunities of sale being numerous, the country is frequently reforested by private individuals, while in the other cantons the State is forced to do nearly everything. The cantons not within the control of the



Federal law differ from those here spoken of in their organization. In Bâle Campagne with its 37,000 acres of forest, 75 per cent. of this being public, has no officials whatever. Laws have been passed, but the people set them at naught; and similarly in Thurgovie there is the greatest opposition to any interference with what the people consider to be their ancient rights; and here also there are no officials, except one who has the care of 300 acres of State forest.

The salaries of the forest officials vary very much in the different cantons, but even in the best-paid districts the remuneration is very modest. Under-foresters receive sometimes a fixed salary, sometimes only daily wages when employed. If the former, the sum varies from £24 to £48; occasionally it reaches £60. If the rate of pay is per day, which is unusual, it is generally fixed at 4s. District foresters usually receive from £88 to £112 a year. In Uri, however, £120 is given, and in Glarus and a few other places as high as £160 per annum. Cantonal forest inspectors receive from £120 to £180 a year, besides allowances, which are always given to the higher officials when travelling on duty, ranging from 5s. to 8s., with the cost of the journey.

#### NOTES.

WE regret to announce the death of Signor Giacomo di Brazza, brother of the Governor of the French Congo Settlements, also an African traveller well known by his investigation of the Ogowé River. He died at Rome, aged thirty.

HERR ANDOR SEMSEY has presented the sum of 8000 florins (£800) to the Natural Science Society of Budapest, for the printing of a work by Herr Otto Hermann on Hungarian birds.

THE International Congress of Americanists, which met in 1886 at Turin, proposes holding its seventh session at Berlin early in the month of October. The Organizing Committee already includes such well-known names as Virchow, Reiss, and others.

MR. A. W. PICKARD-CAMBRIDGE has taken first place in Classics among the senior students at the last Cambridge Local Examination, and has been offered, in consequence, an Exhibition at St. John's College, Cambridge. He has won this honour at an almost unprecedentedly early age, being only fourteen years old. He has been a pupil of Weymouth College for the past four years, and is the son of the Rev. O. Pickard-Cambridge, F.R.S., the well-known naturalist.

A REPORT of the Cambridge Local Examinations and Lectures Syndicate laying down a scheme for the examinations for commercial certificates has been confirmed by grace of the Senate. The examination is to be wholly separate from the local examinations, there being no papers of questions common to the two, and no common classification of successful students. The standard set by the Syndicate is that suitable for well-prepared students of seventeen. Amongst the compulsory subjects are arithmetic, and physical and commercial geography, whilst the optional subjects include algebra and one of the following five subjects in elementary science: (1) inorganic chemistry, theoretical and practical; (2) organic chemistry, theoretical and practical; (3) mechanics, including hydrostatics and pneumatics; (4) sound, light, and heat; (5) electricity and magnetism.

ACCORDING to the *Oldham Evening Express* of March 16, what is described as a full-grown summer butterfly took refuge from a blinding snowstorm in a dwelling-house at Lusley Brook, near that town. The wings are said to be beautifully variegated; and on obtaining shelter in a warm room the butterfly thoroughly revived.

AT the last meeting of the Calcutta Microscopical Society a paper was read by Mr. Simmons on the mango weevil, a pest which is spreading rapidly in India. He has devoted much attention to the weevil, and in this paper he gives much useful information as to its geographical distribution, the extent of the damage done by it, with the observations of English and American entomologists on its ravages among fruit. This lecture is believed to be the first attempt made in India to systematically study the habits of the weevil.

THE Fund which has been established by Mrs. Elizabeth Thompson, of Stamford, Connecticut, "for the advancement and prosecution of scientific research in its broadest sense," now amounts to \$25,000. As accumulated income is again available, the Trustees desire to receive applications for appropriations in aid of scientific work. This endowment is not for the benefit of any one department of science, but it is the intention of the Trustees to give the preference to those investigations which cannot otherwise be provided for, which have for their object the advancement of human knowledge or the benefit of mankind in general, rather than to researches directed to the solution of questions of merely local importance. Applications for assistance from this Fund, in order to receive consideration, must be accompanied by full information, especially in regard to the following points:—(1) Precise amount required. Applicants are reminded that one dollar is approximately equivalent to four English shillings, four German marks, five French francs, or five Italian lire. (2) Exact nature of the investigation proposed. (3) Conditions under which the research is to be prosecuted. (4) Manner in which the appropriation asked for is to be expended. All applications should be forwarded to the Secretary of the Board of Trustees, Dr. C. S. Minot, Harvard Medical School, Boston, Mass., U.S.A. It is intended to make new grants at the end of 1888. The Trustees are disinclined, for the present, to make any grant exceeding \$500.

THE following is a list of the grants already made from the "Elizabeth Thompson Science Fund":—(1) \$200 to the New England Meteorological Society, for the investigation of cyclonic movements in New England. (2) \$150 to Mr. Samuel Rideal, of University College, London, England, for investigations on the absorption of heat by odorous gases. (3) \$75 to Mr. H. M. Howe, of Boston, Mass., for the investigation of fusible slags of copper and lead smelting. (4) \$500 to Prof. J. Rosenthal, of Erlangen, Germany, for investigations on animal heat in health and disease. (5) \$50 to Mr. Joseph Jastrow, of the Johns Hopkins University, Baltimore, Md., for investigations on the laws of psycho-physics. (6) \$200 to the Natural History Society of Montreal, for the investigation of underground temperatures. (7) \$210 to Messrs. T. Elster and H. Geitel, of Wolfenbüttel, Germany, for researches on the electrization of gases by glowing bodies. (8) \$500 to Prof. E. D. Cope, of Philadelphia, Penn., to assist in the preparation of his monograph on American fossil vertebrates. (9) \$250 to Mr. W. H. Perkin, Jun., for experiments on the synthesis of uric acid. (10) \$125 to Mr. Edw. E. Prince, of St. Andrews, Scotland, for researches on the development and morphology of the limbs of Teleosts. (11) \$250 to Mr. Herbert Tomlinson, of University College, London, England, for researches on the effects of stress and strain on the physical properties of matter. (12) \$200 to Prof. Luigi Palmieri, of Naples, Italy, for the construction of an apparatus to be used in researches on atmospheric electricity. (13) \$200 to Mr. Wm. H. Edwards, of Coalburg, W. Va., to assist the publication of his work on the butterflies of North America.

THE latest reports received by the Hydrographic Office of the United States about the logs of the great raft abandoned south of Nantucket about three months ago, prove that,