there are 32 lectures on forestry, 83 other lectures for the education of forest keepers and numerous assistant lecturers.

All the institutions are furnished with abundant means for teaching, with libraries, collections, botanical and experimental gardens, and in some cases with special teaching and instructional districts. The total number of forestry students amounted last year to about 600, of whom the majority were candidates for the State Forest Service. There also exists schools for the lower branches of the service at which theoretical instruction is given in Prussia, Bavaria, Wurtemburg, Baden, Hesse and Meiningen.

### Supervision By Board.

The trial of new methods, and the improvement of the existing ones, is supervised by the German Board of Experimental Forestry, which is the outcome of a union of German experimental forestry institutions, with its headquarters at Eberswalde. To this latter union belong nine experimental institutions in Prussia, Bavaria, Saxony, Wurtemberg, Baden, Hesse, Brunswick, Thuring and Alsace Lorraine. The united interests of German forestry are represented by the 'German Forest Union,' the present organ of which is the 'German Forest Council.' At present about 2,200 members belong to the union. Twenty forest unions exist besides for separate countries or parts of a country. Finally, there is a burial club for the foresters, a union of private forest officials in Germany, etc., etc.

## National Value Recognized by State.

The national value of the forest, its capacity to produce necessary articles of living economically, to provide opportunities for remunerative labor, to influence favorably the cultivation of land, and to use certain kinds of ground usefully, has made it from times immemorial an object of solicitude on the part of the state. The legislation referring thereto, which is very different in the different states, is specially directed towards the preservation and maintenance of inclosed forests and to the recultivation of planting of waste tracts. In the first place, the state and other public authorities acquire waste land and plant it. Private efforts are supported actively by means of subsidies and loans from public funds, by information, advice, and by the state authorities who take charge of the management. According to the latest reports there were 545,000 hectares of waste land in the whole of Germany suitable for the planting of trees, i.e., about 4 per cent. of the forest area, and 1 per cent. of the total area of the country.

### Home Supply Yet Inadequate.

In spite of its considerable home production (about 38, 000,000 cubic metres) of timber, Germany is no longer in a position to supply its timber requirements. The industrial development of the empire and the rapid increase of population necessitates more wood than the country can produce. The excess of imports of wood over exports amounted in 1908 (the latest statistics obtainable) to 6,499 tons. The inference is justified that with a continuance of the present rate of development of the empire the requirements and the imports from abroad will continue to increase, and that the assured growth in home wood will not suffice to meet them.

## Canada Not a Source of Importation.

Germany receives most of its wood from Austria-Hungary, Russia, Finland and Sweden. The United States also exports a certain quantity to Germany, whereas Canada does not figure in the lists of imports.

### TYPES OF WELLS; THEIR COMPARATIVE COST AND MERITS AND METHODS OF PROTECTION FROM POLLUTION.\*

Because of their cheapness, convenience, and fancied safety, wells are by far the most popular source of domestic supplies in all regions in which water is found at reasonable depth. If properly located and constructed they afford an ideal source of supply fully justifying their popularity. But if they are carelessly finished or improperly located they are much more liable to pollution than is commonly supposed, and it is with the view of pointing out some of the precautions that should be taken for their protection, as well as of presenting information concerning desirable types, location, and construction, that the following discussion is presented.

#### Types of Wells.

Although no two wells are exactly alike in all particulars, there are, in reality, only a few distinct forms, the others being simply modifications or combinations of these. The kind of well to be sunk at a particular locality depends mainly on the nature of the material to be encountered, one form being particularly adapted to a certain material, such as sand, while an entirely different form is demanded if rock is to be penetrated. The following tables show clearly and concisely the characteristics and methods of sinking the more common types and point out the conditions to which they are best adapted:

# Types of Wells and Conditions to which They are Adapted.

Dug.—Generally circular excavations, 3 to 6 ft. in diameter, dug or blasted by hand and curbed with wood or with stones or bricks laid without cement. Adapted to localities where the water is near the surface, especially where it occurs as small seeps in clayey materials and requires extensive storage space for its conservation. Should not be near sources of pollution.

Bored.—Bored with various types of augers from 2-ins. to 3-ft. in diameter, rotated and lifted (together with the earth) by hand or horse power. Curbed with wood, cement, or tile sections, with open or cemented joints, and more rarely with iron tubing. Adapted to localities where the water is at slight or medium depths and to materials similar to those in which open wells are sunk.

Punched.—Small holes, usually under 6-ins. in diameter, sunk by hand or horse power, by dropping a steel cylinder slit at the side so as to hold and lift material by its spring. Clay is added to incoherent materials like sand to bind them together so that they can be lifted. Adapted to clayey materials in which water occurs as seeps within 50-ft. of surface, but not at much greater depths.

Driven.—Small iron tubes, usually 1¼ to 4-ins. in diameter and provided with point and screen, driven downward by hand or by simple hand or horsepower apparatus. Adapted to soft and fine materials, especially to sands and similar porous materials carrying considerable water at relatively slight depths. Particularly desirable where upper soil carries polluting matter.

California or Stovepipe.—Overlapping sheet-steel casings, 4-ins. or more in diameter, forced downwards by hydraulic jacks and finally perforated by a special apparatus at water strata. Drillings are removed by a long sandbucket with valve. Adapted to soft materials extending to

\*Extract from Water Supply Paper No. 255, U.S. Geological Survey, by Myron L. Fuller.