rian formations to the south. In France they constitute, not only the great plateau already mentioned between the Paris and the Bordeaux basin, but also the massive peninsula of Brittany; and in eastern Germany they are the predominant rocks of the Erzgebirge, the Sudetic chain, the Böhmerwald, and the inclosed area. They again appear in isolated masses of considerable extent along the inner side of the Carpathians; and in Turkey they reach from Novi-Bazar to the Black Sea, and from the south of the Balkans to the Ægean. It need hardly be added that they constitute the main mass of the Alps. The only country where the Silurian rocks have a large surface area is the Spanish peninsula, and there they are mainly confined to the western half. They show a long line in the Ural range, stretch from Lake Ladoga along the south of the Gulf of Finland, rise above the Baltic in the islands of Dago, Ösel, Gottland, and Öland, and appear sporadically throughout Scandinavia. Their very name comes from the fact that they are present in England. The other Palæozoic formations—Devonian, Carboniferous, and Permian—are widely developed. In Russia they stretch from the Baltic to the Oka, and from the White Sea to Voronezh; they occupy a considerable area to the west of the lower Don, and are laid bare in the valley of the Dniester. In Western Europe they are best represented in the countries on each side of the lower Rhine, in the British Islands, and in northern Spain; but they occur here and there in several other quarters. The Secondary formations are still more extensively distributed,—the Triassic and Jurassic forming a large proportion of central Germany, a good part of France, much of England, and nearly the whole of the eastern portion of European Russia. To the Cretaceous rocks alone belong a large part of the Paris basin, part of the lower Rhine basin, all the Danish or Cimbric peninsula, the great range of the Carpathians, the Balkan range, nearly the whole of Greece, Albania, Montenegro, Dalmatia, Servia, and a wide tract in the centre of southern Russia. The Secondary are in their turn exceeded by the Tertiary formations, which furnish the continent with some of its most valuable agricultural areas. The Miocene alone occupies a considerable part of the Paris basin, part of the basins of the lower Rhine and the lower Weser, the Lombardy plain, the Hungarian plain, Galicia, and Bessarabia, not to mention the valley of the Ebro and other extensive tracts in Spain. The Pliocene is best represented in the Caspian basin and the Ponto-Caspian depression, and along the Russian coast from the Danube to the Don.

Minerals.

Europe is richly furnished with mineral wealth, and the distribution is not so irregular as might appear from the actual state of the mining industry in the different countries. For the precious metals it is mainly indebted to other quarters of the globe, but it possesses abundant stores of iron ores, lead, copper, coal, and salt. Britain, Germany, and the countries of the Austrian-Hungarian monarchy are especially distinguished by the value and variety of their deposits; and Belgium and Sweden are largely indebted for their national prosperity, the one to its coal and the other to its iron. Spain naturally ranks high in this department, but the working of its mines is in a backward condition. In the lands of the Turkish empire matters are still worse, and Greece has comparatively little to show except the silver mines of Laurion. Roumania exports salt and petroleum, and Servia, since it became independent, has begun again to work its iron and copper mines. In the Russian empire there are valuable coal-beds in the European territory, but the richest mineral area lies on the Asiatic side of the Urals.

Platinum has hitherto been obtained nowhere in Europe except in the auriferous sands in the Russian government of Perm, which yield from 900 to 1000 kilogrammes a year. Gold, on the other hand, is widely diffused, but it occurs for the most part in such insignificant quantity as not to repay the expense of collecting. The total production is about 6900 kilogrammes per annum, and by far the greater part is furnished by Russia. The gold mines of Spain were at one time famous, and there was a considerable population supported by gold-washing in Transylvania and Roumania. Silver is much more abundant than gold, but it is less extensively distributed. There are productive mines in the Erzgebirge, the Carpathians, the Urals, the Norwegian Dovre-Fjeld, and the Sierra Morena, as well as in Sardinia and England. The total yield is about 300,000 kilogrammes per annum. A considerable proportion is obtained during the working of the lead mines, which are of great importance in several countries, more especially in Spain, Germany, and Belgium, where the supply of lead exceeds the local demand. In Spain, which has a large export, the lead mines are mainly situated in Murcia, Almeria, and Jaen; in France the most important are in the Puy-de-Dôme; in Britain in Durham and Northumberland; in Austria in Carinthia, Bohemia, Tyrol, and Galicia; and in Hungary at Neusohl and Nagybánya. In the German empire, Prussia, Saxony, Brunswick, and Anhalt are most productive; and in Italy, Sardinia, Tuscany, and Lombardy. In Portugal there are 15 mines; and in Turkey lead ore exists at Gallipoli, and at Olovo in Bosnia. The total amount of copper obtained throughout the continent is estimated at about 589,000 cwt. yearly. The only countries that can afford to export are Spain, Sweden, and Norway; but Germany, Britain, Russia, Belgium, and Hungary are all great producers. In Britain the mines are mainly situated in Cornwall, Devon, and Chester; in Germany they are widely distributed, but the most productive are in the districts of Merseburg and Arnsberg in Prussia; in Hungary they chiefly occur in the Carpathian mountains. Of all the Spanish mines the best known are those of Rio Tinto and Tharsis in the province of Huelva (of which the latter is capable of yielding 500,000 tons of iron pyrites annually). More than a third of all the zinc obtained in Europe is contributed by Belgium, and nearly as much is furnished by Germany. The principal Belgian mines are in the province of Liége, and the principal German mines at Oppeln in Upper Silesia. Tin is found only in a few localities. The richest mines are those of Cornwall in England, which have been worked from the earliest historic period; and next in importance are the Austrian mines in the Erzgebirge. Mercury is practically peculiar to Spain and Hungary, though it is obtained in small quantities at Vallalta in the Italian province of Belluno, at Santa Fiora in the province of Grosseto, and in Germany at Deuxponts in the Palatinate, and is also known to exist in Bosnia and Roumania. The principal Austrian mines are at Idria in Carniola, and the principal Spanish mines at Almaden and Almadalejo in Ciudad Real.

Table showing Statistics of the Produce of several of the more important Metals.[1]

The years vary from 1871 to 1875, and in the case of Spain from 1869 to 1872.

	Gold.	Silver.	Quicksilver.	Tin.	Copper.	Lead.	Zinc.	Antimony.
Austria	13·59 kil.	23,740 kil.	3,350 cwt.	1,843 cwt.	3,945 cwt.	34,720 cwt.	85,528 cwt.	1291 cwt.
Belgium	...	...	...	...	51,366 cwt.	146,516 cwt.	1,442,494 cwt.	...
France	410·5 kil.	34,454 kil.	...	...	423,508 cwt.	423,824 cwt.	163,925 cwt.	2368 cwt.
Germany	327 kil.	127,007 kil.	45 kil.	2,000 cwt.	5,381,242 cwt. (ores)	2,119,030 cwt. (ores)	9,138,046 cwt.	361 cwt.
Great Britain	393 oz.	483,422 oz.	...	170,000 cwt.	93,900 cwt.	1,173,340 cwt.	472,280 cwt.	...
Italy	450 kil.	3,500 kil.	2,740 cwt.	...	11,786 cwt.	363,638 cwt. (ores)	3,754,860 cwt. (ores)	...
Russia	4789 kil.	...	...	155 cwt.	58,520 cwt.	...	62,555 cwt.	...
Spain	...	22,500 kil.	40,540 cwt.	...	149,300 cwt.	2,100,000 cwt. approx.	40,544 cwt.	...
Sweden and Norway	16·86 kil.	4,000 kil.	...	...	12,410 cwt.	...	...	...

[1] Based largely on data furnished by Mr Robert Hunt, F.R.S.

The salt production of Europe amounts to about 95,000,000 or 100,000,000 cwt. per annum. To this total no contribution is made by Finland, Sweden, Denmark, Luxembourg, Belgium, Servia, or Montenegro. It is partly procured from mines, partly from springs, and partly from salt lakes and the ocean. The most productive mines are in the Carpathians (at Wieliczka and Bochnia in East Galicia), and at Salzburg on the north side of the Alps; there are also extensive deposits in Chester and Worcester in England, in the departments of Upper Saône and Ariége in France, at Wilhelmsglück and Friedrichshall in Würtemberg, at Berchtesgaden in Bavaria, at Leopoldshall in Anhalt, at Stassfurt and Erfurt in Prussian Saxony, at Stettin in Hohenzollern, and at Sprunberg in Brandenburg, at Cardona, Pinoso, Gerry y Villanueva, in Spain, and in the districts of Prahova, Valcea, and Bacau in Roumania. Salt springs are still more widely distributed. Bay salt is largely manufactured in France, both on the Mediterranean and Atlantic seaboards; in Russia, along the coasts of the Black Sea; in Spain, at Cadiz and Torrevieja, &c.; in Italy, in Sardinia, Sicily, and Elba; in Turkey, at the mouth of the Danube, and in the island of Crete; and in Greece, in the island of Santa Maria. The salt lakes of Bessarabia alone yielded on an average 13,924,000 cwt. yearly from 1819 to 1850, and carriers come for supplies from Poland, Volhynia, Kieff, and Tchernigoff. About 230 waggons are loaded daily in the season.[1]

Full details on the European coal-fields have already been given in the article Coal, vol. vi. p. 55–58; and the reader will find a similar account of the iron mines under Iron. Sulphur mining is one of the greatest industries of Italy and Sicily, forming, indeed, almost the exclusive means of support for Girgenti and some other towns; graphite is obtained in Bohemia and Moravia, Bavaria, England, Russia, Sweden, and Spain; alum more particularly from Scotland, Bohemia, Germany, Russia, and Spain; asphalte from Switzerland, Italy, Brunswick, Dalmatia, and Tyrol; and petroleum from the Carpathian mountains, Alsace, Lorraine, France, &c.

The four great determining facts in regard to the climate of Europe are these: its northern borders are within the Arctic circle; in the south its most southern points are 9 degrees of latitude from the tropic of Cancer; to the east extends for 5000 miles the continuous land surface of Asia; to the west lie the waters of the Atlantic. Of minor but by no means small importance are the presence of the Mediterranean along the south, and the peculiar character of the African continent. To the ameliorating influence of the ocean must be ascribed the main features that distinguish the climate from that of the corresponding portions of Asia, and assimilate it so largely to the insular type. Like other great masses of water, the Atlantic is less exposed to rapid thermometric oscillations than the surface of the land, and its contiguity tends to produce a similar stability. Slowly but continually it is surrendering the heat which it has gathered in the regions of the sun. Though no problem of physical geography is more keenly debated than the method by which the heat is conveyed and distributed, the fact is admitted on all hands that such conveyance and distribution does take place. Part of the work is done directly by means of currents, part indirectly by means of winds. The questions in dispute are mainly—what are the currents, how are they produced, and what is the area of their individual influence? While one physicist ascribes all the credit to the Gulf Stream, another argues that the Gulf Stream has spent both its impetus and its heat long before it approaches the European seas, and that its contributions, if there be any at all, are altogether infinitesimal. Be that as it may, the influence of the ocean as a whole is easily verified; a glance at a map with isothermal lines at once indicates its extent. The line, for instance, of 36° of mean annual temperature, which in the east of the continent passes near Orenburg, reaches as far north as 73° in the sea between Iceland and Norway. As the complement to this stands the fact that the temperature of the East Spitzbergen Sea is still so high that no true polar ice finds its way further south than 75° N. lat., while on the American coast it is carried down to 36° N. lat. In other words, if the European conditions were the same as the American, instead of the polar ice never being seen at the North Cape, it would come sailing down past the straits of Gibraltar.[2]

As regards its rainfall Europe belongs in the main to the zone which is characterized by irregularity of seasonal distribution; its southern portions to the sub-tropical zone distinguished by the dryness of its summers. The line of demarcation runs at a little distance to the north of the Spanish coast of the Bay of Biscay, continues along the northern slope of the Pyrenees, turns north-eastwards to the neighbourhood of Valence on the Rhone, curves southward to Genoa, follows the line of the Northern Apennines, strikes across the Adriatic from Rimini to the neighbourhood of Zara, and proceeds by way of Seraievo, Novi-Bazar, and Sofia to the coast of the Black Sea, south of Zozopoli. Within the sub-tropical zone the maximum rainfall occurs during winter in the south of Spain and Italy; during autumn and spring in central and northern Spain, the south of France, and northern and central Italy. In the zone of irregular distribution Scotland, Ireland, and western England have their maximum in winter; western France, eastern England, the coast regions of the Low Countries and Denmark, and the greater proportion of Norway have theirs in the autumn; while in eastern France, the German Empire, Austria, Hungary, Russia, and Sweden it falls in summer. The general conditions that determine the quantity of rain in a given district are well known,—the height and direction of the mountains, proximity to the coast, and so on. As most of our rain is brought by south-west and west winds, the western parts of the continent have on the whole a heavier rainfall than the eastern; though to the south of the Alps and the Pyrenees the relief of the peninsulas, and the presence of such a large secondary reservoir of evaporation as the Mediterranean, produce great irregularities. The following statistics show the influence of a western position:—

[1] See "Ueber die Bessarabischen Salzseen," in *Z. für Erdk zu Berlin*, 1859.

[2] See Petermann's *Mittheilungen*, 1877, p. 24, and the works of Carpenter, Croll, Dove, and Buchan.

West.	Centimetres.	Inches.	East.	Centimetres.	Inches.
Galway	129·5	50·9	Dublin	74·2	29·2
Skye	257·8	101·4	Aberdeen ..	74·8	29·4
Penzance	105·4	42·6	London	62·4	24·5
Bergen	225·8	88·8	Christiania.	53·7	21·1
Gothenburg.	82·7	32·4	Stockholm.	40·1	15·7
Husum	74·8	29·4	Lübeck.....	57·0	22·4

The greatest maxima of rainfall are registered at Stye-Pass in the west of England, 189·49 inches or 481·2 centimetres, and at Seathwaite, 152·14 inches or 386·7 centimetres. Next comes Glencroe in Argyllshire, with 128·60 inches or 326·4 centimetres. The Venetian and Lombard Alps furnish such maxima as Tolmezzo 95·9 inches or 243·6 centimetres, and Sta Maria 97·7 inches or 248·3 centimetres; and in general it may be said that the rainfall exceeds 40 inches or 100 centimetres along the whole line of the Alps from Chambery to the neighbourhood of Vienna in the east, and to the sea-coast in the south, down the central ridge of the Apennines to the latitude of Gaeta, along the line of the Balkans, in the Dalmatian, Montenegrine, and Albanian highlands, all round the north and west of Spain and Portugal from Cape Roca to the eastern end of the Pyrenees, in a large proportion of Ireland, Scotland, and Western England, and throughout nearly the whole of Norway. The plateaus are usually well watered, though their maxima are much below the maxima of the mountains; but the great Iberian plateaus are an exception to the rule. The rainfall of Salamanca is only 9·4 inches or 24·0 centimetres, and that of Albacete 10·3 inches or 26·3 centimetres—a fact which is to be ascribed partly to the exhaustion of the rain-clouds by the mountains of Galicia and Portugal, and partly to the treeless condition of the table-land itself. The average throughout Sweden and the greater part of Russia, in the Hungarian plain, the northern half of Bohemia, and the district of Germany from Halle to Dantzic, ranges from 40 to 55 centimetres or 15·7 to 21·6 inches. The lower part of the basin of the Dnieper, the whole of the basin of the Don, and the country watered by the middle division of the Volga receive no more than from 25 to 40 centimetres or 9·8 to 15·7 inches; while the great Aralo-Caspian depression, including about 100 miles of the Lower Volga, is an almost rainless region.[1]

In western Europe by far the most prevalent wind is the S.W. or W.S.W. It represents 25 per cent. of the annual total; while the N. is only 6 per cent., the N.E. 8, the E. 9, the S. 13, the W. 17, and the N.W. 11. Of the summer total it represents 22 per cent., while the N. is 9, N.E. 8, E. 7, S.E. 7, W. 21 and N.W. 17. In south-eastern Europe, on the other hand, the prevailing winds are from the N. and E.—the E. having the preponderance in winter and autumn.[2] Of local winds the most remarkable are the Föhn, in the Alps, distinguished for its warmth and dryness; the Rothenthurm wind of Transylvania, which has similar characteristics; the boro of the Upper Adriatic, so noticeable for its violence; the mistral of southern France; the Etesian winds of the Mediterranean; and the sirocco, which proves so destructive to the southern vegetation. Though it is only at comparatively rare intervals that the winds attain the development of a hurricane, the destruction of life and property which they occasion, both by sea and land, is in the aggregate of no small moment. About six or seven storms from the west pass over the continent every winter, usually appearing later in the southern districts, such as Switzerland or the Adriatic, than in the northern districts, as Scotland and Denmark. As instances of the exceptional strength which is sometimes displayed, it may be mentioned that in April 1800 men and cattle were actually lifted from the ground by the force of the storm, and in November of the same year about 200,000 trees were blown down in the Harz mountains alone.

The snow-line is subject, as is well known, to great local variations. In the western and central Alps it lies about 8860 feet above the sea, and in the eastern Alps on an average about 330 feet higher. In exceptional instances, of course, the snow disappears at a much greater altitude, and even such summits as the Jungfrau (13,671 feet), the Strahlhorn (13,750), and the Chaberton are occasionally stripped completely bare. The whole range of the Pyrenees, where the line usually lies about 8950 feet on the north side and about 10,000 on the south, is sometimes in the same condition. In Norway, towards the North Cape, the snow-line is 2360 feet, in the island of Sëiland about 3200, on Sulitjelma about 3970, on Dovre 5540, on Jotune 4910, on Sululand 5300, and at Folgefonden 4800,—a difference of from 400 to 1000 feet being observable between the eastern and western side of the peninsula, mainly due to the more abundant precipitation on the latter. On the western side of the Caucasus the mean elevation is 11,700 feet, on the eastern 14,100. There are no nevados in the Urals, though some of the summits exceed 5000 feet in altitude. The Alps and the Scandinavian mountains are the only ranges that possess a fully developed glacier system, but both the Pyrenees and the Caucasus have individual specimens of considerable extent. The most important of the Pyrenean group are the Maladetta, the Cabrioules, the Mont Perdu, the Brèche de Roland, the Vignemale, and the Néouville glaciers.

The principal botanical regions of Europe have already been indicated in the article DISTRIBUTION. According to Schouw's nomenclature, the Mediterranean countries belong to the region of Labiatæ and Caryophyllaceæ; the countries of northern Europe, about as far as the neighbourhood of the Arctic circle, to the region of Umbelliferæ and Cruciferæ; and the small remaining portion to the region of the Saxifrages and Mosses. The varying relief of the continent, and the consequent variety of climatic conditions, give rise to many infractions of this general rule,—the most remarkable being furnished by the Alps, which are high enough to have a large arctic area, and by the steppes of Russia, which, as is well known, also afford a peculiar environment.[3] The Arctic region, whether in the Alps or elsewhere, is distinguished by the shortness of its period of vegetation and the small number of its annual plants; the north-European region has a long period of vegetation and a regular winter rest; the Mediterranean region has a long period of vernal growth, a protracted summer siesta, a short period of autumnal growth, and a winter rest varying greatly according to locality; and the steppe region has a short period of exuberant vernal growth, limited on the one hand by a severe winter, and on the other by a parching summer. (The nearest approach to tropical conditions is made by the south of Spain. In the Vega of Murcia there is no set time to sow and time to reap; every month brings its fruit, and spring and autumn keep pleasant fellowship throughout the year. The ground is no sooner cleared of its crop than it is again under the plough, and within a few weeks it is green with another blade.[4]

No exact statement can be given in regard to the number

[1] See Dr Otto Krümmel's papers and map in *Ztschr. für Erdkunde zu Berlin*, 1878.

[2] Wesselovski, as quoted by Wojeikof, *Die Atmosphärische Circulation*.

[3] *Cf.* Grisebach, "Die Vegetationsgebiete der Erde" (with map), in Petermann's *Mittheilungen*, 1866.

[4] *Cf.* Brehm, "Zur Zoologischen Geographie Spaniens," in *Ztschr. für Erdkunde zu Berlin*. 1858.

of genera and species represented in the European floras. Several districts have only been partially explored by the botanist; he not unfrequently finds it difficult to decide whether a given plant has a right to be admitted into his lists; and he is naturally more interested in estimating the comparative richness of his scientific regions than of such conventional areas as the continents. Hinds, reckoning all known species of plants at 134,000, allows 11,200 to Europe; while Friedrich Nyman, in his *Sylloge Floræ Europææ*, 1854–1855, gives 1115 genera and 9738 species according to Fries's classification, and assigns 883 genera and 8104 species to the dicotyledons, 206 genera and 1544 species to the monocotyledons, and 26 genera and 90 species to the acotyledons. In all probability the numbers, especially of the species, are below the truth. The total number of so-called useful plants cultivated in European gardens is stated by Professor Göppert at from 2400 to 2500; but a large proportion of these are mere exotics. The extent, indeed, to which this is the case, even with many species of wide distribution, is one of the most striking facts in botanical geography. The vine, the olive, the fig tree, and the mulberry were not improbably brought from Syria or Asia Minor by the Greeks; the Arabians introduced the cotton plant; the walnut and the peach are originally from Persia, the apricot from Armenia, and the sugar-cane and the orange from China. The leek and the onion, the mustard plant and the cumin, the laurel and the myrtle, are all Asiatic. For the pomegranate we are probably indebted to the Phœnicians, and the quince still bears the name which it received from the town of Cydonia in Crete. The cypress is a native of the neighbourhood of Herat, the plane tree of the Taurus, the chestnut possibly of Armenia. Lucullus, the conqueror of Mithradates, brought the first cherry-tree to Europe; and some less famous Roman of the first century after Christ was the introducer of the pistachio. Maize, tobacco, and the potato are well known to be of American origin, and the same is the case with the agave and the opuntia, two of the most characteristic plants of the Mediterranean region. The scarlet oak was brought from North America to England in 1691; the cedar of Lebanon was first planted in British soil in 1683; and among recent additions are the Douglas pine from the Rocky Mountains, the deodara from the Himalayas, the *Wellingtonia gigantea* from California, and the *Eucalyptus Globulus* from Australia. The last is being planted in thousands in southern Europe, and has produced a greater sensation than perhaps any other botanical stranger. It would be easy to continue the list to an indefinite extent, and it would require to be supplemented by a list of floral additions that have taken place within historic time without the intentional intervention of man. This second class is also a numerous and continually increasing one.[1] In the neighbourhood of Port Juvenal, near Montpellier, 487 exotics from America, Asia, Australia, and New Zealand were collected by Godron, and of these 52 species were new to science. The *Anacharis Alsinastrum* or *Elodea canadensis*,[2] from Canada, now luxuriates in the rivers of England and Prussia, where it was quite unknown about 1850; and the *Eriocaulon septangulare* has found a new home in the streams of Ireland. In the former instance the rapid diffusion is all the more remarkable as the plant is dicœious, and only one sex has reached Europe. It will be readily understood that if the introduction of new species into the continent is of frequent occurrence, the migration of indigenous species from district to district must be more frequent still. The plants of the higher regions are often carried down by the rivers, and effect a permanent settlement in the plains; and from time to time a foreign army leaves the seeds of a foreign flora on its camping-ground. Thus the *Campanula pusilla*, for example, has floated down from the Alps to Strasburg, and the *Bunias orientalis* has grown in the Bois de Boulogne since the Cossacks were there in 1815. There is a limit of course to such introductions and immigrations: of plants as of men it is equally true *non omnes omnia possunt*.

The most important economical position is held by the cereals. Wheat is most extensively cultivated in Russia, Austria, the Danubian principalities, France, England, and Germany. The parallel of 57° or 58° may be taken as its northern limit, though it is grown as far north as 65°, and is found to ripen in the island of Dyro in 69° 5′. Spelt (*Triticum Spelta*) is mainly cultivated in south-western Germany, Switzerland, and Belgium. Barley is cultivated in West Finmark as far as 70°, and is part of the usual crop in all countries of the continent. Oats are more frequent in the central and northern regions; their practical polar limit is 69° 28′, though they have been known to ripen at Hammerfest in 70° 37′. Rye is an important crop in nearly all the great grain-growing countries, but it is especially in favour in the east and north; its northern limit is between 69° and 70°. Maize has been grown in 63° 15′, reaches its practical limit in 59° 55′, and is extensively cultivated only in the southern parts of the continent. Sorgho (*Sorghum saccharatum*) from China and a few other foreign cereals have been successfully introduced, but are hardly anything more than agricultural curiosities. The next place belongs to the potato, which has spread over an enormous area in central and northern Europe. It has been grown as far north as the island of Magero in 71° 7′ N. lat., or about four miles S.E. of the North Cape. The greatest producers are Germany, Belgium, Sweden, the Netherlands, Norway, and Switzerland. A considerable variety of leguminous plants are grown in Europe either for their fruit or forage—beans, pease, lupines, clover, lucerne, sainfoin, &c. The common pea (*Pisum arvense*) and the common bean (*Vicia Faba*) have their northern limits respectively at 64° 41′ and 67° 17′. A species of lupine (*Lupinus linifolius*) furnishes a substitute for coffee both in Norway and Tyrol. The vine can be grown without protection in southern Scandinavia, and has been known to ripen its grapes in the open air at Christiansund in 63° 7′; but its cultivation is of no importance north of 47½° on the Atlantic coast, 50½° on the Rhine, and from 50° to 52° in Russia. The following is the average wine-production of the several countries:—France, 42,000,000 hectolitres (or 924,000,000 gallons); Italy, 30,300,000; Austria-Hungary 23,000,000; Spain, 20,000,000; Germany, 4,440,500; Switzerland, 1,155,000; Greece, 1,150,000; Roumania, 1,000,000; Russia, 614,000. A special Greek variety of vine is the source of the currants of commerce; it is cultivated in the Peloponnesus, Cephalonia, Zante, Ithaca, and Santa Maura, and yields an annual average export of 128,000,000 lb. The olive, with its double crop, is one of the principal objects of cultivation in Italy, Spain, and Greece, and is not without its importance in Portugal, Turkey, and southern Austria. The average total of the oil harvest in these countries amounts to about 140,000,000 gallons; and of this Italy alone produces about 66,000,000.

Besides the turnips and other roots which furnish so much of the winter-fodder required by the northern farmer, the beet holds an important economic position in central Europe as a producer of sugar. Tobacco is extensively grown from Sicily to Sweden, but its cultivation is forbidden in England, Spain, and San Marino, and in Austria it is a state monopoly. Its northern limit is about 63° 26′. It

[1] See Zeyss, *Versuch einer Geschichte der Pflanzen-Wanderung*; Blyth, *Essay on Immigration of the Norwegian Flora during alternating Rainy and Dry Periods*, 1876; Robert Brown, in *Geographical Magazine*, 1874.

[2] See K. Bolle, in *Zeitschrift für Erdk. zu Berlin* 1865.

receives special attention in Turkey, Greece, Russia, Germany, France, and Switzerland. Hemp and flax have a very wide distribution, the former furnishing a valuable export to Archangel in the north and to Italy in the south. Among all European countries Russia is the greatest producer: during their church fasts her vast population make an enormous consumption of hemp oil. Hop-growing is hardly known in the south, but forms an important industry in England, Austria, Germany, and Belgium. The plant grows wild in Norway as far north as 64° 12′. Among the exotics exclusively cultivated in the south are the sugar-cane, the cotton-plant, and rice. The first, which is found in Spain and Sicily, is of little practical moment; the second holds a secondary position in Turkey and Greece; and the third is pretty extensively grown in special districts of Italy, more particularly in the valley of the Po. Of the vast number of fruit trees which flourish in different parts of the continent only a few can be mentioned. Their produce furnishes articles of export to Austria-Hungary, Germany, France, Belgium, Italy, and Spain. In Sardinia the acorn of the *Quercus Ballota* is still used as food, and in Italy, France, and Austria the chestnut is of very common consumption. In the Mediterranean region the prevailing forms—which the Germans conveniently sum together in the expression Südfrüchte, or southern fruits—are the orange, the citron, the almond, the pomegranate, the fig, and the carob-tree. The importance of these fruits to Italy and Spain is too well known to require more than passing mention. Sicily, which was one of the great granaries of the Roman empire, is now almost a continuous orchard. In recent years a new kind of pistachio—the cacahuetes, or mani—has been cultivated in Spain, and its fruit extensively exported. The palm trees have a very limited range: the date palm (*Phœnix dactylifera*) ripens only in southern Spain with careful culture; the dwarf palm (*Chamærops humilis*) forms thickets along the Spanish coast and in Sicily, and appears less frequently in southern Italy and Greece.

Such are the main economic plants of Europe; but the list might be indefinitely extended if we were to include all the plants which enter into the *flora cibaria* of the various regions—from the caper-bush of the south to the *Polygonum viviparum* and *Oxyria reniformis* consumed by the Laplanders in the north.[1]

When the Aryan peoples began their immigration into Europe a large part of the surface must have been covered with primeval forest; for even after long centuries of human occupation the Roman conquerors found vast regions where the axe had made no lasting impression. The account given by Julius Cæsar of the Sylva Hercynia is well known: it extended, he tells us, for sixty days' journey from Helvetia eastward, and it probably included what are now called the Schwarzwald, the Odenwald, the Spessart, the Rhön, the Thüringerwald, the Harz, the Fichtelgebirge, the Erzgebirge, and the Riesengebirge. Since then the progress of population has subjected many thousands of square miles to the plough, and in some parts of the continent it is only where the ground is too sterile or too steep that the trees have been allowed to retain possession. The consumption of timber has of necessity been enormous, more especially on account of the climatic condition of the continent and the maritime activity of a large part of its inhabitants. To the dweller in the warmer regions of the earth the chief value of a tree is not unfrequently its shade; by the European its worth is as often estimated by the quantity of heat it will yield on his hearth. Several countries, where the destruction has been most reckless, have been obliged to take systematic measures to control the exploitation and secure the replantation of exhausted areas.[2] To this they have been constrained not only by lack of timber and fuel, but also by the prejudicial effects exerted on the climate and the irrigation of the country by the denudation of the high grounds. But even now, on the whole, Europe is well wooded, and two or three countries find an extensive source of wealth in the export of timber and other forest productions, such as turpentine, tar, charcoal, bark, bast, and potash.

According to the calculations of A. Bernhardt,[3] the following table gives an approximate view of the forest areas in the several countries:—

	Total Area.		Forest Area.		Population.		Proportion per Head of Total Area.		Proportion per Head of Forest Area.	
	Hectares.	Acres.	Hectares.	Acres.			Hectares.	Acres.	Hectares.	Acres.
Greece	5,010,000	12,380,411	701,500	1,733,504	1,350,000	(1863)	3·7	9·1	0·52	1·28
Turkey	52,747,460	130,346,358	12,660,000	31,284,632	18,000,000		2·9	7·1	0·70	1·72
Italy	29,407,546	72,670,163	4,220,773	10,430,120	26,300,000		1·18	2·9	0·17	0·42
Spain	49,983,160	123,515,386	10,186,045	25,171,143	15,673,536	(1860)	3·18	7·85	0·65	1·60
Portugal	9,277,610	22,926,273	463,880	1,146,312	4,188,410	(1864)	2·21	5·46	0·11	0·27
Austria-Hungary	62,254,000	153,838,349	18,343,810	45,330,122	35,672,073	(1868)	1·70	4·90	0·514	1·27
Germany	54,102,769	133,695,516	13,924,529	34,409,460	40,089,170	(1867)	1·30	3·21	0·35	0·86
Switzerland	4,140,412	10,231,537	724,572	1,790,518	2,670,000	(1866)	1·55	3·83	0·27	0·66
France	52,789,874	130,451,169	8,353,238	20,642,020	36,000,000	(1871)	1·46	3·55	0·23	0·56
Belgium	2,945,539	7,278,839	313,096	773,704	4,829,320	(1866)	0·60	1·48	0·065	0·16
Netherlands	3,545,313	8,760,964	248,172	613,267	3,852,028	(1869)	0·92	2·29	0·06	0·14
Great Britain	31,566,392	78,004,973	1,282,656	3,120,199	35,500,000	(1871)	1·07	2·64	0·04	0·11
Russia	546,657,704	1,350,867,718	169,500,000	418,858,230	69,000,000	(1871)	7·92	19·5	2·45	6·05
Sweden	44,150,700	109,102,560	12,812,800	31,662,222	4,158,000	(1869)	10·5	25·9	3·08	7·61
Norway	31,659,500	78,235,056	19,185,657	47,410,444	1,701,478	(1865)	18·6	45·9	11·2	27·6
Denmark	3,815,658	9,429,025	228,939	565,740	1,783,565	(1870)	2·15	5·31	0·12	0·29

The average proportion for all Europe being rather more than 25 per cent., four countries rise considerably higher in the scale: viz., Norway 66, Russia 31, Austria-Hungary 29·5, and Sweden 29·02; and the others rank as follows:—Germany 25·7, Turkey 24 (?), Spain 20·38, Switzerland 17·5, France 15·8, Italy 14·39, Greece 14, Belgium 10·6, Netherlands 7, Denmark 6, Portugal 5, and Great Britain 4. Other statisticians rate the proportion for the continent at nearly a third, and arrange the states in a somewhat different order.

The Scandinavian countries have a large timber trade. In Sweden and Norway the most usual trees are coniferous; but in the former a certain number of birches, alders, and ash-trees are intermingled, and towards the south the oak and the beech occur. This last is the characteristic tree of Denmark; though some other species, which were common

[1] For a popular account of the European floras see Henfrey's *Vegetation of Europe*, 1852; for fuller details the works of Grisebach, Parlatore, Ledebour, and Boissier; and for a table of the arctic limits of a large variety of plants Schübeler's *Pflanzenwelt Norwegens*.

[2] J. C. Brown, *Reboisement in France*, 1876.

[3] See *Zeitschrift für Forst- und Jagdwesen*, Berlin, 1872.

in the prehistoric period, are not without importance, and coniferous trees have been again introduced. The Russian forest area is mainly in the northern part of the country, but it is separated from the Arctic coast by a wide treeless belt. Towards the south there are no great stretches of woodland, and for the most part the only trees are found along the banks of the rivers. The Mennonites on the Sea of Azoff have formed plantations, and there are others in the land of the Don Cossacks. The fir-tree is found as far south as 48° N. between Novomovskovsk and Pavlograd in the government of Kharkoff.[1] The most widely distributed tree is the pine; and of the deciduous trees the most frequent are the birch, the aspen, and the oak. In the north of Russia alone the annual production of tar amounts to 297,000,000 lb. In Austria-Hungary there is still abundance of wood, especially in the Alps and the Carpathians; but in some quarters, more particularly in Transylvania, the most reckless destruction is allowed to take place. The principal trees are the pine, the fir, the beech, the oak, the larch, and the hornbeam; next come the ash, the elm, the maple, and the birch; and in the third place, the acacia, the poplar, and the *Götterbaum*. According to the Bulletin of the Geographical Society of Belgium, the value of the timber obtained on the lands of the Hungarian crown amounts annually to about £1,042,000. In Germany, the pine and fir are most frequent in the south, and the oak and birch in the west and south-west; while in the central district coniferous and deciduous trees are about equally common. In no part of Europe are the forests under more judicious management. France is most indebted to the oak, the birch, the chestnut, the fir, and the pine; but they fail to satisfy the home consumption. The poplar gives a peculiar character to its southern landscapes, and the chestnut furnishes a valuable addition to its alimentary resources. Italy has a rich variety of types—the silver fir (*Abies pectinata*) and other conifers, the *Quercus sessiliflora*, the cork-tree, and other oaks, the chestnut, the sycamore, the mountain ash, the evergreen oak. It exports manna, which is obtained from the ash tree, galls, and turpentine. Switzerland not only supplies a great internal demand for timber, but is able to contribute to foreign markets. The common trees are for the most part the same as in Austria-Hungary. In Spain and Portugal the first rank as an economic factor belongs to the cork tree, which yields in the former country about £3,820,000 worth of bark for export, and gives employment to thousands of the population. The oak, the red birch, the chestnut, the cypress, the plane, and several conifers are also of importance. In Portugal the largest individual forest—the royal domain of Leiria—consists mainly of the Bordeaux pine.

According to the system proposed by Dr Sclater, and adopted by Mr Wallace, the most recent English writer on the distribution of animals, Europe belongs to the great Palæarctic Region, which also includes the most part of the continent of Asia and a broad belt along the north of Africa. The northern and central portions of Europe constitute a special sub-region, distinguished as the "European" *par excellence*; and the southern portions in conjunction with the African belt constitute the Mediterranean sub-region. The line of demarcation between these two is almost the same as that which separates the zone of subtropical rains from the zone of rain at all seasons of the year, the only important difference being that, while the Italian Alps and the Lombard plain belong meteorologically to the north, they are zoologically assigned to the south. According to Mr Wallace, the "European" sub-region contains two distinctive genera of mammals, the *Mygale* or musk-rat and the *Rupicapra* or chamois, and its characteristic forms are the mole, the hedgehog, the shrew, the badger, the bear, the wolf and the fox, the weasel, the otter, the hare and the rabbit, and the dormouse. In the Mediterranean sub-region a similar position is held by the *Dama* or fallow deer, the civet, the hyena, and the porcupine. In former geological periods not only were the Quadrumana represented in Europe by several species, but one of those, the *Dryopithecus*, discovered in the Miocene formations, probably approached nearer to man than any of the existing anthropoids. At present the only species of the order in the continent is the *Macacus inuus*, a little monkey about a foot and a half long, which disports itself about the rock of Gibraltar, but strangely enough has Asiatic rather than African affinities. The cosmopolitan Cheiroptera or bats are well represented,—no fewer than thirty species of the family *Vespertilionidæ* alone being described. Perhaps the most common species throughout central Europe is the *Vespertilio pipistrellus* or ordinary British bat, but several others, as the *Vespertilio discolor* and the *Vespertilio limnophilus*, have a wide range. Of the genus *Sorex* among the Insectivora there are at least ten species, the *Sorex tetragonurus* or common shrew inhabiting nearly every country in the continent. An Italian species, *Sorex etruscus* or *Crocidura etrusca*, is remarkable as the smallest of all known quadrupeds. Besides the *Mygale muscovitica*, already mentioned as peculiar to the European sub-region, there is another species, the *Mygale pyrenaica*. The common hedgehog (*Erinaceus europæus*) is universally distributed; and a smaller species, *E. auritus*, is found in the province of Astrakhan. The ordinary English mole, *Talpa europæa*, is unknown in Ireland, and in southern Italy gives place to the *Talpa cæca*. There are comparatively few of the larger members of the Carnivora, and their domain is continually being diminished. The brown bear, or *Ursus arctus*, is still found in the Pyrenees, here and there in the Alps, in the Carpathians, and the Scandinavian mountains; and his polar cousin, the *Ursus maritimus*, is met with along the arctic coasts. To the general distribution of the badger there appears to be no exception. The glutton is for the most part confined to the forest regions of the countries that border the Arctic Ocean. The genus *Mustela* is represented, not only by the polecat and the weasel, but by the martin, the pine-martin, and the ermine, all of which are pretty familiar in most of the sub-region, though it is only in the colder countries that their value as fur-bearers is developed. The *Mustela boccamela* or honey-weasel appears to be confined to Sardinia; and it is questionable if the ferret, *Mustela furo*, introduced by man from Africa, exists in the wild condition. An important place in the fauna of Europe is still held by the wolf and the fox, the former being from its numbers the most formidable of man's feral antagonists. It will be a long time ere the more mountainous countries of the Continent can boast, like Britain and Ireland, that their last wolf is killed, and the "tabunchiks" or horse-herds of Russia will probably for many generations have to renew their annual battles with the famished packs. It is indeed asserted that since the abolition of serfdom the number of wolves has considerably increased, since the peasants are no longer obliged, as they formerly were by their landlords, to organize regular hunting expeditions. Besides the common or grey wolf, *Canis lupus*, of universal distribution, there is a black species, *Canis lycaon*, of less frequent occurrence. The jackal, *Canis aureus*, is found in southern Russia, Greece, and Turkey. There are at least four species of fox:—the *Canis vulpes*, well-known in western, central, and northern Europe; the *Canis melanogaster*, or black-bellied fox, familiar in Italy, Sicily, and Sardinia; the *Canis lagopus*, arctic or blue fox, whose most popular name indicates its localities:

[1] See Wojeikof, *Die Atmosphärische Circulation*. 1874.