Monterey Cypress (*Cupressus macrocarpa*): Probably 1,000 acres cover the area planted by the State, Afforestation Companies and Local Bodies with this species, but it has been widely used by farmers in small plots and as shelter-belts. As a species for farm forestry it probably has no peer, growing quickly and at an early age producing durable timber suitable for fencing material, etc. Its greatest drawback is that it is somewhat difficult to transplant unless very carefully handled. A few years ago a limited quantity was used by the writer in interplanting in the Wellington District with results so promising that in the future it will be used more extensively. In progressive height growth, a most important factor in this work, it has actually exceeded any other species experimented with.

Several other species of Pacific Coast origin have from time to time been planted in small areas in various places in New Zealand, but the areas are so small that it is not possible to prognosticate on their success or otherwise had they been used on a larger scale.

**References.**

(2) Hocking, G. H. (1933) *Te Kura Ngahere* Vol. 3 No. 3 p. 147.

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**CHIEFLY ON CHILEAN FORESTS.**

By D. MILLER, Cawthron Institute, Nelson.

Having in mind the interest of all New Zealand naturalists in the biological relationships that exist between Chile and this Dominion, the following account is presented. It is written merely from the viewpoint of a general observer and is summarised from the diaries of expeditions to South America, where from people met and from other sources information was gathered on a variety of subjects outside the actual object of my missions.

In outline, Chile is represented by the lofty snow-capped Andes mountains and a narrow sea-board, the whole extending over some 2,800 miles from the latitude of Fiji to that of the Macquarie Islands (Maps 1 and 2).* In a country covering so many latitudes, one would expect to find climates varying from tropical to sub-antarctic. However, though the latter is found in the far south of Chile, the climate is agreeable on the whole, being mostly temperate with a wide-ranging rainfall, but never tropical even in the northernmost region within Capricorn. This is largely due to the influence of the Humboldt Current that runs north along the coast; this visibly flowing current is associated with a temperate climate even northward beyond Chile and Peru, and along the greater part of Ecuador, until it turns abruptly westward, practically under the Equator, into the Pacific Ocean.

* Page 172
The area of Chile is some 292,100 square miles, and its width varies from 100 to 248 miles. Along the coast of this narrow country, running parallel to the Andean Cordillera (with its many peaks, some active volcanoes rising from 15,000 feet to the 23,081 feet of Mt. Aconcagua), and separated from it by the great longitudinal valley, is the much lower and evenly contoured Coastal Cordillera. In such a mountainous country with its narrow sea-board, extensive areas are naturally unsuitable for settlement and development. The country is well watered as a whole, though few of the rivers are navigable and these only for a short distance; in the northern arid region most of the rivers from the Andean Cordillera do not reach the coast.

Chile is divided into three natural economic zones (Map 1); (1) Northern Chile comprising the desert, mineral zone, which is the southern limit of a desert extending north through Peru and Ecuador to the Equator, (2) Central Chile, the principal agricultural zone, and (3) Southern Chile, the zone of natural forests. Formerly, the Republic mainly depended upon the mineral wealth of Northern Chile, where, besides copper, silver, and borax, the famous nitrate deposits were worked; and where, as a by-product of the nitrates, 80% of the world’s iodine was produced. Though a depreciated currency continued to favour the mineral industry, the development of the agricultural resources in recent years has led to the farmers being now one of the wealthiest sections of the community.

The population of under 4½ million people is very unevenly distributed; the dominant type is the mestizo, descendant of the Spaniards and Indians, though there are many pure Spanish families and many British, German, French, and Italian settlers. I have endeavoured to illustrate the distribution of population in the accompanying map (Map 1), from which it will be seen that the most populated region (E) is the Province of Santiago (140 to the square mile) and the surrounding provinces in Central Chile. The most sparsely populated provinces are Aysen (K), and Magellanes (M) in the south (.2 and .75 people per square mile respectively); this is not to be wondered at when one considers the dense and extensive virgin forests that dominate these inhospitable regions, though here lies the main centre of the sheep industry. The sparsely populated Provinces of Tarapaca (A), Atacama (B), and Antofagasta (C), in the desert region of the north, is a matter to be expected, as apart from the mining population there is little else except for isolated areas suitable for irrigation; from the air these scattered settlements break the monotony of the endless, though brightly coloured and deeply dissected, barren lands.

I have very little on the climatological statistics, but the few figures shown on the map give some idea of the position. Throughout the northern arid zone with its diurnal and nocturnal extremes of temperature, there is a regular coastal fog which in places supplies sufficient moisture for the maintenance of a scanty vegetation. Malaria occurs in some of the most northern valleys but not elsewhere.
The Province of Coquimbo (D), where the desert is giving place to more fertile country, has the most delightful climate of the whole Republic. As one proceeds further south the rainfall increases with a corresponding fall in temperature; as precipitation occurs mostly in winter, irrigation is resorted to in the agricultural regions during the summer.

Transport is by rail, sea, and horse. There are no good harbours except in the fiords of the sparsely populated south. The main railway is of great length, extending from the southern limit of Central Chile almost to the extreme north of North Chile; there are numerous branch lines. The roads are poor, indeed impassable in winter, except in the vicinity of the larger towns and in the arid north.

Excluding North Chile, the Republic reminds one very much of the South Island of New Zealand. There is the same lay-out of agricultural and pastoral lands and the same southern-beech forests (many cleared or partly cleared); the presence of certain familiar weeds such as blackberry (*Rubus ulmifolius*); the absence of poisonous animals except, as with us, a species of “Katipo” (*Latrodectus formidabilis*); the plantations of eucalyptus, poplars, and old-world conifers in settled areas, but no extensive reforested areas; the presence in gardens of our cabbage tree, pittosporum, and phormium (at Valdivia there is a commercial plantation of the last) imported to the Republic; and the whole dominated by the lofty range of mountains. Though an exotic impression is given to the visitor by such strangers as cacti and the stately Chilean palms (*Jubea spectabilis*), one finds New Zealand in one or more of the 25 species of Chilean *Acaena* (called *cudillo, trune*, or *amores secos* by the Spaniards, and *upul-guru* by the Indians), or in the species of *Uncinia* (called *el quinquin*, of which two species, *U. phleoides* and *U. longifolia*, have burrs strongly hooked by which not only are large insects such as dragon-flies impaled, but also sheep, dogs, and cats are entangled). However, the most intimate link with New Zealand is discovered in our own species of kowhai (*Sophora tetraptera*), locally known as *pelu*, and of tutu (*Coriaria ruscifolia*), called *el deu* or *el hique*, being native to the country; while we also find the familiar “monkey-puzzle” (*Araucaria araucana*) growing uglily in its native habitat in the territory of the Araucanian Indian. Reference must be made to the potato of commerce, the native home of which is the Andes; after being searched for by expeditions over a long period of years, the wild plant has been recently found.

Amongst the Chilean vertebrates there is much of interest. There are numerous lizards and frogs; of the latter, Darwin’s frog (*Rhinoderma darwini*) which lives in rotting forest logs, presents a remarkable characteristic in that the male has a brood pouch opening on the floor of the mouth in which the eggs hatch and the tadpoles develop. There is also one of the species of weasels (*Grison cuja*), an enemy of rodents and birds; it is easily tamed and was often used
for the control of rats and mice, while it was formerly trained in the chase of the valuable fur-bearing chinchilla, though the semi-extermination of the latter was due to the use of small hunting-dogs. The South American puma, ranging over the whole continent, occurs in Chilean forests but is seldom met with.

The sombre-coloured birds of Chile are numerous though not in species; they are comparatively silent. The granivorous birds (mostly Fringillidae) are in the minority but some are destructive to agricultural crops. There are comparatively few insectivores, and these are regional in distribution being confined mainly to the high country, so that it is only the migratory species that are to be seen temporarily in agricultural country. There are some species of the pigeon family and certain ones include forest-tree seeds in their diet; e.g. the torcasa (Columba araucana), the tortola comun (Zenaida auriculata), and the tortolita (Columbula picui). Of the several species of rapacious birds the vulture is the largest. A species of night owl called the nucó (Asio brachyotus) is feared by the Araucanian Indians, and it is no uncommon thing to see the skull of a horse or a cow hoisted high on a pole outside an Indian shack, or ruka, as a charm against this bird. One of the commonest raptorial birds is the tuique (Milvago chimango) which congregates in thousands on the irrigated fields where it feeds on the caterpillars brought to the surface by the water. There is a species of parrot, the turco (Hylactes megapodius) which always remains concealed; it has a note very much like the opening notes of the tui. Other birds are the Chilean blackbird, the tordo (Ouraeus aterrimus), and the humming-birds; one of the latter (Trochilus gigas) is a large species and visits the flowers of the kowhai (pelú) and New Zealand phormium. Several native birds are valued as game, the most outstanding being the so-called partridge or perdiz (Nothoprocta perdicaria) on account of its abundant and tender flesh. Among the most successfully acclimatised game birds is the familiar Californian quail which is very abundant.

Mention has been made of the exotic plantations and indigenous southern-beech forests. There being no extensive afforestation operations as we know them in New Zealand, the exotics are limited to the settled areas, and consequently the areas under these trees increase directly with the population. For example, in the Provinces of Tarapaca and Antofagasta (Map 1, A and B; Map 2, 1) it is estimated by the Chilean Forest Service that there are three square miles of exotic trees (restricted to the irrigated parts of this arid region) the dominant tree being Eucalyptus globulus; in the Provinces of Atacama and Coquimbo (Map 1, C and D; Map 2, 2) there are about eight square miles, the species most commonly met with being E. globulus, E. diversicolor, and Cupressus macrocarpa; in the most densely populated areas of Santiago and adjoining provinces (Map 2, 3) there are some twenty-seven square miles and here one meets with Eucalyptus globulus, E. resinifera, Cupressus macrocarpa, Acacia melanoxyylon, Populus pyramidalis and Pinus radiata, as well
as species of *Quercus*, of which trees *E. globulus* is the most commonly grown and *P. radiata* the least, while the poplar is one of the most outstanding features of the countryside in the vicinity of dwellings; in the next region to the south (Map 2, 4) there are about fifty-eight square miles of exotics of which *P. radiata* is the most common, while other species in addition to those already mentioned are *Picea excelsa*, *Pinus maritima*, *Quercus pedunculata*, and *Q. sessiliflora*. In the regions further south (Map 2, 5 and 6), which are yet occupied by the virgin forests, there are few areas of exotics; here (Map 2, 5) there are only 1.5 square miles in which *P. radiata* is the commonest species, while in the case of the most southern region (6) I have no data except that species of eucalyptus grow there, though the exotics will be few and the area small. Regarding the growth rate of exotics in Chile; *Picea excelsa* is said to attain a height of 20 feet in five years, and over 50 feet in twenty-five years, while *Pinus radiata* in twenty years grows higher than its maximum height in California.

Bro. Claude Joseph, formerly of the Institute San Jose at Temuco, supplied me with data on the botany of Chile, while for the greater part of the following information regarding the forest zones of Chile, a publication by Ernesto Maldonado has been consulted.* There are six botanical zones in the Republic and I have attempted to delimit these in the accompanying map (Map 2). The indigenous forests are estimated to cover about 20% of the total area of the country and are mostly under State control. The principal area of exploitation lies in the southern part of Central Chile (Map 2, 4), the regions to the south of this being densely forested and yet unexploited. In the region of exploitation one meets with much the same conditions as in New Zealand—extensive areas of lowland and mountain cleared of forests and under pasture and crops, and considerable areas of hill country reverting to secondary growth; there has been the usual wastage of the forest resources. Apart from timber-milling operations, owners of agricultural land have their forests cleared and the land broken in either by a co-operative agreement with the native workman, or by hired labour, which is almost costless according to our standards; for example, a woodsman, or a camp cook, receives about 1/3 a day, and farm labourers from 6d. to 9d.; that is when the *peso* (=6d.) is at par, though during my last mission it had fallen to about 2½d.

The two most northern botanical zones (Map 2, 1 and 2) together comprise the arid northern Chile, where there is no rainfall in many parts. The rainless area in the first botanical zone is known as the Pampas del Tamarugal from the dominant tree, a legume called *tamarugo* (*Prosopis tamarugo*). Only about .05% of this zone is occupied by low trees of which are the *tamarugo*, the *algarrobo* (*Prosopis dulcis*), and *carbon* (*Cordia decandara*); the wood of the *tamarugo* is extremely durable, and the charcoal prepared from it is of the finest quality.

* "Contribucion al estudio de la industria maderera y bosques chilenos:"

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The tree covering becomes denser, though still scant, in the second botanical zone (2), where about 2.5% of the area is occupied. In this zone, where lies the famous Atacama Desert in which Pizarro’s followers met with so much suffering, one finds the species of the first zone together with others, such as the chanar (Gourliea chilensis), algarrobilla (Caesalpinia brevifolia), guayacan (Portiera hygrometica), and alcaparra (Cassia flacida). Of these species the shrub-like and deep-rooting legume, algarrobilla, which resembles a mimosa, is very valuable being exploited for its tannin. From 30% to 50% of tannin is extracted from the seeds and most of it is exported to Europe; further, the green pods possess a very sweet flavour and are eaten by the valuable chinchilla.

In the third zone lies the most densely populated region of Chile. Here the forests are more abundant, but owing to exploitation and settlement there are now very few accessible areas of indigenous trees. The zyphytic flora of the north is now rapidly dominated and replaced by other trees of which the following are characteristic and among which we find some New Zealand genera:—the espino (Acacia carenia), belloto (Bellota miersii), quillay (Quillaja saponaria), matien (Maytenus boaria), peumo (Cryptocarya peumus), boldo (Boldoa fragans), litre (Litrea caustica), avellano (Guevina avellana), and canelo (Drimys winteri), while toward the next zone to the south the robles or southern beeches (Nothofagus), so dominant throughout the remainder of the Republic, and Libocedrus chilensis are met with.

Of the above species Quillaja saponaria, which ranges south through the fourth botanical zone, occurs at sea-level to 6,000 ft. altitude. The timber, which is subject to borer attack, is largely used as mine props being durable under damp conditions. The bark, utilised in large quantities, contains a soapy substance extracted by maceration in water; this neutral soap solution is used by dyers in the treatment of wool and silk, as well as to give a “head” to beverages, while the Araucanian Indians use it as a specific for colds and as a shampoo. Boldoa fragans attains a height of about 35 ft., a decoction of its aromatic bark is used to sweeten wine casks, and its foliage has some value in the treatment of liver disorders. Drimys winteri, growing to some 50 ft. high, is the sacred tree of the Araucanian Indians; they call it voighe and hold their important functions under its shadow, while it was customary for them to carry leaves or flowering branches as an emblem of peace during negotiations with a hostile tribe. For a considerable time, and even in Europe, the bark and fruit were utilised in the treatment of scurvy. It is of interest that Chessman records that a decoction of the bark of the New Zealand Drimys axillaris was occasionally used by country settlers as an astringent. A very picturesque and ornamental tree is the valuable Guevina avellana which is readily propagated from seed in sunny situations where there is a dry season during the year. The cylindrical trunk is straight, and the branching regular, while the flowers are whitish to rose-yellow. The fruit, which is rich in an oil used as
a lubricant, turns from green through reddish-violet to dark brown at maturity; it is edible when toasted, and at one time was extensively used in Chile and exported to Peru and Ecuador. Further, the bark and husk of the fruit contain a high percentage of tannin, and are also used as an astringent in cases of chronic diarrhoea. The timber is fine grained, dense, and mottled. There are certain parts of New Zealand where this tree would flourish.

In the fourth botanical zone (4) lie the most important immediate reserves of indigenous timber possessed by the Republic; they cover about 8,494 square miles. Among the trees utilised are the following: in the northern half of the region, the espino (Acacia carenia), litre (Litrea caustica), peumo (Cryptocarya peumus), canelo (Drimys winteri), roble de Maule (Nothofagus megalocarpa), and in the southern half, the lingue (Persea lingue), pehuen (Araucaria araucana), raúli (Nothofagus procera), roble pellin (Nothofagus obliqua), coigue (Nothofagus dombyei), laurel, (Laurelia aromatica), maniu (Podocarpus chilena), luma (Myrceugenia luma), cipres de cordillera (Libocedrus chilensis), and ulmo or muermo (Eucryphia cordifolia).

Persea lingue ranges north over the third zone and south into the northern part of the fifth; the timber is largely used for furniture, coach work, and paper, and resembles walnut and cedar when polished. This species, however, is of outstanding importance on account of the high tannin content of the bark, and upon it depends the tannery industry of Southern Chile; the leaves, also, contain an active stimulant eagerly sought by animals, but which causes death if eaten to excess. A very important tree in the paper industry is Araucaria araucana which attains a height of 165 ft. and a diameter of about 7 ft.; its natural distribution is between 30° 30' and 45° 30' S. It is known by the Chileans as pehuen, pino Chileno, pinon, or sinonimos, and in its native state is far from the symmetrical tree as we know it. The Araucanian Indians use the resin in the form of a plaster in the treatment of rupture and headache, and when mixed with the pulverised fruit and toasted administer it in pill form as a diuretic; the bark also has medicinal properties.

Amongst the southern-beeches Nothofagus procera, the bark of which is scaly and vertically furrowed, is one of the most important; but it is rapidly becoming scarce owing to the demand for it, and to the fact that it grows most prolifically in fertile soils suitable for agriculture. It grows to a height of some 130 ft., and requires a humid climate and soil; it is readily propagated from seed and is considered suitable for afforestation. The timber differs from that of other species of the genus in that it seasons rapidly, is compact, hard, fine-grained, and durable, while as veneer there is no danger of warping; it is used for doors, window-frames, and furniture, as well as for barrels and parquetry. One of the tallest trees growing in considerable areas is Nothofagus obliqua which is deciduous. The heavy timber, known as "red-oak," does not season even after 60 years,
and when mature is everlasting even in contact with wet ground; it is thus invaluable as railway sleepers, piles, fence-posts, bridges, and house foundations. The immature timber is not durable. The Indians use *N. obliqua* for coffins by splitting logs of the required length and hollowing them out. There is a young specimen growing on a steep northern slope in the Cawthron Institute grounds, but during the past eight years has hardly gained as many feet in height. In Chile this tree is attacked by an edible fungus similar to the one growing on New Zealand *Nothofagus menziesii* and known locally as *diguene* (*Cyttaria sp.*); this fungus, which is much prized (but tastes like the smell of rubber), develops externally as orange-coloured spheres which have a smooth skin when collected for food and honeycombed centre; it forms large woody galls on the limbs of the trees, and it is from these galls that the yellow fructifications grow.

Among other species is *Nothofagus dombeyi*, used in the paper industry, but the timber is of little other use as it readily rots, warps, and splinters. In the case of the aromatic *Laurelia aromatica*, which attains a height of 70 ft., the timber is also of little value owing to warping and splitting; the bark and leaves of that species have some medicinal value as a specific for digestive disorders. The durable timber of *Podocarpus chilena* is of yellow colour and largely used for furniture, flooring, masts, and spars; several trees I noticed had the foliage heavily infested by a smut fungus. *Myrcuegenia luma* produces a red, exceptionally hard, and heavy timber capable of withstanding enormous strain, and *Eucryphia cordifolia*, a very handsome tree with a scarlet flower, is of fundamental value to the honey industry, while its bark produces tannin; the honey from the latter tree is virtually white and of an appealing flavour comparable to none other I know of.

The forests of the fifth botanical zone (5) are as yet little exploited and contain the future forest resources of the country; the forest area is estimated at 17,375 square miles. In this zone the following trees of the fourth zone are absent; *Araucaria araucana*, *Nothofagus procera*, *N. obliqua*, and *Libocedrus chilensis*, while *Podocarpus chilena* and *Persea lingue* extend into the northern part of the zone only. On the other hand they are replaced by the following species; *ciruelillo* (*Embothrium coccineum*), *tiaca* (*Calcluvia paniculata*), *tenio* (*Weinmannia trichosperma*), *pelu* (*Sophora tetraperta*), *meli* (*Myrcuegenia meli*), *tepú* (*Teputualia stipularis*), *maiten de Magellanes* (*Maytenus magellanicus*), *roble de Chiloe* (*Nothofagus nitida*), *roble de Magellanes* (*Nothofagus betuloides*), *cipres de Guáitecas* (*Libocedrus tetragona*), *alerce* (*Fitzroya patagonica*), *huahuan or laurelia* (*Laurelia serrata*), *maniu macho* (*Saxegothea conspicua*), and *maniu hembra* (*Podocarpus nubigens*).

* Common in the fourth zone but whether growing naturally or planted there I cannot say.

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Embothrium coccineum, with its scarlet flowers, reminds one of the New Zealand rata and throughout its habitat is a very conspicuous tree. *Weinmannia trichosperma*, which grows to a tall tree of some girth, has hairy seeds; it is not exploited. *Libroedrus tetragona* is very abundant on many of the islands, and its very durable wood is of value as railway sleepers in wet locations. Perhaps the most interesting tree of the zone is *Fitzroya patagonica* which resembles the Sequoia in many respects, especially in the qualities of its wood and its favourite habitat of swampy ground. Specimens are known up to a height of 240 ft. and a girth of 42 ft. The red and extremely light wood splits so easily that boards can be thus secured by means of wedges; the wood is unaffected by moisture and is largely used in Southern Chile for roofing shingles, while the thick and fibrous bark is of value in caulking; I understand that the seeds will germinate only in the first year.

The sixth botanical zone (6) I have not visited. It extends to and embraces Tierra del Fuego, and carries a forest area of some 31,275 square miles. The trees of the fifth zone disappear to the south except for *Nothofagus betuloides*, *Maytenus magellanica*, and species of dwarfed *Myrceugenia*.

As is to be expected, the environment within the Chilean forests is much the same as in the southern forests of New Zealand, except that one is not long free from the attacks of the blood-sucking tabanid flies. The forest undergrowth includes many ferns and the tree-trunks are clothed with species of the Hymenoflickes. In the south one is impressed by the immense fronds of *Alsophila quadripinnata*, the only Chilean species of the genus, while on the Island of Chiloe one finds *Asplenium obtusatum* which occurs also in New Zealand. It is of interest to note here Cheesman’s statement that *Polystichum aculeatum* var. *vestitum* is common to New Zealand and Tierra del Fuego, while the Chilean botanists record *Polystichum aculeatum* and *P. vestitum* from the mountains of Chile. Another species common to both countries is *Aspidium mohrioides*.

I have made several references to the Araucanian Indians, and have had some experience with two of the tribes—the Mapuches (or people of the north), and the Lulilches (or people of the south). These Indians live in thatched houses, or *rukas*, which do not form villages, each *ruka* being isolated on some knoll where it has all the appearance of a rectangular hay-stack. Except for the heavy supporting timbers, the framework of a *ruka* (and of the thatched fence surrounding it) is of the Chilean bamboo, or *quila* (*Chusquea quilla*), while for the thatch a broad-leaved rush, the *ratonero*, is used. This *quila* forms dense thickets, and regenerates rapidly; it is of fundamental importance to the cellulose industry of Chile, and from it is manufactured paper of great resistance and compactness.

The Araucanians, like all native races, have an intimate knowledge of the uses of the indigenous vegetation; in addition to the
medicinal value of plants already referred to, they prepare a concoction from Acacia argentea, A. pinnatifolia, and A. splendens for use as a diuretic and in the treatment of wounds.

The Indians spin wool and manufacture their own cloth. They secure their dyes from a variety of plants, the wood, bark, leaves, flowers, fruits, and roots of which are boiled to extract the colours, while extracts of species of Oxalis and Ourisia, and putrefying urine are used as mordants. The following is a brief summary of the data given me by Bro. Claude Joseph on the colours, and plants from which they are derived.

Red is secured from the wood of Nothofagus obliqua, and from the finer roots of the herbaceous Relbunium hypoxarpium, a very intense red being secured from the flowers of Loranthus sternbergianus and L. heterophyllus. When the wood and bark of N. obliqua are boiled together in different proportions a range of intermediate red tints is produced. The roots of Berberis heterophylla give a clear yellow; the bark of Eucryphia cordifolia, or the wood of Eugenia multiflora, or the branches of Muehlenbeckia rhamnifolia a bright yellow; and the fleshy rhizomes of Rumex romassa an orange yellow. Grey is secured from the shoots and branches of Fuchsia macrostemma, violet from the ripe fruit of Aristotelia maugei, brown from the bark of Laurelia aromatica, bright green from the leaves of Solanum gayanum, and indigo-blue from the somewhat ligneous Chiropetalum lanceolatum. Black is derived from the shoots of Cortaria ruscifolia (the New Zealand tutu). In the south, however, the large sea-weed Durvillea utilis is burned, pulverized, and mixed with water, when a very intense black, resembling Chinese ink, is produced. Indeed, this was used in the place of ink during the early days of European settlement following the Spanish conquest.

As I have been approached by several people interested in the subject, and as too little is known in this Dominion of the biology, etc. of that interesting Republic, some reference here to the scientific literature and scientists of Chile may not be out of place. The Chilean scientific literature is extensive, as shown by the 15,000 references compiled in 18 volumes by Dr. Carlos Porter in his bibliography of the natural sciences of that country.

Those interested in any of the branches of the subject, and wishing to do so, could communicate with the following gentlemen who were amongst the many who gave me invaluable assistance:—Dr. Carlos E. Porter, Casilla 2974, Santiago, the founder and publisher of an annual review of Chilean natural history (zoology, botany, anthropology, geology, etc.) and who is in contact with all the leading scientists of Chile. Among the specialists are the botanist Dr. Otto Urban, Director of the German College at Osorno; Dillman S. Bullock, Esq., of the Bunster Institute, El Vergel, Angol, who is an authority on birds and insects; the entomologist Hermano Flaminio Ruiz,
Colegio San Pedro, Huérfanos esquina Claras, Santiago; and the Chief of the Plant Protection Service in the Ministry of Agriculture, Dr. Alberto Graf Marin, Casilla 4647, Santiago, whose department deals with the economic aspect of biology.

(Editor's Note:—

I am indebted to the Director of Forestry for permission to publish the following extract from a letter written by Senor E. L. Benth, of Santiago de Chilí, whose references to Pinus radiata make an interesting supplement to Dr. Miller's article.)

The date of the introduction of Pinus radiata to Chile is not known but is probably between 1880-1890. Since that time insignis pine has been widely planted for ornamental and shelter purposes. As a forest tree it has been planted since about 1906 in which year the Coal Mining Co. of Lota contracted a German Forest Engineer.

This forester was responsible for planting the largest pine forests existing in South America.

Lota is a little coal mining town near Concepcion; the latter being famous for a naval battle between Britain and Germany during the Great War.

There exists at present near Lota 37,000 acres of well stocked P. radiata forest, the Chilean Sugar Co. having an annual planting programme of about 1 million trees. There are about 49,000 acres of P. radiata forest in Chile. (See frontispiece)

Explanation of Maps.

Maps showing the economic zones, population distribution, temperature, and rainfall (Map 1), and the six botanical zones (Map 2) of Chile, together with the relative positions of Fiji, New Zealand and Macquarie Islands.

A, Tarapaca; B, Antofagasta; C, Atacama; D, Coquimbo; E, Santiago; F, Talca; G, Concepcion; H, Cautin; I, Valdivia; J, Chile; K, Aysen; and L, Magellanes Provinces. M, Tierra del Fuego; N, Patagonia; O, Argentine; P, Bolivia; and R, Peru.

rf, rainfall; mx, maximum; mi, minimum; me, mean; psm, population per square mile.

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