

THE FORESTS OF THE WESTERN CAUCASUS¹

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(With Plates VII—IX)

The following is a brief phytogeographical sketch of the forests of the western portion of the Caucasus range, which I visited in 1912 as a member of the excursion to the Caucasus and Armenia arranged and conducted by Prof. M. Rikli of Zürich, whose "Naturwissenschaftliche Studienreisen" are so well known to and appreciated by botanists, as well as by workers in other fields, that I need not give particulars concerning them here, beyond mentioning that those interested will find details—botanical, zoological, geological, ethnographical, etc.—in the book edited by Prof. Rikli giving an account of the 1912 excursion².

THE COLCHIAN MIXED DECIDUOUS FORESTS

On the eastern shores of the Black Sea lies the country of Colchis, famous in ancient Greek history. It is a very fertile stretch of land. The parts of Europe and Asia which lie around the high ridge of the Caucasus are mostly dry deserts and dry grasslands, but this southwestern part is thickly wooded all over. The water-laden southerly winds which beat against the high walls of the Caucasus bring great quantities of rain and atmospheric moisture to Colchis, or Abchasia as it is called today. Of places on the shore, at Suchum Kalé the annual total precipitation is 1218 mm., at Sotchee 2042 mm., and at Batum 2357 mm. The precipitation is evenly distributed over the whole year; for instance, the minimum (in May) at Batum is 72 mm. This great and uniform degree of moisture tends to produce an *oceanic climate*.

¹ Paper read at the International Phytogeographical Conference, Chicago, August 5, 1913.

² "Natur- und Kulturbilder aus den Kaukasusländern und Hocharmenien. Von Teilnehmern der schweizerischen naturwissenschaftlichen Studienreise, Sommer 1912, unter Leitung von Prof. Dr. M. Rikli in Zürich." Pp. viii and 317, with 95 illustrations and 3 maps. Zürich (Art. Inst. Orell Füssli), 1914. Price 10 francs (paper) or 12 francs (bound). Contributors:—Prof. M. Rikli (phytogeographer), Dr. W. Bally (botanist), Prof. C. Keller (zoologist), Dr. W. A. Keller (geologist and alpinist), Pfarrer J. Koller, Bishop Mesrop of Tiflis, E. Paravicini (cand. agr.), Dr. E. A. Rübel (phytogeographer), C. Seelig (alpinist).

The plates reproduced here (Plates VII—IX) are taken from the book by courtesy of the publisher.

The following phytogeographic papers resulted from this Excursion:—

Engler, A. "Ueber die Vegetationsverhältnisse der Kaukasus auf Grund der Beobachtungen bei einer Durchquerung des westlichen Kaukasus." *Abhandl. d. bot. Ver. f. Brandenburg*, **55**, 1913.

Krause, K. "Ueber die Vegetationsverhältnisse des Ararat in Hocharmenien." *Verhandl. bot. Ver. d. Prov. Brandenburg*, **54**, 1913.

Krause, K. "Die floristischen Beziehungen des Araratgebietes." *Engler's bot. Jahrb.*, Beihefte, 1914.

Rikli, M. "Beiträge zur Pflanzengeographie und Florengeschichte der Kaukasusländer und Hocharmeniens." *Verhandl. d. schweiz. naturforsch. Ges.* 1913.

Rikli, M., and **Rübel, E. A.** "Vegetationsbilder aus dem westlichen Kaukasus." *Schenck u. Karsten's Vegetationsbilder*, Reihe 11, Heft 6/7, 1913.

Rübel, E. A. "Die Kalmückensteppe von Sarepta." *Engler's bot. Jahrb.*, Festband, 1914.

The mean annual temperatures of the coastal regions as well as of those (e.g. Kutais) at the foot of the mountains all lie between 14° and 15·5° C., the means of January between 4·6° and 5·9° C., the means of the hottest month (July or August) between 23° and 26° C. The differences in mean temperature between the hottest and the coldest month are thus 18—20° C., indicating in this respect a rather *intermediate* climate. But the absolute minima are well marked, ranging from -7·8° at Batum to -15·6° at Sothee; in the cold winter of 1910-11 a minimum of -23° was observed near Gagry, 10 km. (about 6 miles) inland.

With the Mediterranean climate the Colchian has only the warmth in common, but neither the dry summer nor the mild winter, hence the unfavourable season to which the vegetation must adapt itself is the winter. We do not find, therefore, a dominance of the Mediterranean sclerophyllous type, which can endure drought but not cold; the dominant trees of the Colchian region are protected against winter by leaf-fall. On the other hand the high atmospheric humidity of this region reminds us of the "cloud belt" of the Canary Isles with their laurel wood, and even more of western Ireland which has, together with great moisture, a January isotherm above 5° C. In these places we find the glossy, light-reflecting laurel-leaved plants, which love mist and subdued light. They must be distinguished sharply from the true sclerophylls, which are adapted to endure strong light and dry heat by their dull greyish hairy leaves. Here in Colchis we expect, and we find, the laurel-leaved plants as *underwood*, protected from the strong summer sunlight by the tropophytic standards. *The Colchian district is characterised by deciduous forest with partly evergreen underwood.*

We became well acquainted with this luxuriant forest in the Sho-ekwara valley (see Plate VII) near Gagry, a summer resort on the northeastern shore of the Black Sea, and again in the Kodor valley, long stretches from the sea inland towards the austere heights of the Caucasus. For days we travelled through this luxuriant primeval forest which covers the country, irrespective of the variations in the subsoil. Overlying granite, as on calcareous soil, this mixed deciduous forest continues unchanged as the climax vegetation of these lowlands. The small-leaved oriental hornbeam (*Carpinus orientalis* Mill.) is abundant and may nearly be called dominant in large parts, especially in the lowest altitudes. The common hornbeam (*Carpinus betulus* L.) is also present. Maples are abundant and include, besides the European *Acer pseudoplatanus* L. and *Acer campestre* L., the Asiatic *Acer laetum* C. A. Meyer. Abundant also are elm (*Ulmus montana* With.), ash (*Fraxinus excelsior* L.), and especially lime (*Tilia caucasica* Ruppr.) as well as oaks (*Quercus robur* L. and *Q. sessiliflora* Salis.). The prominent trees are thus mostly the same as in the oceanic parts of Europe, but in very luxuriant forms with large leaves.

Epiphytes and lianes are very abundant. Mosses and ferns clothe the trees. The vine (*Vitis vinifera* L.) climbs all over the trees, competing with *Clematis vitalba* L. Creepers, evergreen and deciduous, cover stems and ground alike. The underwood is usually rich, sumachs (*Cotinus coggygria* Scop. and *Rhus coriaria* L.) being its most prominent members. The ground vegetation is made up of luxuriant and tall (up to 1 m.) herbs and grasses. In correlation with the shade and great moisture the leaves are large, very thin and dark green—well-defined "shade-

leaves." Flowering under these conditions takes place very late, most of the plants were only in bud on our visit in the first fortnight of August.

From about 300 m. upwards the montane evergreens become more prominent—*Prunus laurocerasus* L., *Ilex aquifolium* L., *Buxus sempervirens* L. (which reaches 8 m. and more in height with stem 20 cm. in diameter and a meagre, story-forming, cedar-like habit), *Rhododendron ponticum* L. and *R. flavum* L. During three whole days we rode on and on through these forests from Suchum Kalé to Adshary in the Kodor valley. Above Adshary from 800 m. upwards the montane forest changed its character, and we entered the beech woods.

BEECH FORESTS

In a continental climate the vegetation limits are generally well marked and easy to determine. On the other hand, in oceanic countries, when warm enough, different types of vegetation may merge into one another—alpine species may descend to the sea shore and mix with lowland or southern species, as is the case with *Dryas octopetala* L. in west Ireland¹ or *Rhododendron ferrugineum* L. in the chestnut groves on Lake Maggiore. Deciduous forest may rise to the tree limit as the beech does on the southern slopes of the Alps. This is also the case on the southern slopes of the Caucasus. Formations merge into one another, but main types may be recognised.

The *beech forest* is widely distributed in the Caucasus. Its main belt lies between 700 and 1500 m., but it may ascend to the tree limit and descend into the hornbeam mixed deciduous forest formation. We even found it locally dominant near the sea shore at Pitzunda near Gagry (see Plate VIII). It is not the common European beech but an eastern variety, *Fagus silvatica* L. var. *asiatica* DC. (= *F. orientalis* Lipsky). The forests of the aggregate species *Fagus silvatica* L. demand a certain definite complex of ecological factors, a *well-defined habitat*. Thus I do not hesitate to include those beech forests in the European beech wood formation² as a subformation. In both cases this forest is developed in an intermediate climate, not too oceanic and not too continental; the differences between January and July temperatures are about 20° C. in Central Europe as in the Caucasus; snow lies in winter. The soil is formed of typical beech forest humus. The forest grows with small variations on granitic as well as on calcareous subsoil, variations which may be spoken of as associations or even only as ground societies.

Two well-defined associations were conspicuous. From 700 to 1000 m. we traversed a pure dense shady beech forest nearly devoid of undergrowth, a mode of occurrence which we also have in Central Europe. Most of these fine beeches had a stem about 1 m. in diameter. The dominant beeches were accompanied by solitary elms (*Ulmus montana* With.), limes (*Tilia caucasica* Ruppr.), and hornbeams (*Carpinus orientalis* Mill., *C. betulus* L.).

A distinctly different association was found higher up in the Klytch valley

¹ E. A. Rübel. "The Killarney woods, Co. Kerry, Ireland." *New Phytologist*, **11**, 1912, pp. 54—57.

² Of which Macgregor Skene (*Journal of Ecology*, **1**, 1913, pp. 94—96) so well shows that the same association occurs on chalk in England as on schist in the Cevennes, France.

from 900 m. to about 1500 m. Here the beech dominates as standards, below which there flourishes a rich underwood of dense cherry-laurel (*Prunus laurocerasus* L.), which causes in the dark forest a shining and glittering of reflections from its leathery glabrous leaves. Though the flora is tolerably varied, the aspect is completely governed by these two dominants, beech and cherry-laurel. This *Fagetum asiaticae laurocerasosum* is very intimately related to the *Fagetum silvaticae aquifoliosum* of the subalpine belt in Corsica, where under very similar ecological conditions the beech forest is richly interspersed with *Ilex aquifolium* L., a species of the laurel type which also occurs here but sparsely among the abundant *Prunus laurocerasus* L.

NEEDLE-LEAVED FORESTS (ACICULISILVAE)

The *subalpine belt* is characterised by needle-leaved forests (Aciculisilvae) just as in the Alps and other mountains. There are three forest-forming species: *Abies Nordmanniana* Stev., *Picea orientalis* Carr. and *Pinus silvestris* L.

The pine forest is extremely similar to those of the Alps. It occupies the same type of habitat, and occurs on the northern side of the Caucasus (see Plate IX, Phot. 2) which has very little rain and a dry continental climate like that of the inner Alpine valleys. The undergrowth is also to a large extent the same, though with some eastern species.

Picea orientalis Carr. is often interspersed in beech and fir forests but may become dominant; it especially clothes gorges, as it loves moisture and a deep loamy soil.

The most conspicuous conifer forests we met with were those of Nordmann's fir, *Abies Nordmanniana* Stev. They cover large stretches on both slopes of the Caucasus. On the northern dry side of the range they leave, as already stated, the driest and most exposed slopes to the pine; but moist localities on both sides bear a beautiful, dense and pure fir forest. On the southern side the fir mixes also with the ascending beech, producing a fine picture in light and dark green (see Plate IX, Phot. 1). *Abies Nordmanniana* has luxuriant cylindrical forms, the branching resembling that of the Arolla pines (*Pinus cembra* L.) in the Alps. These beautiful forests contain a large number of European species in the undergrowth, as *Dryopteris filix mas* (L.) Schott, *D. spinulosa* (Müll.) Kuntze, *Deschampsia flexuosa* (L.) Trin., *Urtica dioica* L., *Oxalis acetosella* L., *Solidago virgaurea* L., etc., etc.; among the Eastern species are *Rhododendron caucasicum* Pall. and *Vaccinium arctostaphylos* L.

To sum up, we have seen that the forests of the Western Caucasus show very considerable resemblance to those of Central Europe and extremely little to those of the Mediterranean. As in Central Europe, the subalpine zone is mostly clad with needle-leaved forests, whilst those of the lower belts belong to the formation group of Aestatisilvae (summer forests). Very rich mixed deciduous forests cover the lowlands, beech forest with laurel-leaved underwood dominating the higher belt, while *Abies Nordmanniana* woods clothe the highest tree-bearing zone, leaving the dry poor slopes to *Pinus silvestris* forests. These communities are all climatic, each being the climax for its own climate.



Photo

Dr. E. Pritszel

Primeval forest in the Sho-ekwara valley near Gagry. Rich mixed deciduous forest of *Carpinus*, *Acer*, *Quercus*, *Tilia*, *Ulmus*, *Fraxinus*, *Taxus*, etc.

RÜBEL—FORESTS OF WESTERN CAUCASUS (see pp. 39—42).



Photo

Dr E. Pritzel

Beech wood at Pitzunda near Gagry. In the foreground *Rhododendron ponticum* L. up to 4 m. high; centre behind, *Prunus laurocerasus* L.

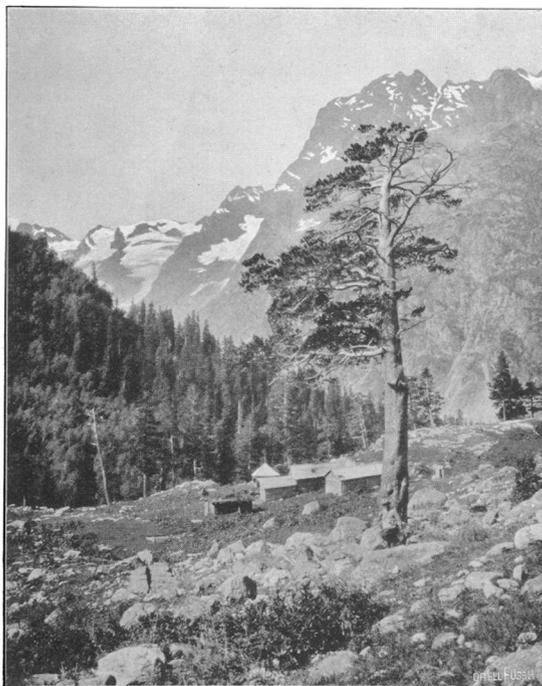
RÜBEL—FORESTS OF WESTERN CAUCASUS (see pp. 39—42).



Photo

Dr E. A. Rübel

Phot. 1. View of a side valley to the Klytch at 1320 m. Between the large dark cylinders of *Abies Nordmanniana* Stev. the light green *Fagus silvatica* L. var. *asiatica* DC.; near the brook large *Alnus rotundifolia* Mill.



Photo

Dr E. A. Rübel

Phot. 2. Kluchor Kasarma, 2100 m.; north side of the Caucasus. In foreground a *Pinus silvestris* L., belonging to a pine wood on the dry slope to the right out of the picture; on the wetter slope to the left a wood of *Abies Nordmanniana* Stev.; near the brook a wood of *Betula pubescens* Ehrh. var. *carpatica* W. & K.

RÜBEL—FORESTS OF WESTERN CAUCASUS (see pp. 39—42).