

INTERNATIONAL ASSOCIATION OF WOOD ANATOMISTS

News Bulletin

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Editor: A. Frey-Wyssling, Secretary-Treasurer

A. Frey Wyssling

EDITORIAL

Worldwide forest policy and the future of woodlands are major concerns of foreseeing personalities who are anxious to ensure the welfare of mankind. Our member, Dr.F.Kollmann, Professor of Wood Technology in the University of Munich, came to the conclusion that these problems ought to be discussed and permanently followed up by an International Academy of Wood Science (I.A.W.S.). Since this Academy (incidentally with almost the same initials as our I.A.W.A.) will be founded in the near future, this News Letter includes an exposé on the purpose and the organization of the said project by its promoter.

A.Frey.Wyssling

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INTERNATIONAL ACADEMY OF WOOD SCIENCE

by F.Kollmann

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After a thorough preparation the foundation of an International Academy of Wood Science is in the near future. The reasons for the establishment of such a world-wide Academy are the following:

1. The maintenance of the forests on the earth globe is of the highest importance for the industrialized society of the atomic age as the beneficial effects of the forests: amelioration of local climate, protection of water sheds, purification of the air and opportunities for physical and mental recreation and spiritual inspiration of men are now more indispensable than ever before.
2. Maintenance of forestry and forest lands for the continuous production of forest products which must be utilized economically and effectively.
3. Substitution of wood and increasing consumption of wood exist side by side temporarily, locally and in different fields of utilization. Taking everything into consideration a slowly rising consumption of wood per caput and year is evident.
4. New type wood base materials and wood products, often manufactured combined with other materials, e.g. plastics, have in the future to be created by intimate cooperation of research and development.
5. Modern wood research is characterized by the cooperation of biologists, chemists, physicists, technologists and mathematicians. It fits well in with the circle of highly mathematized natural and technical sciences.
6. The International Academy of Wood Science is indispensable in order to establish an appropriate platform for scientific discussions, publications and statements of the leading scientists in the field of wood research. The world-wide importance of forestry, wood economy and wood science demands the international character of this Academy.

7. Gifted academically graduated people have to be attracted to devote themselves to forest products research and wood technology. Such people should not only be attracted by space research, construction of rockets, aeronautics, automation, electronics and the construction of highly specialized machinery. The International Academy of Wood Science and Technology and its publication, The Quarterly Review of Wood Science and Technology, draw the attention of the public, including the academic youth to the increasing importance of wood science.

A Constitution for the International Academy of Wood Science has been worked out together with leading experts and scientists from many parts of the world.

The tasks and goals of the International Academy of Wood Science shall be the following:

- a) promote wood research and wood science on a highly scientific and technical level;
- b) represent wood research and wood science on request at international or national meetings of other organisations dealing with or concerned with the production and/or consumption of wood;
- c) focus the attention of governments, parliaments, industries, the press, associations etc. on the importance of wood research and wood science.

The IAWS shall

- a) hold regular world-wide regional meetings of its members for the presentation and discussion of original reports on latest results of advanced wood research;
- b) delegate members as speakers to the meetings mentioned above;
- c) publish the reports of their members in a Quarterly Review of Wood Science and Technology.

The IAWS shall consist of no more than 100 ordinary members who are actively engaged in wood research and who have already gained high scientific reputation in this field. Corresponding members who are actively engaged in research that is related to wood research can be elected. The IAWS shall have the following officials: A President, a Vice President, a Secretary, a Treasurer, a Board of Advisors. The Board of Advisors shall consist of 12 members. Members ex officio shall be the Chairman of IUFRO, Sect. 41, and as a representative of FAO, the Director of its Forestry and Forest Products Division. Ordinary and corresponding members of the IAWS shall be elected in a Plenary Meeting according to the proposals of the President of the Board of Advisors with majority of at least 2/3 of the attendants.

A Circle of Sponsors and Friends of the IAWS shall create the necessary financial basis for its activity. Invited to become members of this Circle shall be Forest Services and private forest administrations, wood consuming industries and other industries related to wood, pulp and paper.

The IAWS shall consist of 3 classes:

- a) biological-anatomical class
- b) chemical class
- c) physical and technological class.

The following regional working groups shall be established:

- a) European and African Group
- b) Panamerican Group
- c) Asiatic-Pacific Group

The Permanent Secretariate of the IAWS shall be located at Vienna/Austria.

Leading personalities which are interested on forestry and forest products research were invited to sign the following Declaration:

"For the highly industrialized atomic world of today, and even more that of tomorrow, the forests of the Earth must be preserved under all circumstances. This goal can be reached and secured only by balanced production and consumption of wood. Thorough investigations

and analyses of trends during the last decade have proved that the total annual consumption of wood is increasing everywhere. We need, therefore, the highest possible efficiency in utilization and improvement of wood and wood-based products. Only a highly scientific treatment of all related problems can accomplish this goal.

Wood is so complex a material that many branches of science are involved in research on it. Research on wood and forest products generally has been carried out for more than 50 years at many famous laboratories. International cooperation in this field already exists to some extent.

Missing is still an academy-like organization as described in the attached Constitution. The foundation of an International Academy for Wood Science could doubtless instigate further scientific progress and stimulate world-wide cooperation in this field. The undersigned therefore welcome and support the foundation of this Academy."

The Declaration was signed by:

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Member of the Perm.IUFRO-Committee
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Dr.Egon Glesinger
Assistant Director General
Rome

N.A.Osara
Director, Forestry & Forest
Products Division
Rome

FOREST BOTANICAL STUDIES IN EASTERN BOLIVIA

by Eberhard Schmidt

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From August to November 1951 the Bolivian Ministry of Foreign Affairs sent an expedition to the northeast of the province of Velasco on the Brazilian frontier. This expedition had mainly geological and topometrical aims. In order to justify the elevated costs spent for an enterprise which was to reach completely unexplored and uncivilized regions, it was useful to send along also a botanist who was entrusted with a rough investigation on the flora along the route covered by the group. According to my special interests in wood anatomy I decided to collect botanical material of the commercially most important timbers, taking into consideration smaller woody plants as well which, with their great number and easy attainability in the savannahs, might one day prove to be of interest for the modern industries. From every tree I collected under the same collective number herbarium material and a piece of the trunk thick enough to show possible heartwood formation. Owing to the circumspect and friendly help of the leader of the expedition, Coronel Arturo Cuéllar Rea, I was able to perform this task of botanizing with the axe, inspite of the great speed of our journey.

The results of my activity have been compiled in a yet unpublished report, to which I added pictures of trees and barks and wood-anatomical micro-photographs of every species. My special thanks go to Prof.A.Burkart (Buenos Aires), Prof.H.Merxmüller (Munich), Prof.F.Markgraf (Zurich) and Dr.H.H.Heine (Paris) for their co-operation in determining or confirming the herbarium.

The herbarium material has been handed over in complete sets to the
Ministerio de Relaciones Exteriores, La Paz, Bolivia
Instituto de Botanica Darwinion, San Isidro, Argentina
Botanische Staatssammlungen, München-Nymphenburg, Germany
Bundesforschungsanstalt für Forst- und Holzwirtschaft, Reinbek bei
Hamburg, Germany

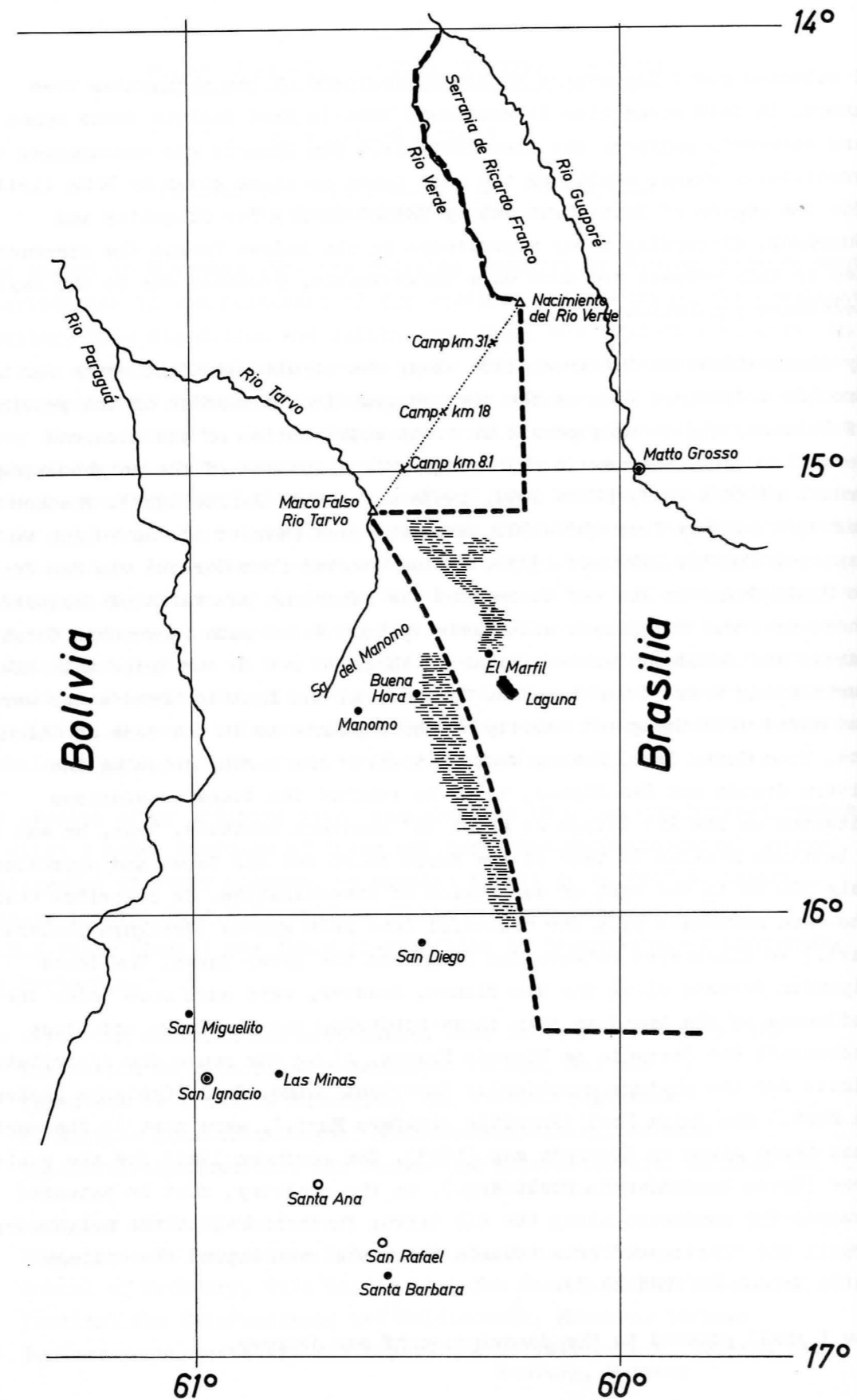
Wood samples were given to

Ministerio de Relaciones Exteriores, La Paz, Bolivia
School of Forestry, Yale University, New Haven, Conn., U.S.A.
Institut für Holzforschung und Holztechnik, München, Germany
Bundesforschungsanstalt für Forst- und Holzwirtschaft, Reinbek bei
Hamburg, Germany

I attached great importance to the correctness of the vernacular tree names. In this connection it was found that in East Bolivia these names are extremely uniform. The farm-hands from San Ignacio who accompanied us practically always mentioned the same names as those given by PENA (1944) for the region of Santa Cruz and by HERZOG (1910) for Chiquitos and Guarayos. (According to my experiences in the Andean Yungas the circumstances in this respect are much more unfavourable, probably due to the less sedentary population.)

My observations on the tree flora along one single, straight route can not provide a distinct idea of the phytogeographical situation of the province of Velasco, nor do they permit an exact coordination of the observed formations with the newest phytogeographical systems of the neighbouring Brazil (HOEHNE 1923, HUECK 1957, 1957a and 19591 Paffen 1957). Theodor Herzog's journey from 1907-1908, however, came nearest to the region we explored (HERZOG 1910 and 1923). Herzog started from Corumbá via San José to Santa Cruz. On his way he crossed the sandstone mountains of Chiquitos where he found the Campos with their typical Totai palm (*Acrocomia Totai* Mart.) and deciduous woods similar to those we met on our trips into the surrounding area of San Ignacio. However, in San Ignacio these woods were not mixed with the great variety of Chaco plants as in the case of Chiquitos. From Santa Cruz, Herzog went on towards the north, crossing the rivers Grande and San Miguel, until he reached the Guarayos missions situated on the Rio Blanco at about 15° southern latitude. Thus, he was at a latitude similar to that of the Marco Falso del Rio Tarvo and approximately 300 km to the west of our region of investigation. He describes nearly the same savannahs with the beautiful Cusi palm groves (*Orbignya phalerata* Mart.) we discovered between San Diego and the river Tarvo. The dense riparian forests along the Rio Blanco, however, were much more under the influence of the Amazonas than those bordering the Rio Tarvo and those underneath the Serrania de Ricardo Franco. Along our route the distribution limits for the phytogeographically important palms, Cusi (*Orbignya phalerata* Mart.) and Palma Real (*Mauritia vinifera* Mart.), were more to the north than those given on Herzog's map (1923). The southern limit for the rubber tree (*Hevea brasiliensis* Muell.Arg.), on the contrary, must be extended towards the southeast along the Rio Tarvo; furthermore, in the neighbouring Brazil the "Seringaes" grow towards the south even beyond the village Matto Grosso (HOEHNE 1923).

Now I shall proceed to the description of our journey.



When in August we reached this area the nature was still completely under the influence of the dry season and it was extremely difficult to orientate oneself in this very bare flora. But on September 24th, finally, the first abundant rains produced a rapid eruption of leaves and blossoms, so that we were fortunate enough to complete our observations and collections on our way back.

During our direct flight from Santa Cruz to San Ignacio, after having passed the savannah of Santa Cruz, we noted until San Ignacio a continuous stretch of woodland of which, however, we were not able to discern any particulars. Only in the immediate vicinity of the Rio San Miguel some farms and the brilliant yellow treetops of several *Alcornoques* (*Tecoma spec.*) were to be seen. During the next days, on a tour to the mountain Kamaka near San Ignacio, we had the opportunity of investigating the eastern limit of these forests which were on this spot of weak growth and showed very scarce foliage. The *Curupaú* (*Piptadenia macrocarpa*) was the predominant tree. These forests extend approximately towards the former estancia San Diego.

The woods to the west and southwest of San Ignacio, which I observed until Santa Ana, San Rafael and Santa Barbara, show much more variations. They are closely related to the Campos with their characteristic Totai palm (*Acrocomia Totai Mart.*). In general, the forests are less dense and the variety of species is much greater. The appearance of the forests changes constantly. During the short period of our visit, however, we were unable to discover its probably edaphic reasons. It is true that many stands of useful timber trees found in the vicinity of villages and the formerly more densely populated and pastured Campos have been decimated. But also in more remote parts it is to be observed and inhabitants confirm the fact, that the most valuable trees, such as Cedro or Tumbalo (*Cedrela spec.*), Verdolaga (*Calycophyllum multiflorum*), Soryokó (*Amburana cearensis*) and Copaibo (*Copaifera Langsdorffii*), can be found merely in small clusters, disappearing again for several kilometers. Only Soto (*Schinopsis Lorentzii*) and Cuchi (*Astronium urundeuva*) are evenly distributed. It is a great advantage of these forests that during the dry season they are easily accessible from the open Campos. Today, however, the roads are still in such a bad state that the ox-carts can carry very light loads only having a maximum of six Cuchi posts as used for house-building. It is superfluous to deal with the details on these savannahs, since all the important tree species we will meet again in the Campos farther north. The more open Campos of San Ignacio are characterized by the Totai palm, together with a large amount of shrubs,

such as Chahaco (*Curatella americana*) and Barbasco (*Magonia glabrata*).

On the camión trip from San Ignacio to the Marco Falso del Rio Tarvo, one leaves, after crossing a hilly territory of an extension of about 50 km, the woodland near San Diego and is suddenly confronted with the most beautiful Cusi Campos, so enthusiastically described by Herzog. One enters the vast inundation area continuing towards the north until the Rio Tarvo. The lower parts, which even during the dry season are full of small lagoons, are covered with grassland and are almost entirely devoid of trees or bushes. Wherever the area surpasses the inundation line, one finds small groves of trees overtopped by the gigantic fronds of the Cusi palm (*Orbignya phalerata* Mart.). The most remarkable companions of the Cusi palms are rather large Tocos (*Enterolobium contortisiliquum*), Tajibos (*Tecoma* spp.) with their red and yellow blossoms, and the blue-blooming Tarumás (*Vitex cymosa*) and Tinto blancos (*Jacaranda cuspidifolia*). All these trees supply very precious timber, even though only in their forests of the Monte or Monte Alto they develop more magnificently than here. Although the Cusi palm can be found almost up to Rio Tarvo, in the north of El Marfil those splendid groves are no more to be observed, but merely isolated and smaller Cusi palms which in this rather peculiar Campo region grow together with Chahaco (*Curatella americana*), Totaichi (*Byrsonima cydoniaefolia*) and Sucupira (*Bowdichia virgilioides*) as well as some poorly developed representatives of the Monte, such as Motact and Chonta palms (*Attalea princeps* Mart. and *Astrocaryum Chonta* Mart.), and Ambaibos (*Cecropia* spec.). Sometimes the ground is densely covered with creeping Sipoi herbs (*Bauhinia* spec.).

It could not be ascertained how far this landscape stretches beyond the Brazilian frontier, but on our way back, during a stay in Buena Hora and its environs, we were able to observe, with the ascending territory to the west, the gradual transition of grassland, Cusi groves and dry Campo towards the Monte. From Buena Hora, we drove in northwestern direction to the closed-down Manomó estancia. While the other members of the group climbed the Serranía del Manomó, I investigated the so-called Monte forest covering the slightly waved surroundings of our camp. The wood examined had been severely damaged by former fires. In order to improve the pastures, the inhabitants often set the Campo on fire, these fires, not restrained by any obstacles, penetrating into these dry forests. In this Monte, the tree-crowns are neither dense nor closely set, so that Campo trees and bushes can enter and form a very dense thicket below. In parts, these forests have become practically impenetrable, due to the growth of the thorny bamboo, Tacuara

or Uapa (*Chusquea* spec.). On the ground we found the small Cusicito palm (*Orbignya humilis* Mart.), a close relative of the Cusi, and the strange Cycadacea, Patoré (*Zamia boliviana* A.DC.).

Typical for the Campo were the following species:

- few Totai palms (*Acrocomia Totai*)
- Barbasco (*Magonia pubescens*)
- Alcornoque (*Tecoma Caraiba*)
- Bototó (*Astronium fraxinifolium*)
- Lucuma del Campo (*Pouteria* spec.)
- Sucupira (*Bowdichia virgilioides*)
- Huevo de Burro (*Caryocar brasiliense*)
- Motesillo (*Guettarda* spec.)

Trees occurring in the Campo as well as in the Monte:

- Moduré (*Brosimum Gaudichaudii*)
- Perotó (*Bombax* spec.)
- Mani (*Vatairea macrocarpa*)
- Paquio (*Hymenaea* spec.)
- Paquio Negro (*Peltogyne confertiflora*)
- Azucaro (*Alibertia* spec.)
- Cuta pobre (*Trichilia* spec.)
- Conservilla (*Rubiaceae*)
- Almendro (*Coumarouna alata*)
- Pezoé amarillo (*Platypodium elegans*)
- Utobo (*Luehea paniculata*)
- Tinto blanco (*Jacaranda cuspidifolia*)
- Tinto negro (*Callisthene fasciculata*)
- Ichisojó (*Terminalia argentea*)
- Mochochó (*Eugenia* spec.)

Typical Monte trees:

- Tajibo blanco (*Saldanhea laterifolia* var.)
- Cuchi (*Astronium urundeuva*)
- Ichituriki (*Aspidosperma subincanum*)
- Curupat (*Piptadenia macrocarpa*)
- Pezoé negro (*Pterodon pubescens*)
- Turere (*Rhamnidium glabrum*)
- Coco (*Guazuma tomentosa*)
- Mangaba (*Hancornia speciosa* Com., *Apocynaceae*).

When approaching the Serranía del Manomó, the representatives of the Campo are more and more disappearing. I myself reached a creek with the first Motact (*Attalea princeps* Mart.). A small fringe on the foot and on the slope of the Serranía shows, as I was told, a forest with rather large trees, a so-called Monte Alto. On top of the Serranía, we saw a shrubby Campo from underneath.

From the Marco Falso del Rio Tarvo onwards, we proceeded on foot in a direct line beating our way through the woodland without regard to any natural obstacles. We calculated the distance in km of our campamentos from the Marco Falso (see attached map). This region is solely roamed by savages,

the abandoned fireplaces of whom and a lost stone-axe we found on our way. Unfortunately, the Bolivians who accompanied us were unable to give me the vernacular names of the majority of plants found there.

The last, dry parts of the Cusi region reach up almost to the woods of the Rio Tarvo. In this Cusi Campo there stands a rubber estancia from where the first rubber trees are to be reached in a few minutes. The presence of the rubber tree (*Hevea brasiliensis*) tell us that meanwhile we have reached the Amazonas basin. But nevertheless, we find here nothing more than a transition forest with partly deciduous trees: the typical tropical forest of the Amazonas, the *Hylaea*, was nowhere to be found on our tour. Thus we did not see any arrow reed (*Gynerium sagittatum*), nor the giant tree *Ochobô* (*Hura crepitans*), or the Brazil-nut tree (*Bertolletia excelsa*), the first two of which can be found further on the south, in Western Velasco. This rubber forest is situated south of river Tarvo and could be followed 3 km to the east without reaching its end. The *Hevea* stands are much drier here than in the typical "Gomales", and their characteristic complementary tree, the stalk-rooted *Pachiuba* palm (*Iriarteia exorrhiza* Mart.) is missing. All the more remarkable seemed to us their abundance and the diameter of the stems (many of them exceeding 40, up to 60 cm.). Practically all the trees had already been utilized more than once, but they were all in good condition which indicates that the undoubtedly very experienced *Seringueros* give the trees time enough for recovering. It is rather curious that no young *Hevea* plants were to be found in this rubber forest. Here, too, was the only habitat of the immense stems of the precious Palo Maria (*Calophyllum* spec.) on our whole expedition.

Our first camp we established in a distance of 8.1 km from the Marco Falso on one of the affluents of Rio Tarvo on both sides bordered by very high forests. These woods clearly showed three stories: the first being the dominating trees of 30 to 40 m of height, the second one exhibiting trees of medium height with about 15 m, and the third one being practically impenetrable thicket. Even though we still found trees from the drier regions, such as *Paquio* (*Hymenaea* spec.) or *Bi* (*Genipa americana*), the forest was predominantly composed of more hygrophytic trees and plants. We saw immense *Bibosis* (*Ficus* spec.), *Maras* (*Swietenia macrophylla*, largest diameter 1.15 m), or *Tumbalos* (*Cedrela fissilis*), *Gargateas* (a wild *Carica* species), *Cabezas de Mono* (*Apeiba Tibourbou*), and *Gutas* (*Chrysophyllum gonocarpum*). The most characteristic palm is *Motach* (*Attalea princeps* Mart.). On the fringe of the forest, we found beautifully blooming *Helicteres*

guatumaefolia H.B.K. (*Sterculiaceae*) and *Hirtella* aff. *Pohlii* Hook. f. (*Chrysobalanaceae*). From the numerous epiphytic orchids not yet in blossom, we could identify *Lockhartia micrantha* Reichb.f. only.

During the dry season, this affluent of Rio Tarvo is but a small rivulet, bedded into a 1 km wide, swampy area, which was very difficult to cross. The entire surface of the river is covered by the big-leaved *Scitaminea*, *Patujá* (*Heliconia* spec.), amidst of which numerous magnificent *Palmas Reales* (*Mauritia vinifera* Mart.) are growing in regular intervals, mingled with *Ambaibos* (*Cecropia* spec.).

After we had transversed the forest extending north of this rivulet, in a small basin a tree formation came to sight we had not expected to find, namely the "Bobales" known from the gravel and sand banks of the main rivers of Bolivia. These "Bobales" are composed of practically one single tree species, the Bobo or Parajobobo, according to Herzog (*Tessaria integrifolia* Ruiz et Pav., *Compositae*). The small, very upright stems of 5 to 10 m remind us of the alders in European lowlands.

The last 20 km of our way to the foot of the Serranía de Ricardo Franco ascended no more than about 100 m to 320 m above sea-level, but passing several smaller ground waves. The condition of this forest area obviously depends largely on the supply of water from the subsoil. While approaching the Serranía, the number of brooks increased and the state of the forest improved.

At first, from km 11 to km 17.4, where we did not encounter any running water, the floor was covered with the xerophytic rosettes of *Bromelias*, the underwood mixed with bamboos; no tree was stronger than 10 cm, except for some larger specimens of *Paquio* (*Hymenaea* spec.).

Then follows a remarkable forest area with *Hevea* until km 18.8. On the sandy river deposits, rich on minerals, especially feldspar, a luxuriant flora has developed. The rubber tree covers an area of about 1 km east of our path. It is composed of an extraordinary amount of young rubber plants, mostly less than 20 cm thick. I have only found one stem of 32 m of height having a diameter of 60 cm. These trees are still completely unexploited in this region menaced by savages and are still too weak for gum-production, since usually the utilization of stems starts with a diameter of more than 30 cm. The accessory tree species growing here are far more typical already for *Hevea* stands than on the river Tarvo. We find, for instance, the stalk-

rooted Pachiuba palm (*Iriarteia exorrhiza* Mart.), a great number of Chonta palms (*Astrocaryum Chonta* Mart.) and more seldom Motact palms (*Attalea princeps* Mart.). Strangely enough, I discovered in this forest a Palma Real (*Mauritia vinifera* Mart.), just in bloom. Apart from a gigantic *Ficus* tree with wide-spread meandering roots, practically no stronger trees were to be found in this inundation area. On a little excursion 510 m high up to a hill in the east, we met a forest of lesser density. On the slope we found magnificent trees of species requiring less humidity, such as *Bombax*, which had just spread their innumerable woolly seeds, some *Ichiturikis* (*Aspidosperma* spec.), *Huevo de Perros* (*Peschiera* or *Tabernaemontana* spec.), etc. The rich development of these stems is undoubtedly due to the granite subsoil. On the sandstone summit only smaller trees are growing, mostly weak *Curupa* (*Piptadenia macrocarpa*).

Continuing our main route following the *Hevea* forest, we passed a somewhat drier region with *Paquio* (*Hymenaea* spec.), the bottle-shaped trunks of *Toborocho* (*Chorisia* spec.), *Bibosi* (*Ficus* spec.), and *Motact* palms (*Attalea princeps* Mart.). But only from km 25 onwards the closed high forest set in, the Monte Alto, improving steadily towards the north until it reaches the foot and slope of the *Serranía de Ricardo Franco*.

An extremely humid basin cut by a deep rivulet full of water was the only place in the lower regions where I found some tree ferns of 3 m of height as well as the *Marayaht* palm (*Bactris infesta* Mart.) famous for its restricted habitat along the *Paragua* river. A group of extremely large *Toco* trees (*Enterolobium contortisiliquum*) showed branch-less trunks of 16 m of height and 60 to 80 cm in diameter.

Our campamento km 31 was situated in the midst of a very uniform forest belt surrounding the southern parts of the *Serranía de Ricardo Franco*. A hill west of our route (485 m above sea-level) allowed a very good survey over this continuous woodland. Due to the protection against the wind granted by the *Serranía* and due to the humid soil fed by numerous brooks, this forest has undergone such a splendid development. Nevertheless, practically one half of the trees remain leafless during the dry season. Almost without any interruption the entire region lies under a canopy of 25 to 35 m high treetops; the undergrowth is very dense and lianas (especially *Bignoniaceae* with their beautiful blossoms) climb well up to the highest crowns. But even here the appearance of the forest changes continuously, and particularly the dominant trees, such as *Mara* (*Swietenia macrophylla*), *Yesquero* (*Cariniana* or *Couratari* spec.), and

Toco (*Enterolobium contortisiliquum*), tend clearly to growing in clusters. For this reason it is very difficult to determine the wood reserves. I have taken the pains at least to measure one fourth of a hectare near our campamento which I considered typical. This area showed the following tree species: *Paquio* (*Hymenaea* spec.), *Mara* (*Swietenia macrophylla*), *Mora* (*Chlorophora tinctoria*), *Ajo-Ajo* (*Gallesia* spec.), *Toborocho* (*Chorisia* spec.), *Palo santo* (*Triplaris caracasana*), *Toulicia eriocarpa* and *Terminalia* cf. *oblonga*.

According to the diameter of their stems in breast-height I registered:

18 trees with 25 to 35 cm in diameter
6 " " 35 to 45 cm " "
4 " " 45 to 55 cm " "
1 " " 55 to 65 cm " "
2 " " 65 to 75 cm " "
1 " " 75 to 85 cm " "
1 " " 95 to 105 cm " "

Three of the biggest trees showed the following dimensions:

	Height	branchless trunk	Diameter
<i>Terminalia</i>	35 m	8 m	100 cm
<i>Swietenia</i>	30 m	18 m	60 cm
<i>Hymenaea</i>	26 m	18 m	75 cm

(*Mara* in this region frequently reaches a diameter of more than 80 cm, in one case of 1 m).

The result of these measurements is surprisingly positive. In this forest and in the woods covering the slopes of the *Serranía* and the hills nearby, about 10 to 20 trees having a diameter of more than 60 cm per hectare can be expected. The variety of species is relatively small, but from the economical point of view this is only an advantage.

Apart from the species given in my list of wood samples under Nos. 21 - 29 and 56 - 60, I also found in this forest *Motact* palms (*Attalea princeps* Mart.), *Sumuqué* (*Cocos botryophora* Mart.), *Pachiuba* (*Iriarteia exorrhiza* Mart.), wild *Chirimoyas* (*Annonaceae*), *Cabeza de Mono* (*Apeiba Tibourbou*), and *Tajibo* with yellow blossoms (*Tecoma* spec.). Prof. Burkart, Buenos Aires, pointed out that until now this is the only place where *Poeppigia procera* is known to grow in Bolivia. (Near campamento km 31 we discovered a botanical peculiarity: on a *Ficus* tree which had collapsed years ago, with invariably sound wood, several branches had developed into self-dependent trees. The height of these young trees, all of the same age, increases towards the top of the lying mother-tree. Thus, the well-known growth advancement of the terminal shoot had transferred itself in an exaggerated way to entire trees. An impressive example of tropical reproduction!)

The composition of the forests does not change beyond campamento km 31 situated at a height of 320 m, when climbing up the steep slopes and several terrasses to the Serranía de Ricardo Franco. A steep gorge is marked by some tree ferns and *Hymenophyllum tunbridgense* (L.) Sm. Only about 50 m below the crest of the Serranía, lying 820 to 965 m above sea-level, the forest dissolves and bushes grow in loose groups, while the last 25 m of the slope are covered with soft grass. In this region of the forest boundary we found low-growing specimens of *Caryocar brasiliense* and the following bushes all full in blossom:

Norantea guianensis Aubl., ssp. *paraensis* (Mart.) de Roon (Marcgraviaceae), offering a striking aspect due to their brown, horizontal blossom clusters rising well above the bushes.

Miconia tiliaefolia Naud., Melastomaceae

Miconia albicans Fr., Melastomaceae

Macairea adenostemon DC., Melastomaceae

Odontadenia lutea (Vell.) Markgraf, Apocynaceae.

From the Serranía itself one gets a magnificent view to the north and east. A slightly waved plane, the High Campo, stretches right up to the horizon. This uninhabited and treeless region is avoided even by the nomadic indios. The Palma Real (*Mauritia vinifera* Mart.) grows on the edge of stagnated water, accumulated in a few shallow valleys reaching from east to west. The wide summits are full of weather-worn sandstone blocks covered with lichen. Grass, a few low shrubs and, in more sheltered places, some very small xerophytic trees grow among these stones. The large number of densely growing stems of the *Vellozia phalocarpa* Pohl having a height of 50 cm and the knee-high bushes of *Microlicia depauperata* Naud. hinder the step. In a more open region, on the ground, we found the Composite *Bulbostylis spadicea* (H.B.K.) H. Pfeiffer, the Amarantaceae *Pfaffia* spec. and *Gomphonema lanigera* Pohl as well as *Euphorbia coecorum* Mart. HERZOG (1910, p. 363) gives a similar description of the high-campo flora in the regions between 600 and 700 m of the Serranía de Chiquitos. I hesitate, however, to identify this southernmost part of the Serranía de Ricardo Franco with one of the "Formações subxerophiles" as described by HOEHNE (1923) for the neighbouring Matto-Grosso region.

The origin of Rio Verde on the Serranía was our last target. Below a pool amidst of grassland where fresh-water turtles live, a deep, rather bare gorge had formed. On its steep walls solely mosses and ferns were to be collected.

Within the framework of this brief and sober report which may perhaps help to facilitate further research on this region, I was not able to include any details about the practical value of the timbers available in that area. I hope, however, the specification of the scientific names of these trees will give the possibility to evaluate the reliable statements of the inhabitants on the possible uses of the timbers as well as to make use of the modern scientific literature on this matter (viz. RECORD and HESS, 1947).

Finally, I should like to point out that the success of the expedition was greatly furthered by the careful help of the Ministerio de Relaciones Exteriores, the practical sense of Coronel Cuéllar Rea, who is best informed about East Bolivia, and, last not least, by the understanding of the friendly inhabitants themselves with their great love and interest for their home country. I also wish to extend my sincere thanks to the Franciscan monastery in San Ignacio for providing me with the ideal vehicle for botanical studies - a cart driven by six osen.

List of Wood Samples collected with Herbarium Material

The capitals C, M and MA indicate the general distribution of the trees in the Campo, Monte, or Monte Alto, according to our own experience; the preferred vegetation type is underlined.

Rio Tarvo, Campamento km 8.1

1	Guta	Chrysophyllum gonocarpum (Mart.et Eichl.)Engl.	Sapotaceae	
6	Coca falsa	Erythroxyton spec.	Erythroxyloaceae	
7	Bi	Genipa americana L.	Rubiaceae	M
8	Sahuintu	Eugenia spec.	Myrtaceae	
11	Tumbalo	Cedrela fissilis Vell.	Meliaceae	M, <u>MA</u>

Campamento km 29

14	Toco	Enterolobium contortisiliquum (Vell.)Hauman	Mimosaceae	
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Campamento km 31

21	-	Trichilia spec., forsan Tr.Catigua A.Jussieu	Meliaceae	
22	-	Poeppigia procera Presl.	Caesalpiniaceae	
23	-	Allophylus scrobiculatus (Poepp.et Endl.)Radlk.	Sapindaceae	
24	Mora	Chlorophora tinctoria G.Don	Moraceae	MA
25	-	Ampelocera spec.	Ulmaceae	
26	-	Parinari spec.cfr.P.laxiflorum Ducke et P.Krukovii Gleason	Chrysobalanaceae	
27	-	Toulicia eriocarpa Radlk.	Sapindaceae	
28	-	Inga edulis Martius	Mimosaceae	
29	-	Terminalia spec. (T.oblonga (Ruiz et Pavon)Poiret?)	Combretaceae	
56	-	Croton urucurana Baill.	Euphorbiaceae	
57	-	Colubrina glandulosa Perk.	Rhamnaceae	
59	Ajo-Ajo, Cutuqui	Gallesia gorarema (Vell.) Moq.	Phytolacaceae	M, MA
60	-	Pisonia spec.	Nyctaginaceae	
61	Vapomó	Guarea grandifolia C.DC	Meliaceae	

Campamento km 18

62	Seringá	Hevea brasiliensis (Willd.) Muell.Arg.	Euphorbiaceae	MA
63	-	Calocarpum mammosum(L.)Pierre	Sapotaceae	
64	-	Miconia spec.	Melastomaceae	
65	-	--	Bombacaceae	
66	-	Coussarea macrophylla Mart. Muell.Arg.	Rubiaceae	

Rio Tarvo

67	Sucupira	Bowdichia virgilioides H.B.K.	Papilionaceae	C
69	Totaichi	Byrsonima cydoniaefolia Juss.	Malpighiaceae	C
70	-	Ternstroemia cf.delicatula Choisy	Theaceae	
71	-	Panopsis Sprucei Meissner ex Rusby	Proteaceae	

Campamento below the Serranía de Manomó

75	Turere	Rhamnidium glabrum Reiss.	Rhamnaceae	M, MA
76	Tajibo blanco	Saldanhea laterifolia Bur. var.elliptica Bur.	Bignoniaceae	M, MA
77	Alcornoque	Tecoma Caraiba Mart.	Bignoniaceae	C
78	Huevo de burro, Biqui	Caryocar brasiliense Cambessèdes	Caryocaraceae	C
79	Lucuma del Campo	Pouteria spec.	Sapotaceae	C
80	Udovo	Luehea paniculata Mart.	Tiliaceae	C, M
81	Ichituriki	Aspidosperma subincanum Mart.	Apocynaceae	M, MA
82	Pezoë amarillo	Platypodium elegans Vogel	Papilionaceae	<u>C, M</u>
83	Ichisojo	Terminalia argentea Mart. et Eichl.	Combretaceae	C, M
84	Tinto negro	Callisthene fasciculata Martius	Vochysiaceae	<u>C, M</u>
85	Mani I	Vatairea macrocarpa (Benth.)Ducke var.cinerascens (Mart.)Ducke	Papilionaceae	C, <u>M</u>
87	Tinto blanco	Jacaranda cuspidifolia Mart.	Bignoniaceae	C, <u>M</u>
88	Bototó	Astronium fraxinifolium Schott	Anacardiaceae	C
89	Cuchi	Astronium urundeuva (Fr.Allem.) Engl.	Anacardiaceae	M, MA
90	Coco	Guazuma tomentosa H.B.K.	Sterculiaceae	M, MA
91	Moduré	Brosimum Gaudichaudii Trec.	Moraceae	<u>C, M</u>
92	Mochocho	Eugenia spec.	Myrtaceae	<u>C, M</u>
93	Paquio negro	Peltogyne confertiflora (Hayne) Bentham	Caesalpiniaceae	C, <u>M, MA</u>

San Rafael

96	Soto	Schinopsis Lorentzii (Gris.) Engl. var.marginata (Engl.)Cabrera	Anacardiaceae	M, MA
97	Arca od.Jarca I	--	Leguminosae	<u>C, M</u>
98	Espino blanco	Acacia albicortata Burkart	Mimosaceae	<u>C, M</u>
99	Penoko	Samanea Saman (Jacquin)Merrill	Mimosaceae	<u>C, M</u>
100	Huevo de Puerco, Huevo de Perro	Peschiera concinna Miers	Apocynaceae	M

101	Chirimoya silvestre	Rollinia longifolia St.Hil.	Annonaceae	M,MA
102	Cupesì	Prosopis chilensis (Mol.) Stuntz var.boliviana Burkart	Mimosaceae	C
103	Ajunado	Pterogyne nitens Tulasne	Caesalpinaceae	C,M,MA
104	Chahaco	Curatella americana L.	Dilleniaceae	C
105	Moduré	Brosimum Gaudichaudii Trec.	Moraceae	M
106	Almendra	Coumarouna alata (Vog.)Taubert	Papilionaceae	C,M
107	Mani II	Sterculia carthagenensis Cav.	Sterculiaceae	M,MA
108	Tipa	Machaerium villosum Vogel	Papilionaceae	M,MA
<u>Santa Ana</u>				
109	Guapurú	Myrciaria cauliflora(Mart.) Berg	Myrtaceae	M,MA
110	Ichituriki	Aspidosperma cylindrocarpum Muell.Arg.	Apocynaceae	C,M
111	Piton	Talisia esculenta (St.Hil.) Radlk.	Sapindaceae	M
112	Pezoë negro	Pterodon pubescens Benth	Papilionaceae	M
<u>Las Minas</u>				
113	Soryokó	Amburana cearensis (Fr.All.) A.C.Smith	Papilionaceae	MA
114	Palo morado	Machaerium spec.(M.Nictitanti Benth.et M.scleroxylon Tulasne affine)	Papilionaceae	M,MA
115	Piquana blanca	Cordia alliodora (Ruiz et Pavon) Chamisso	Boraginaceae	M,MA
116	Momoqui	Caesalpinia cf.floribunda Tul.	Caesalpinaceae	M,MA
117	Verdolaga	Calycophyllum multiflorum Griseb.	Rubiaceae	M,MA
118	Ajunado	Pterogyne nitens Tulasne	Caesalpinaceae	M
119	Copaibo	Copaifera Langsdorffii Desf.	Caesalpinaceae	C,M
120	Cusé	Casearia aff.gossypiosperma Briquet	Flacourtiaceae	M,MA
121	Cuta pobre	Trichilia spec.	Meliaceae	C,M,MA
122	Coco	Guazuma tomentosa H.B.K.	Sterculiaceae	C,M
123	Sirari	Copaifera Chodatiana Hassler	Caesalpinaceae	M
124	Curupañ	Piptadenia macrocarpa Benth	Mimosaceae	M,MA
<u>San Ignacio</u>				
125	Paquio	Hymenaea Martiana Hayne	Caesalpinaceae	C,M,MA
126	Almendo	Coumarouna alata (Vogel) Taubert	Papilionaceae	C,M
127	Coca falsa	Erythroxylon spec.	Erythroxylaceae	
128	Toborochi	Chorisia spec.	Bombacaceae	M,MA
129	Ichituriki	Aspidosperma subincanum Mart.	Apocynaceae	C,M

130	Barbasco	Magonia pubescens St.Hil.	Sapindaceae	C
131	Piquana negra	Cordia glabrata (Mart.)DC.	Boraginaceae	C
132	Leche-Leche	Sapium bolivianum Pax et K.Hoffmann	Euphorbiaceae	C,M
134	-	Helicteres Lhotzkyana (Schott et Endl.)K.Schum.	Sterculiaceae	
135	Ichisojo	Terminalia modesta Eichler	Combretaceae	C,M
136	Cupesì	Prosopis chilensis (Molina)Stuntz var.boliviana Burkart	Mimosaceae	C
137	Cari-Cari	Piptadenia viridiflora (Kunth) Benth.	Mimosaceae	M
138	Conservilla	--	Rubiaceae	C,M
139	Purga negra	Trichilia cathartica Mart.	Meliaceae	M
140	Carne de Toro	Combretum leprosum Martius	Combretaceae	M,MA
141	Tasara	--	Papilionaceae	MA
142	Jarca del monte	Plathymenia reticulata Benth.	Mimosaceae	M,MA
143	Tajibo de Pansa	Zeihera tuberculosa Bureau	Bignoniaceae	M,MA
144	Toco	Enterolobium contortisiliquum (Vell.)Marong	Mimosaceae	C,M,MA
<u>San Miguelito</u>				
145	Cambara	Vochysia divergens Pohl	Vochysiaceae	C
146	Tusequi	Machaerium pilosum Benth.	Papilionaceae	C,M
147	Guayabo	Cochlospermum regium (Mart.et Schrank) Pilger	Cochlospermaceae	C,M,MA
148	Perotó del monte	Bombax marginatum (St.Hil.) K.Schum.	Bombacaceae	C,M,MA
149	Perotó del campo	Bombax longiflorum K.Schumann	Bombacaceae	C,M
150	Chiriuana	Simaruba versicolor St.Hil.	Simarubaceae	C
151	Cabeza de mono	Apeiba Tibourbou Aublet	Tiliaceae	M,MA
<u>San Ignacio</u>				
152	Azucaro	Alibertia spec.	Rubiaceae	C,M
153	Mani III	Ferreirea spectabilis Fr.Allem.	Papilionaceae	M,MA
154	Pinon	Jatropha Curcas L.	Euphorbiaceae	C,M
155	Tarumá	Vitex cymosa Bertero	Verbenaceae	M,MA
156	Jarca III	Stryphnodendron obovatum Benth.	Mimosaceae	C
157	Motesillo	Guettarda spec.(G.viburnoides Chamisso et Schlechtendal?)	Rubiaceae	C

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