NOTES ON THE ISLAND OF BAWEAN (JAVA SEA) WITH SPECIAL REFERENCE TO THE BIRDS

by

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GENERAL (Historical).

Some particulars on the Geomorphology, Topography and Vegetation.

The island of Bawean is situated in the Java sea between Java and Borneo about 95 miles north of Surabaya and 220 miles southwest of Bandjermasin along Borneo's south coast.

According to R.D.M. VERBEEK & R. FENNEMA (1896) the island, which has an irregular square form, covers almost 200 square kilometers and is built up from the remains of an old volcano with a maximum altitude of 655 m. above sea-level. The oldest outermost crater brink runs over the summits of the mountains Ontjé, Besar (with its 655 m. the highest point of the island), Waringin and Munggu and it shows an opening towards the north. The more recent innermost crater fringe is closed except for an incision along the east side caused by the drainage of the crater lake Telaga Kastoba (Plate XXXI, fig. 2 and Plate XXXII, fig. 1). This lake is also of an irregular square form with a length of 600 m. a width of 400 m. and a depth of 140 m.

On all its flanks this mountain descends to the sea showing a large number of small hills along its cone, partly caused by erosion, but partly considered to be independent eruption centres some of which still show a horse-shoe shaped crater rim. The largest of these smaller craters is the sharp, conical Mt. Tinggi near Belibag, 615 m. above the sea.

At several localities along the coast alluvial river deposits are present, principally consisting of grey clay and sea sand. Such areas are used almost exclusively for rice growing. At altitudes of 10-30 meters above these rice fields are a number of almost horizontal platforms of brown clay, which must be seen as older alluvia originating from rivers or from the sea.

At four different localities hot wells appear, viz. north of Trusan, near the village Rudjing, not far from Sangkapura, along Mt. Petahunan and near the village Kepuh Laut, quite close to the north-east coast. They spring from limestone and deposit limetuff.

Almost half a century before VERBEEK & FENNEMA (loc. cit.) published their particulars, C. DE GROOT (1851) gave a geological description of the island. According to this author about 85% of Bawean is formed by eruptive rocks with, locally along the coast, especially along the south coast, sedimentary formations consisting of a lime layer on or leaning against the eruptive rocks with sand, clay and lignite layers in it.

The nucleus of the island consists of leucite containing alkali rocks mixed to a small degree with marl and limestone. The soil is said to be composed of old red, laterite showing an acetous reaction, of which the quality depends on the depth.

DE GROOT (loc. cit.) stated that the depth of the Telaga Kastoba was measured in 1850 and proved to be 75 ell (about 70 m.) which is only half the depth VERBEEK & FENNEMA mentioned half a century later. The length DE GROOT indicated as 250 ell (about 230 m.) and the greatest width only 200 ell (about 185 m.).

Concerning the vegetation, DE GROOT reported that the slopes around the crater lake Telaga Kastoba were covered with brushwood and heavy forest.

Some years earlier an extensive description of the island was published by one of the first Officers of the Civil Administration on Bawean, J. ALTING SIBERG (1846). According to this author there was at that time hardly any real forest on the island, but he drew attention to the *njamplung* trees (*Calophyllum inophyllum*) which were abnormally heavy, when compared with those on Java. SIBERG supposed that, in the old days, there must have been heavy teak forests (*Tectona grandis*) though there was hardly any left during his working period there. He also mentioned *kaju putih* (*Melaleuca* sp.) of which leaves and fruits were used by the human population for medical purposes. J. HAGEMAN (1859) found remains of coffee gardens, which were said to have been established at the instigation of the Civil Administrator DUNKI (1831-1843).

J.A.B. WISELIUS (1874) reported the import of timber from Java of which Bawean did not produce enough for *proa* building purposes because good teak was scarce.

Jhr.G.C. QUARLES VAN UFFORD & J. AALTSZ (1892) remarked that the isolated hills were covered with brushwood, but that the highlands were well forested; here too the occurrence of teak forest is recorded.

J.E. JASPER (1906) published extensive particulars about the population of Bawean, and of the cultivation of certain useful trees and crops. He too found the island rich in *njamplung* and estimated the areas covered with Nipa (*Nypa fruticans*) along the coast at roughly 75 ha. (185 acres).

The forester E.H.B. BRASCAMP (1923) gave a number of particulars concerning the state of the forests which he considered bad, generally speaking. The mountains, even very steep ones, were heavily devastated for the greater part and almost everywhere indications of fresh clearings were to be seen, even along the steepest slopes. The same phenomenon was also reported almost 25 years earlier by the forester of Modjekerto, I.H.W. SURIE, who also reported the scarcity of water in the interior. He supposed that the scarcity of *lalang* grass (*Imperata cylindrica*) stimulated a quick natural re-afforestation. The forester of Tuban, KRUYNE, when visiting Bawean Island in 1916, had the same opinion and he showed that even after heavy rainfall only small quantities of soil were removed by water rushing down the slopes.

In 1929 still another forester of whom I could not find out the name, visited this island. He estimated the area of wet ricefields at 5000 ha (12,500 acres), of cultivation on dry soil at 10,000 ha (25,000 acres) and of the reserved forests, mainly occurring on precipitous slopes and hardly accessible summits in the interior at 5,000 ha (12,500 acres). Contrary to BRASCAMP's opinion of six years earlier these woods did not make an unfavourable impression upon this

reporter. On his way to Telaga Kastoba beyond the village of Tjandi he found real heavy forest and also the surroundings of the crater lake were covered with a vegetation looking like an impressive primary forest. Locally remains of teak forests of an inferior quality were found. But the growth and habit of many trees made such a favourable impression that the flourishing state on Bawean Island of this useful timber need not be doubted. A fairly good road of about 35 miles suitable for motor transport surrounded the island.

The alarming phenomenon of clearings along very steep slopes was seen by almost all visitors but the present report suggested an important improvement in afforestation. Since about 1900 the random clearings for agricultural purposes were brought to a stop for unknown reasons; also the administrative measure on the strength of which—in 1916—the mountain forests were set aside as so-called reserved woods, was a favourable influence. The maintainance of such hydrologically important forests was considered the only means to safeguard a permanent irrigation of the wet ricefields in the lowlands. As a proof of the improvement it was emphasized that in 1929 the scarcity of water in the interior, reported by I.H.W. SURIE in 1900, no longer existed.

According to the botanist O. POSTHUMUS (1929) the central part of Bawean was well forested, though agricultural clearings were common, resulting in the secondary character of most forests and showing a rather homogeneous composition for the same reason. Though he did not exclude the presence of real primary forest, this was not considered very probable.

LEKKERKERKER (1935) stated the total area of Bawean Island as 19.815 ha. which does not differ much from the figure given by VERBEEK & FENNEMA (loc. cit.). At that period the cultivated area was estimated at 12.000 ha. of which 27% was used for wet ricefields and 73% for rotational cropping (shifting cultivation) on dry soil. These figures do not quite agree with those mentioned above for 1929.

Another Dutch botanist, P. BUWALDA, came to Bawean in 1937 to collect plants and he stayed there from 20th November till 6th December. During 12 days 439 herbarium items were collected, including a number of wood samples. As a result of this trip an extensive service report was compiled in which are many data about the collected material. From his description of the island it is evident that the situation was almost similar to that reported by his predecessors, for he too found clearings along very steep slopes up to 300-400 m. above sea level and extensive devastated areas near the villages. Though he did not find very large stretches covered with *lalang* grass *Imperata cylindrica*, this plant was fairly common along roads and paths. Some other plants, elsewhere often considered a pest, *Lantana camara* and *Melastoma malabathricum*, showed about the same picture as *lalang*.

In contradistinction to his colleague POSTHUMUS (loc. cit.) he indicated the vegetation covering the central part of the island and the summits of the mountains as primary forest though he accentuated the low maxima of the tree tops, averaging considerably lower than 40 meters, a height only reached by some rare specimens. Tidal forests and freshwater swamps of large extent were not found and the existing small areas of this type were heavily influenced by man.

BUWALDA reported a rather close similarity of Bawean's flora to the one known from Java and he obtained only two species until then not known from the latter island, viz. Irvingia malayana and Tristeropsis canarioides. Kaju putih (Melaleuca) mentioned in literature as occurring near the village of Gelam was not obtained.

The phenomenon typical of so many small isolated islands, *viz.* the occurrence of moss covered forest at low altitudes was also found on Bawean.

A small area used for the cultivation of coffee was found near the village Kumalasa and on the limestone peninsula Tandjung Ga'ang a small stalactitic cave was visited.

The many strong enclosures bordering the cultivated sections were attributed to efforts to keep away the boars and to indicate the different individual properties. Perhaps SIBERG's opinion was more realistic when he ascribed these fences to measures against damage by domesticated cattle and feral horses.

From particulars which became available in 1949 it is evident that from the beginning of the Japanese occupation of the island (March 1942) till the end of 1948 about 1,000 ha. of the 5,000 ha. of reserved forests were cut down. The cleared areas were used for agricultural purposes, pastures or remained fallow. Notwithstanding these activities there was a serious shortage of firewood. Especially for the fish (*pindang*) cookeries—an important industry on this island the need of firewood is extremely high. As a consequence of this reafforestation with different species of rapidly growing trees was recommended in reports which appeared during that period.

Human Population.

According to J. VAN ROON (1916) Bawean was still completely uninhabited in 1350, but in 1803 the counted human population amounted to 11,393 possessing 1,056 buffaloes and a rather important area covered with ricefields, coconut plantations and gardens for the cultivation of some other products.

There was a tremendous population increase during the following 20 years because there were 20,646 humans in 1824 which means a growth of almost 100π . But at that time it was not really a pleasure to live on this island because it was repeatedly visited by pirates, as was still the case in 1844 when 200 buccaneers plundered seven villages, killed many people and kidnapped still more, among whom were 80 women. A year later a similar piracy took place on Pulau Gili and this island was robbed again in 1850 and in 1862.

Fauna.

Though generally there are not many faunistic particulars in the rather extensive literature on this island, ALTING SIBERG (loc. cit.) did his best to give information on this subject. Mentioning the lack of domestic pigs, he reported an abundance of wild Boars (*Sus scrofa milleri* JENTINK) differing from those known from Java because of their small dimensions, aberrant colour and pointed muzzle. He also mentioned the common appearance of deer and from the description given it is evident that he meant the small Bawean Deer, *Axis* (*Hyelaphus*) kuhlii (MÜLLER & SCHLEGEL) which he already knew did not

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occur anywhere else! Monkeys [Macaca mulatta fascicularis (RAFFLES)] were considered exceptionally plentiful, perhaps he thought more abundant than anywhere else within the Indonesian Archipelago. He mentioned the occurrence of the Civet Cat [Viverricula malaccensis rasse (HORSFIELD)], the Palmroller [Paradoxurus hermaphroditus javanicus (HORSFIELD)] and the Porcupine [Hystrix brachyura javanica (F. CUVIER)]. But the presence of Barking Deer [Muntiacus m. muntjak (ZIMMERMANN)], Dwarf Deer [Tragulus j. javanicus (OSBECK)] and Coconut Squirrel (Callosciurus sp.) was not established, which is in accordance with our present knowledge. Crocodiles were called rare but Monitors (Varanus sp.) plentiful as were Snakes.

DE GROOT (loc. cit.) too paid attention to the small deer species living on this island, but as opposed to ALTING SIBERG and G.N. VERLOOP (1905) he did not meet with a single monkey! The frequent occurrence of boar, though also recorded by SURIE in 1900, could not be confirmed by VERLOOP: he saw these animals only sometimes, though more often on a trip to the crater lake Telaga Kastoba. JASPER (loc. cit.) referring to ALTING SIBERG's statements wrote: "Deer, though formerly plentiful are apparently exterminated now". But, as did VERLOOP, who stated in that same year that Bawean people told him that the grass plains in the eastern half of the island were well populated with Barking Deer, JASPER also mentioned this animal as occurring on Bawean. This makes it probable that both these species were confused in these cases and Axis (Hyelaphus) kuhlii is meant if the Barking Deer is mentioned, because the occurrence here of the Barking Deer still remains to be proven.

A.G. VORDERMAN (1892) also mentioned the Monkey, which he called *Cercocebus cynomolgos* and recorded "a small deer species, *Cervus kühlii*, hitherto not known from any other place in the World, and which has antlers of only a maximum length of 28-30 cm."

The occurrence of the wild Jungle Fowl was unknown to ALTING SIBERG but he mentioned the Bustard Quail (*Turnix suscitator*) and several species of pigeon and dove which may be considered *Ducula aenea*, *D. bicolor*, *Streptopelia chinensis* and *Geopelia striata*. He also recorded the presence of "white herons", the Reef Heron (*Demigretta*

sacra), the Grackle (Gracula religiosa) and the Java Sparrow (Padda oryzivora). He added that the two doves, Streptopelia chinensis and Geopelia striata were introduced in 1802 from Java by the first Prefect of this island, a certain Mr. FREDERIKS, and the "white herons" in 1824 by a prominent Chinese.

This author also gave a good description of the rock on Pulau Nusa and its cave where edible nests of Swiftlets were harvested at the rent of 240 Dutch guilders a year. At the same time breeding of numerous "gulls" were reported on the summit of that rock, which we now know were *Sterna sumatrana* and *S. anaethetus* which still try to breed there.

About Pulau Gili, an island east of Bawean, the frequent occurrence of Oriolus chinensis was established, though the species was not known to ALTING SIBERG from Bawean itself. Fascinated by this fact he transferred six orioles to the latter island but "when released along Bawean's north coast they at once returned to Pulau Gili". Furthermore this small island was indicated by ALTING SIBERG as a roosting place for the Pied Imperial Pigeon (*Ducula bicolor*), and the Green Imperial Pigeon (*D. aenea*) was also recorded there.

This chronicler did not tell us anything about the neighbouring rocky island Pulau Manukan Aër, (Plate XXXIV, fig. 1). but VERLOOP (loc. cit.) saw there a great many white birds showing a pinkish tint in their plumage, a long black or dark-coloured tail, blood red bill and yellow feet. It is not quite clear which species the author meant but one is inclined to suppose that they were Tropic-birds (*Phaeton rubricauda*). The same visitor also recorded the occurrence of thousands of white birds on still another rock, Pulau Karang Bilo, which is about a mile off Bawean's north-west coast. There were many eggs of these birds and one may accept that in this case they were terns, most probably *Sterna sumatrana* or *S. anaethetus*.

When the ornithologist VORDERMAN (loc. cit.) visited Pulau Gili in 1892, he also found *Ducula bicolor* numerous and besides he recorded the presence of thousands of seabirds, restricted to only a few species of which the Frigate-bird, *Fregata aquila* (= *minor*) was the most common. It seems not impossible that VORDERMAN did

not differentiate between Pulau Gili and P. Manukan Aër and that it was on the latter island where those thousands of Frigate-birds were located. This makes it possible that in those days that small rock was inhabited by such typical oceanic birds as Tropic-birds and Frigate-birds, which often share each other's habitat, though perhaps not always simultaneously as found on Mt. Gunung Api in the Banda sea (HOOGERWERF, 1939, V. BEMMEL & HOOGERWERF, 1940).

VORDERMAN's paper will be discussed *in extenso* below as will be done with H.C.A. OBERHOLSER's (1917) paper, dealing with a visit to Bawean of another zoologist, Dr. W.L. ABBOTT which took place from 19th to 28th November 1907.

JASPER (loc. cit.) called the surroundings of the crater lake Telaga Kastoba a suitable hunting area, because of the many wild ducks visiting there during the rainy season.

Regarding a collecting trip made in 1928 by Dr. K.W. DAM-MERMAN, formerly Head of the Zoological Museum at Buitenzorg (Bogor) and some members of his staff, no detailed particulars are known to me. There does not exist an official report nor any publication about this visit as Dr. DAMMERMAN himself told me 20 years later.

When I, in the last days of May 1939, visited Bawean and surrounding islands for the first time and stayed on Pulau Gili, I failed to obtain evidence of the abundance of orioles as recorded by ALTING SIBERG. Not a single representative of the species was encountered and also of the thousands of seabirds found by VORDERMAN, none came to my notice. Similar disappointing results were found when visiting neighbouring Pulau Manukan Aër, bearing in mind the experience of VERLOOP, for we saw hardly any birds.

The visit we paid to Pulau Noko, a coral island at some distance east of Sangkapura was much more interesting on account of the large number of terns, principally *Sterna sumatrana*, of which some eggs were found. And there was also a small flock of Gull-billed Terns (*Gelochelidon nilotica*), a species of rather rare appearance along Java's coasts. This small island is apparently unsuitable for any form of cultivation and is uninhabited; the most striking feature in the

vegetation was a number of fairly high Casuarina equisetifolia with as lowest plants Spinifex littoreus and Ipomoea pes-caprae.

Equally interesting was our visit to Pulau Nusa (Plate XXXIII) west of Bawean. It is composed of a rock rising from the sea connected with a crescent shaped bank of coral debris and sand. The summit of this rock and the rather steep sides are covered with a grasslike vegetation mixed with some poor Ficus shrubs and a small Pisonia sylvestris. The top of this rock is not larger than about 20 to 30 meters and in its west flank is a cave where Swiftlets (Collocalia fuciphaga) made their edible nests. That this cave lost almost its entire economic importance is evident when comparing the rent of 240 Dutch guilders paid a century ago, according to ALTING SIBERG (loc. cit.) and the one of 1937 amounting to only 10 guilders a year for harvesting the nests. This small island was also inhabited by a fair number of terns of the species mentioned above. Sterna sumatrana was chiefly concentrated on the bare, semi-circular coralbank and the second species S. anaethetus, on the rock mainly overgrown with grass. Of both these species some eggs were found, but-as on Pulau Noko-we got the impression that the eggs were regularly harvested by people from Bawean because there were many empty nests and no incubated eggs or pulli.

OUR EXPERIENCES, CHIEFLY THOSE OF OUR 1954 EXPEDITION.

General.

Our expedition to this island, which formed the primary reason for compiling this paper, took place from 21st May till 3rd July 1954. We travelled by the Research vessel "Samudera" under the command of Mr. VIËTOR, leaving Tandjung Priok (Djakarta) on 20th May and returning there on 7th July. During our stay on Bawean we camped at ten different localities. They are indicated below together with the dates of our stay at these camping places.

1.	Sangkapura (south Bawean)	21-23 May, 7-11 June
		and 3 July
2.	Balibakgunung (south Bawean) (Plate XXXIV. fig. 2).	24-26 May
3.	Telaga Kastoba (central Bawean)	27-29 May

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4.	Martalaja (west Bawean)	30-31 May
5.	Kumalasa (southwest Bawean)	1-6 June
6.	Pulau Gili (east of Bawean)	12-14 June
7.	Sekarputih (east Bawean)	15-17 June
8.	Gn.Padjungpadjung (northeast Bawean)	18-20 June
9.	Batulintang (central Bawean)	21-24 June
0.	Muara (south Bawean)	25 June-2 Jul

Prior to this trip, Bawean Island was visited by us from 28th till 31st May 1939. We also paid short visits to the area on 31st May and on 3rd and 4th July 1953 when on our way to and from Komodo Island (Lesser Sunda Islands). During these earlier visits most attention was paid to the small surrounding islands mentioned above. The particulars obtained on these occasions are also included in this paper.

In the present expedition also the late Mr. D.A. FABER, soil expert of the Institute for Soil Research at Bogor, participated, accompanied by two assistants, SUKIRNO and SUMARI. The present author was accompanied by the assistant taxidermist SASTRO of the Museum Zoologicum at Bogor. FABER and his co-workers brought together quite a collection of rock and soil samples and we continued the work after they returned to Java on 9th June.

Though this was not the most important goal of the expedition, a rather extensive zoological collection was brought together consisting of about 400 vertebrates, viz. 100 mammals (flying foxes, other bats and rats), 200 birds, 100 reptiles and amphibians and quite a number of fishes, crabs, shrimps, molluscs and insects. Besides, 300 herbarium specimens were collected. All this material was incorporated into the collections of the Institutes mentioned, above, the plants into those of Herbarium Bogoriense and of the Leyden Herbarium. It is not very probable that this collection contains plants which were not also obtained by BUWALDA in 1937 but I have no details; most of the collected plants are enumerated below when discussing the vegetation of the island and of Pulau Gili.

From the vertebrates obtained a large number of blood-and intestinal microscopic slides were taken on behalf of the Institute for Tropical and Protozoary Research of the University of Utrecht.

As far as available particulars about this material are incorporated below, and the birds will be discussed at length, this being one of the most important reasons for compiling this paper.

Weather Conditions.

The extremely bad weather-abnormally bad for the time of the year at which we visited Bawean-hampered our work and caused much trouble when trying to keep our collections in good condition, and to safeguard our ammunition. There was rain almost every day, often very heavy showers and in the night from 2nd to 3rd July such heavy weather as never before encountered by the Districthead of Bawean during the five years he had lived on the island.

About the average rainfall on the island little is known to me; there is only one locality where it has been measured over a long period, viz. at Sangkapura along Bawean's south coast. This is perhaps not sufficient to obtain a satisfactory picture of the average rainfall on the entire island because of its mountainous character. The annual average at Sangkapura amounts to 2564 mm; four months with less than 100 mm. and two with less than 60 mm.

Human Population.

On the basis of information obtained from the Civil Administration the total population amounted to about 45,000 people, living in 30 villages; including about 150 people on Pulau Gili. Given an area of about 200 square kilometers this means a population density of 200 per square km., which represents an increase of more than 100% when compared with 1824.

There were no Chinese on the island, which at that time was a rare phenomenon when compared to neighbouring Java and to many other islands in the Indonesian Archipelago. Trade was completely in the hands of the local population. This is quite different from the situation of 150 years ago, when there were so many Chinese that the appointment of a Chinese Administrator became necessary. Amidst the commercial and economical minded Bawean people a Chinese community could not hold its own and round-about 1900 there were no Chinese left. The most important means of livelihood were stock-breeding, agriculture, the plaiting of mats made of *Pandanus* fibre, practised already in the beginning of the 19th century and perhaps much earlier, and fishery, including fishery-industries. Bawean is well known because of its "*ikan-peda*" obtained through a special method of fish conservation, the so-called "*pindang*-cooking". But a large percentage of the men had a comfortable living by working on Java, other islands or even in Singapore, only returning to Bawean about *Id-ul-Fitr* (*Labaran* = Islamic New Year). A similar situation was already reported at the beginning of the 19th century when it was estimated that one third of the men worked outside their native island.

Vegetation.

Above, when discussing the experience of previous visitors, we have tried to give some indication of topography and vegetation around the turn of the century. Because our expedition took place about 15 years after our most recent predecessor visited the island, it was considered important to give some more recent data. Also, during the intervening period, a war scourged this country and a long period of unstable government preceded the indepence of Indonesia.

Though Bawean, when seen from the sea, gave the impression of being well forested, it soon became evident when the ship rounded the island at close range, that the greater part of that forest was nothing more than shrub-forest or gave the impression of a distinct secondary vegetation, whereas cultivated sections covered most slopes, often even entire hills. (See Plate XXIX figs. 1 and 2.)

Although it is logical that such disastrous agricultural methods must result in serious erosion, it was impossible to obtain any evidence of this when sailing along the island. And when travelling through the interior we did not get a more unfavourable impression. This was based on the rather rare occasions when we really saw traces of serious recent erosion and when observing the water discharged by streams.

There was apparently no similarity to the situation seen by SURIE in 1900 who found Bawean's interior extremely poor in water.

Because of the very heavy rains during our stay there it speaks for itself that there was an abundance of water almost everywhere, especially in the many rivulets of which, however, none is navigable on account of their shallowness (Plate XXXI, fig. 1). It is difficult to compare these situations without knowing more about the weather conditions during SURIE's visit.

Almost all forests on Bawean Island are of secondary origin, varying in age. Trees measuring over 30-40 cm. in diameter were rare in almost all forests we visited, if we exclude quick-growing species. But along precipitous and at some other barely accessible localities such as the surroundings of Mt. Batu, Mt. Besar and Mt. Menangis heavy forest was seen of primary appearance because of the presence of forest giants, measuring 80-100 cm. or still more, in diameter.

In spite of the fact that almost any acre of this island may be considered anthropogenically influenced, this is not always evident, because many hill-forests show a striking resemblance to the mossovergrown rain-forest on larger islands at altitudes between 2000 and 3000 meters above sea level. This phenomenon is caused, as indicated already by BUWALDA, by cloud forming around the summits of the mountains as a consequence of the removal of damp and warm air into the interior of the island by the regularly blowing sea winds. This results in abundant rainfall, sometimes even, as witnessed, during the east monsoon, the period of low rainfall in that part of the world.

Underneath the epiphyte-laden trees and shrubs, the soil is covered by a thick layer of moss and ferns among which sometimes beautiful tree ferns appear. At the foot of such hills a foaming stream pushes its clear water over a bed of rocks and stones in which cataracts of even 15-20 meters high may tumble down. Only the climate differs from real mountainous rain-forest, for one is never higher than 650 m. This is one of the reasons that Bawean Island with its many suitable roads and paths makes such a fascinating impression, accentuated by the varying landscape and an abundance of localities offering unforgettable panoramas.

Because I did not collect herbarium specimens from forest giants and other high trees, I have copied the particulars in this respect

from Dr. BUWALDA's report; all other features published below are mine. For classification of my herbarium I have to thank Drs. J. VAN BORSSUM WAALKES, at that time botanist of Herbarium Bogoriense, and Prof. Dr. C.G.G.J. VAN STEENIS, Director of the Leyden Herbarium.

Among the trees growing in heavy forest, often giving the impression of being primary, the following species were found: Spondias pinnata, Ficus variegata, Mischocarpus sundaicus, Litsea confusa, Cananga odorata, Artocarpus elastica, Podocarpus rumphii, Buchanania arborescens, Canarium hirsutum, Canarium asperum, Planchonella nitida, Dysoxylum amooroides, Gironniera cuspidata and Eugenia, Horsfieldia, Erythrina, Antidesma spp.

For the heavy secondary forest BUWALDA mentioned: Buchanania arborescens, Lagerstroemia flos-reginae (=speciosa), Ficus septica, several Eugenia species, an Antidesma, Acronychia trifoliata and Irvingia malayana.

Among the epiphytes often encountered he recorded the orchids Aerides odoratum and Cymbidium sp. and among the lianas, though never plentiful: Gnetum sp. and Tetrastigma sp.

The so-called cultivated areas include enormous sections of fallow land, originating from recently abandoned gardens where low shrubs and weeds form a pioneer vegetation towards new secondary forest, to be cleared again after a number of years. This type of vegetation also covers the greater part of the hills, though locally it may be rather old, giving the impression of real primary forest when seen from some distance. Besides those species mentioned by BUWALDA a number of other trees may be considered fairly common among which we found: Polyaltia littoralis, Uvaria littoralis, Ficus superba, F. benjamina, Memecylon myrsinoides, Alchornea rugosa, Alstonia scholaris, Psychotria angulata, P. rhinocerotis, P. adenophylla, Guettarda speciosa, Lasianthus obscurus, L. tomentosus, Petunga microcarpa, Brucea javanica, Leea sambucina, Vitex pubescens, Eugenia antisepticum, Cinnamomum sintoc, Tetracera indica, Mallotus philippinensis, Glochidion zeylanicum var. malayanum, Pongamia pinnata, Fagraea fragrans, Evodia glabra and Grewia microcos; plus the mistletoe Dendrophthoe falcata.

Among the rapidly growing shrubs, covering freshly abandoned fields may be mentioned : Melastoma malabathricum, Blumea balsamifera, Lantana camara and Leea spp. and incidentally also Calotropis gigantea and Crotalaria sp. In addition a number of other shrubs were fairly regularly observed, such as : Abelmoschas moschatus, Sida retusa, Urena lobata, Derris thyrsiflora, Cassia tora, Bridelia ovata, Breynia racemosa, B. microphylla, Euphorbia pulcherrima, Brucea javanica, Clerodendrum inerme, Azadirachta indica, Ardisia humilis, Gnetum gnemon, Ixora timorensis, Helicteres hirsuta, Trema orientalis, Eurya nitida, Murraya paniculata.

Among the many weeds and other low herbs, we established the following species; Crassocephalum crepidioides, Tridax procumbens, Ageratum houstonianum, A. conyzoides, Hibiscus surattensis, Sida veronicaefolia, Euphorbia prunifolia, Bidens biternata, Triumfetta bartramia, Uraria lagopodioides, Barleria prionitis, Biophytum reinwardtii, Tacca palmata, Stachytarpheta indica, Pistia stratiotes, Moschosma polystachyum, Kalanchoe pinnata, Coleus scutellarioides, Justicia gendarussa, Scoparia dulcis, Desmodium heterocarpum, D. pulchellum, D. styracifolium, Vernonia patula, Sphaeranthus indicus, Ipomoea maxima.

Though *lalang* grass (*Imperata cylindrica*) is not really abundant on Bawean Island and may be less obstructive than it is in many other localities in Indonesia, it still may be considered one of the most common weeds. Grasses and sedges were fairly plentiful also, of which as the most common may be mentioned : *Cyperus compactus*, *C. pulcherrimus*, *Fuirena ciliaris*, *Fimbristylis dichotoma*, *F. complanata*, *Themeda arguens*, *Centotheca latifolia*.

Heavy lianas were rarely encountered but this, and especially the lack of rattan, may be attributed to human interference. Indonesian countrymen are always extremely interested in such, often very useful, climbers. Among the thinner climbers the following species are among the material we collected: *Flagellaria indica, Jacquemontia* paniculata, Merremia tridentata, Cayratia trifolia, Tetrastigma sp., Smilax zeylanica, Freycinetia sp., Hoya sp., Cassytha filiformis, Piper bantamense, Passiflora foetida, Argyreia mollis and Jasminum pubescens.

Though orchids are certainly fairly common in this island, we only collected three terrestrial species, viz. Liparis, sp., Anoectochilus

sp. and *Trichoglottis* sp. We did not collect mosses and only a very few ferns, though both groups are abundantly present; ferns are so numerous on this island that a separate paper was published about them (POSTHUMUS 1929).

The mangrove or tidal forests, as a rule of little significance, show the usual composition. We saw many Sonneratia alba, including very beautiful specimens; several species of mangroves : Rhizophora mucronata, Bruguiera cylindrica, and Lumnitzera racemosa, etc. with Acrostichum aureum and Acanthus ilicifolius as undergrowth; Nypa fruticans is not very conspicuous (Plate XXX fig. 2). On the ridges of sand and other coral debris grow some trees and shrubs belonging to the Barringtonia formation such as Barringtonia racemosa, Terminalia catappa, Calophyllum inophyllum, Hibiscus tiliaceus, Thespesia populnea, Premna corymbosa, Pemphis acidula, Diospyros maritima, Caesalpinia nuga, Vitex negundo, Guettarda speciosa, Scaevola taccada, Excoecaria agallocha, with the herbs Spinifex littoreus, Euphorbia atoto, Ipomoea pes-caprae, etc. in the ground cover.

How extensive the total area of cultivation was when we visited the island, I do not know, but I suppose it was considerably larger than was estimated in 1929 when the ricefields covered about 5,000, the dry gardens (possibly including the pastures) 10,000 and the reserved forests 5,000 ha.

Besides rice—which on this island may be considered the main crop, on irrigated as well as on dry grounds, the so-called *ladangs* we found the sweet potato, *ubi* (*Ipomoea batatas*), *ubi kaju* (*Manihot esculenta*) and maize (*Zea mays*) as the most important crops.

Teak, also introduced by man and which may have a long history on this island, has apparently been cultivated at a rapidly increasing rate and during our visit some hills were entirely teakcovered, especially in the Mt. Padjungpadjung and Mt. Bisik areas in the north-east corner of the island. This has been carried out by the Forestry Service, but when these valuable trees are not well guarded many of them will be cut down by the population long before they can produce their optimal value in timber. We found numerous traces of recent wood cutting in these and other reserved forests.

Strangely enough I repeatedly failed to find out the reasons for the felled trees seemed quite intact, though in some rare cases they apparently were brought down to prevent erosion.

Though coconut palms too are a very striking feature in the cultivated areas, large plantations of this very useful palm were rarely encountered. Many of these palms did not appear healthy, which is perhaps a well known feature of this island because almost 30 years prior to our visit a paper appeared dealing with diseases of coconut palms on this island (G.J. VINK 1927). Very conspicuous are extremely large mango trees (*Mangifera indica*) and *njamplung* (*Calophyl-lum inophyllum*), giving a charming effect to Bawean's scenery.

There are of course many other cultivated trees, such as Nangka (Artocarpus integra), different djambu species (Eugenia spp.), djeruk (Citrus spp.) and capoc (Ceiba pentandra). Also plentiful are pandan (Pandanus tectorius), bamboo (Bambusa spp.), aren palms (Arenga pinnata) and, especially along the coast, waru (Hibiscus tiliaceus as well as Thespesia populnea). Besides, asem (Tamarindus indica), bungur (Lagerstroemia speciosa), kësambi (Schleichera oleosa) and some fig trees (Ficus spp.) were rather common trees. Kaju putih (Melaleuca leucadendron) mentioned by some authors, was rarely seen, though we collected some material of it on the summit of Mt. Bisik. We failed to find any coffee gardens.

The island of Pulau Gili east of Bawean, is rather flat but on the north point is a low leucite hill. The island is almost entirely surrounded by a coral bank. A couple of teak and mango trees, some giant Calophyllum inophyllum, a few Tamarindus indica, Terminalia catappa, Sterculia foetida, Schleichera oleosa, Pongamia pinnata together with some bamboo formed the major features of the vegetation, in addition to a region of tidal forest in which we found: Avicennia marina, Sonneratia alba, Rhizophora mucronata, etc. This complex of mangrove bordered a dry section where the following species were encountered: Casuarina equisetifolia, Diospyros maritima, Sophora tomentosa, Derris heterophylla, Canavalia maritima, Bauhinia binata, Ixora timorensis, Morinda citrifolia, Guettarda speciosa, Thespesia populnea, Hibiscus tiliaceus, H. sabdariffa, Premna corymbosa, Vitex negundo,

Pemphis acidula, Melia composita, Scaevola taccada, Trema orientalis, Gnetum gnemon and Breynia racemosa.

The remaining waste part of the island was covered with low plants among which were seen: Lantana camara, Wedelia biflora, Tridax procumbens, Physalis angulata, Pachyrrhizus erosus, Barleria prionitis, Commelina nudiflora, Sida acuta, Polanisia icosandra, Cassytha filiformis, Cayratia trifolia, Flagellaria indica, Sesuvium portulacastrum and Portulaca oleracea. There was quite a lot of lalang grass, Imperata cylindrica, and other grasses as: Dactyloctenium aegyptium, Oplismenus compositus, Themeda arguens, Eragrostis amabilis, Rottboellia exaltata, Panicum repens, Cenchrus brownii, Schizostachyum sp., Gigantochloa sp. and Spinifex littoreus.

The greater part of Pulau Gili was used by the population—at that time about 150 people—for crops, though fishing was the most important means of livelihood. Strangely enough no coconut palms were encountered; people told us that the efforts repeatedly made to cultivate them failed, which is something I can hardly believe.

The small island Pulau Manukan Aër which—when the tide is out—can be reached on foot, is nothing more than a low almost flat rock, overgrown with a poor vegetation nearly exclusively consisting of grass, ferns, and *Pandanus*, and some low brushwood among which was *Glochidion rubrum*.

About the coral islands Pulau Noko and P. Nusa, respectively south and west of Bawean, some particulars are given above. We did not visit these islands during our 1954-expedition but we were there in May and July 1953 when on our way to and from Komodo Island.

On Pulau Noko, some medium-sized Casuarina equisetifolia, the shrubs Pemphis acidula, Wedelia biflora and Scaevola taccada were common and as herbaceous plants we found Spinifex littoreus, Ipomoea pes-caprae, and the halophilous Salsola kali and Sesuvium portulacastrum. Concerning Pulau Nusa we noted only that it looked quite similar to the situation found in May 1939 and pictured on p. 310 of this paper.

Fauna.

Mammals. In 1954 livestock was said to consist of about 3000 head, of cattle chiefly of the Balinese type and a small number of Water buffaloes and horses. Since my visit to the island I am inclined to consider this figure heavily exaggerated. Goats and sheep were only encountered on fairly rare occasions and pigs were absent, which agrees with the situation of about a century ago reported by ALTING SIBERG. Though the poultry stock was perhaps not small we did not see poultry growing on any important scale.

Taking into consideration the Islamic religion of the people and the absence of Chinese, the number of dogs was large. Though it is perhaps right that their presence may be attributed in the first place to the useful services they render by protecting the standing crops against monkeys and boars, they undoubtedly are also used for deer hunting, because deer are difficult to hunt without dogs.

Some chroniclers were of the opinion that the heavy fences surrounding most gardens were erected to protect the crops against wild animals, particularly marauding boars. I believe SIBERG was right in attributing these palings to the keeping out of free living domesticated cattle apparently often run wild.

Though boar (*Sus scrofa* subsp.) was certainly not rare, the presence of this game was nowhere a pest during our visit to the island, because it is chiefly concentrated in the extensive forests and shrub wildernesses and on the enormous areas of fallow land.

Apparently the common monkey (*Macaca mulatta* subsp.) caused considerably more damage to coconut plantations and standing crops, for this animal preferred cultivated localities, sometimes acting very impudently.

The third game species, the Bawean Deer, Axis (Hyelaphus) kuhlii (Plate XXXV) can hardly be called harmful to crops because it retires to the most remote parts of the island. In behaviour it resembles the Barking Deer of Java, with which it also agrees in size; it is only slightly larger, not much higher in the shoulder than 90 cm. This beautiful and interesting animal dislikes leaving dense cover and apparently only visits gardens bordering such cover.

Unlike the Java Deer, Cervus (Rusa) unicolor russa, which principally feeds on grasses or grasslike plants, the natural food of the Bawean Deer consists of leaves and fruits of herbs, shrubs and trees. This makes Bawean Island a very suitable habitat because enormous areas, including the temporarily abandoned gardens, are covered with such plants. The young deer we obtained disliked grasslike plants but was fond of Passiflora foetida and Merremia tridentata and drank hardly any water.

The phenomenon repeatedly mentioned above, that *lalang* grass is not such a predominant plant in this island as it is at most other localities in similar situations, must be a favourable circumstance for this endemic deer, because the light inflammable *lalang* prevents reafforestation. Owing to its preference for the type of food indicated above, Bawean Deer show more resemblance to the Barking Deer (*Muntiacus muntjak*) than they do to the Java Deer. Though the Barking Deer was repeatedly reported from this island there does not exist any reliable proof of its occurrence so far as I know.

It speaks for itself that areas preferred by Bawean Deer which are, for the greater part, situated in mountainous country with many very steep slopes, provide this species with excellent cover. It may be attributed to this that it still exists, because it is not only very tiring for human beings and dogs to hunt the animals under such conditions, but the density of the vegetation also hampers shooting.

Probably it was not its scarcity but our collecting activities with consequent regular shooting, which must be considered the most important reason why we could not set eyes on a single free living representative of this species. Though on different occasions footprints and rubbing traces on trees and shrubs were found, the finding of such indications was hampered by the almost daily heavy rains which obliterated even very recent footprints. Owing to the fact that during our short stay on Bawean Island people succeeded twice in obtaining a fawn, it is perhaps justifiable to suppose that at that time this deer was not very rare; in any case sufficiently large numbers were extant to propagate. These calves were obtained, one

at the beginning, the other towards the end, of June, near Mt. Mas and Mt. Landjang, not far away from the village Kumalasa in the south-west corner of the island. They were about six weeks old when captured, so April/May are within the dropping season as we also know it in the Java Deer, so far as west Java is concerned.

Both these fawns were females, one was bought by me and kept as a pet in Bogor for more than two years and presented in 1957 to the Dutch Zoo ARTIS at Amsterdam. In September 1963 it perished there as a consequence of a fatal accident caused by lack of care. During the rutting season it was put together with a stag of *Axis porcinus* known from continental Asia which is considered closely related to the Bawean Deer. Until 1963 the antlers of this stag were cut off in order to prevent the doe being injured, but this was omitted in that year which resulted in the death of the doe, probably the only specimen in captivity in the world. The skeleton and hide of this animal are in the collection of the Zoological Museum at Amsterdam and particulars about this specimen were published by VAN BEMMEL and others (1962, 1963).

The Districthead of Bawean intended to present the second fawn to the Surabaya Zoo, but I do not know whether this was done.

The Bawean Deer, until now only known from this island, may be considered one of the rarest animals of the World. The great menace to it on account of its small range on a densely populated island should be more than enough reason to exercise the utmost care to prevent extermination. According to very recently obtained information (February 1965) hunting Banteng (Javanese Wild Ox) *Bos banteng*, Deer-which, of course, includes the Bawean Deerand the Barking Deer is prohibited in Java and surrounding islands. From the same official source poaching of Barking Deer on Bawean Island is reported, but because this species does not occur there, it is certain that Bawean Deer were the victims of illegal hunting activities. From reports received in September 1964 and February 1965 by the Netherlands Committee for International Nature Protection, originating from the cultural anthropologist J.G. VREDENBREGT, who spent the greater part of 1964 on Bawean, it is evident that

poaching of this rare deer is not uncommon, nets as well as firearms being used. Though Mr. VREDENBREGT does not mention figures relating to the present stock, he assumed that large numbers of Bawean Deer were still present. Because this statement is not based on any reliable information and there is no evidence that a single specimen was seen, this information is not of great value.

Possibly on account of this piece of information the following communication appeared very recently in Oryx, vol. 8 (1965): "The Bawean deer, at one time thought to be in danger of extinction, is now reliably reported to number several thousands. Confined to the island of Bawean in the Java Sea, it is regularly hunted by local people, despite being fully proteced, but is preserved by its inaccessible habitat. Continuous deforestation, however, might threaten it again ... " This "reassuring" news is not in accord with my field experience nor with later (1957) local information and I should be very happy if in reality a hundred specimens were still left on Bawean today. Moreover the species is not specifically included in the list of protected animal species in Indonesia, as very recent information from that country proves ! The only effort to prevent the species from extinction is a prohibition on hunting wild oxen and deer on Java (and the smaller surrounding islands) which, however, may be considered a "paper measure" only, because there is no enforcement whatever, and no game reserve on Bawean to protect this animal.

The Bawean deer should be considered the most threatened deer species of the world, in need of the most serious efforts to prevent it from becoming extinct, and the sooner this is known in international circles of conservationists the better for this poor animal. The situation is alarming, nothing less.

Very much importance should also be attributed to the recent information about a rapidly increasing area occupied for agricultural purposes because of the migration of many farmers from the still more densely populated island of Madura. This should result not only in the reopening of extensive areas of fallow gardens but also in clearing well forested regions. These activities are said to be stimulated by the so-called "sandan-pangan" programme through which

the cultivation of maize (*djagung*) and sweet potatoes (*ubi ketela*) is encouraged by the Government. On account of this Bawean's deforestation may reach an extent which must soon become catastrophic for the existence of *Axis* (*Hyelaphus*) kuhlii.

Above-mentioned information states that the total area of reserved forests amounts to 4557 ha. When previously speaking about the habitat of the Bawean Deer, at the least an equal area could be added, formed by shrub covered fallow gardens and young secondary forest, not incorporated into those reserves. But if such regions are distributed amongst transmigrated Madurese people, who are known as experienced and diligent farmers, it hardly needs to be emphasized that very efficacious protection is necessary to ensure survival for this vanishing mammal in such a small area as 4557 ha.

As one of the most important measures must be seen a permanent prohibition of hunting or capturing this animal, connected with a strict enforcement of such regulations. Whether or not the species is or will be put on the list of strictly protected animal species is not of paramount importance when considering the establishment of protective measures which seem *very urgently wanted*. There seems little reason to keep open the possibility for hunting this game on an island where enough cattle and poultry are available, in addition to fish which is perhaps the most important protein source.

In addition to these measures, it seems justifiable to consider the possibility of removing some specimens to other islands where suitable territory is available. Because of the difficulty of finding such areas in very densely populated Java where effective protection even of the game-reserves Baluran and Udjung Kulon proved to be very difficult, it would be wise to select other islands for such a purpose. It is logical to consider neighbouring Borneo as a future habitat and to select there forest reserves situated in unpopulated or very thinly populated areas where its survival does not depend in the first place on the effectiveness of protective measures.

As a further measure efforts could be made to breed the species in captivity. Because in the past propagation of Bawean Deer under similar conditions succeeded, success seems almost certain. In such

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a case a well managed zoological park or a Zoo in tropical or subtropical zones ought to be preferred because of a suitable climate during the entire year. It need not be emphasized that capturing animals for one of these purposes must take place with the greatest caution and under the management of competent, nature protection minded people and by means which preclude serious injuries to the captured creatures.

As is evident above some reporters mentioned the Barking Deer from this island, though more than a century ago ALTING SIBERG (loc. cit.) emphasized the absence of this game species, together with the absence of Dwarf Deer (*Tragulus javanicus*) and Coconut Squirrel (*Callosciurus* spp.). I did not find recent indications of any of these mammals, and of the remaining mammals mentioned by ALTING SIBERG, only the presence of the Palmroller (*Paradoxurus hermaphroditus*) could be ascertained, of which a young one was offered us for sale on 16th June. However, I would not like to suggest that Civet Cat and Porcupine (*Viverricula malaccensis & Hystrix brachyura*) no longer occur there. Once an Ichneumon (*Herpestes javanicus*) was probably encountered but I did not succeed in obtaining certainty on this.

All the mammals secured during this expedition were incorporated into the collections of Museum Zoologicum at Bogor, but in 1957 put into the hands of the mammalogist of the Leyden Museum, Dr. A.M. HUSSON, in order to be classified. Prejudging a definite classification Dr. HUSSON was so kind as to give me the names as used below.

Rats may be numerous, for in the neighbourhood of all our bivouacs these animals were captured, *Rattus rattus diardii* as well as *Rattus rattus jalorensis* \geq *roquei*. Regarding the first race there seems little doubt about its true identity because the extensive material was classified on account of two different tabulations. Though the collected skins appear as a beautiful series representing all extreme variants, it is considered a pity that almost all specimens are juveniles or not fully adult.

Besides the subspecies *diardii* a still larger series of rats belonging to a different race was obtained, most probably R.r. jalorensis x roquei. Three previously studied specimens from Bawean Island were classified by H.J.V. SODY (1941) as Rattus rattus roquei (?). Though Dr. K.W. DAMMERMAN always considered jalorensis and roquei identical, this has never been accepted as an established fact and SODY was a convinced opponent of that conception. W.C. VAN HEURN (1930) pointed to clear differences in habits and habitat: and there are apparently also differences in litters, in *jalorensis* these are said to consist of 6-8, sometimes even up to 12, in roquei of only three or four young. Because I only secured juveniles and semi-adults and no pregnant females were examined, I cannot give particulars on litter size. I also failed to obtain enough data on habitat and behaviour to facilitate the classification since all my material was trapped at night without giving enough evidence about the surroundings of the secured specimens belonging to both these groups.

Flying Foxes (*Pteropus alecto aterrimus*) and other bats were fairly common; during our stay on Bawean they could even be called numerous in certain localities. The representatives of the subspecies *aterrimus* of which Bawean Island is the type locality, demonstrated an uncommon behaviour when compared with that of all other Flying Foxes observed by me at other localities. They were seen flying and feeding at almost all hours of the day, solitary individuals as well as small flocks, not even avoiding such low vegetation as bananas. It sometimes also happened that they circled very high above the island bathing in sunlight as certain birds of prey, storks and other birds do and on 25th May at 11.30 a.m. about 50 were seen flying over the island.

Many times I noted in my diary the strange behaviour of these flying mammals without any trace of human interference, though feeding at night was also recorded.

Smaller bats were regularly encountered and several roosting places were visited: caves near Telaga Kastoba, Tandjung Ga'ang and on the island of Pulau Nusa, and big hollow trees near Martalaja and at some other localities. The specimens secured belonged to *Mega*-

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derma spasma and Hipposideros ater. Megaderma spasma badly needs a revision making it possible to establish the racial affinity of the material secured; the species is apparently seriously oversplit. Hipposideros ater must belong to the subspecies saevus or aruensis, according to Dr. HUSSON. Though the range of the first mentioned subspecies includes Bawean Island the skulls of the (4) individuals examined show an important character of aruensis crania. Even in the most recent revision of the genus Hipposideros the status of ater is not satisfactorily solved in the opinion of Dr. HUSSON and of the revisor himself (J.E. HILL 1963).

Reptiles and Amphibians. Concluding from the material we secured, we may suppose that these groups are well represented and that some of them are perhaps abundant on Bawean Island. Without concentrating our activities on these animals we obtained 65 Geckos, House-geckos, Chameleons and Skinks, 20 Frogs and Toads, together with 11 Snakes, all belonging to 16 different species. This material was classified and published by the herpetologist R. MERTENS (1959).

According to this expert there are no species among the secured material which are not also known from Java, but a Tree-Viper (*Ahaetulla prasina*) secured on Pulau Gili differs from representatives of the species known from other localities. Therefore it is a pity that only one specimen was obtained. Also a large specimen of the very poisonous "*ular welang*" (*Bungarus candidus*) was secured. As a remarkable fact may be mentioned that near the crater lake Telaga Kastoba a very high percentage of the observed *Mabuya multifasciata*, a skink of common appearance also on Java, were without their tail or the greater part of it.

We did not record Crocodiles but the common Monitor Varanus salvator was regularly encountered without being common.

Molluscs. The few freshwater molluscs we obtained were classified by Mr. L.J.M. BUTOT of Museum Zoologicum at Bogor. They belong to the following species and subspecies: Elaphoconcha bataviana, E.b.duplocincta, Achatina fulica, Leptopoma perlucidum, Amphidromus contrarius baweanicum, A. perversus infrapictus, A. perversus subsp. and Brotia testudinaria. Of these specimens those belonging to Leptopoma perlucidum and Achatina fulica were new for the island of Bawean.

The Giant Snail (*Achatina fulica*) is considered a pest in many Indonesian regions so that its presence in Bawean may not be considered a pleasant appearance.

Insects. The insects were partly classified by the entomologists J.H. DE GUNST, M.A. LIEFTINCK and J. V.D.VECHT. Among the classified part of the collection are 11 species of Odonata, 46 of Coleoptera, 19 of Hemiptera, 2 of Homoptera and 23 of Hymenoptera. Among the Vespidae (Hymenoptera) there is a melanistic subspecies of the common Javanese Wasp Eumenus arcuatus but in this case too, only one male specimen was obtained.

The Butterflies secured were not as yet classified when I left Java in 1957.

Other material. We also collected some freshwater fishes, shrimps, crabs, etc. chiefly from the crater lake Telaga Kastoba. So far as I know they also are not yet studied. About the freshwater fishes of this island those interested may be referred to the papers of P. BLEEKER (1859, 1860) and P. VAN OYE (1917).

Notwithstanding the efforts made to obtain some more particulars about the many microscopic slides made from blood and inestines of the collected vertebrates, I did not succeed. As a consequence of the death in 1958 of Prof. Dr. F.C. KRANEVELD, Director of the Institute for Tropical and Protozoary Research of the University of Utrecht, examination of these samples was perhaps never brought to an end, if ever taken up.

I do not know whether the large quantity of rock and soil samples was ever seriously studied or resulted in some report or publication. The sudden serious illness of the soil-expert FABER, which compelled him to return to Europe in 1956, and caused his death in 1960, may have been the reason that in this case too the material collected and the many fieldnotes did not get the attention they certainly deserve. It therefore may be of some use to report the presence of this material at Bogor, brought together by a very enthusiastic fellow-worker.

(To be conluded).



Fig. 1. Paddyfields alternate with forest and shrub-forest. At top right a recently deserted agricultural clearing.



Fig. 2. Shrub forest in the foreground with lowland rice paddies beyond.



Fig. 1. Lowland rice along the south coast.



Fig. 2. Nypa fruticans at a south coast river mouth.

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Plate XXXI



Fig. 1. There are many rivers but few are larger than this and none is navigable.



Fig. 2. The crater lake Telaga Kastoba. The surrounding hills are partly covered with primeval forest.



Fig. 1. A close up of part of Telaga Kastoba.



Fig. 2. Village road in the northern lowlands.



Fig. 1. Coral bank off Pulau Nusa. Breeding place of Sterna anaethetus and Sterna sumatrana.



Fig. 2. Looking back from the coral bank to Pulau Nusa where Collocalia fuciphaga and Sterna anaethetus nest.

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Plate XXXIV



Fig. 1. Pulau Manukan at low tide seen from nearby Pulau Gili.



Fig. 2. One of our bivouacs-a few miles north of Sangkapura.



Fig. 1. Bawean deer Axis (Hyelaphus) kuhlii at about 18 months.



Fig. 2. Bawean deer: kept for 2 years in Bogor as a pet. The species is now in danger of extinction.

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Plate XXXVI



Fig. 1. Bridled Terns Sterna anaethetus on Pulau Nusa.



Fig. 2. A single egg (complete clutch) of Sterna anaethetus in a nest on Pulau Nusa.