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ZONATION OF BIRD COMMUNITIES ON FERNANDO POO

D. R. Wells

Introduction

With recent work, particularly by Basilio and by Eisentraut and his collaborators, the terrestrial vertebrate fauna of Fernando Poo is now comparatively well known. The birds of the island have figured in recent papers on taxonomy and evolutionary divergence, faunal balance vis a vis adjacent mainland Cameroun and probable patterns of colonisation, by Amadon (1953) and Eisentraut (1965); and notes, primarily on the taxonomy and distribution of selected species, by Wolff-Metternich and Stresemann (1965), Amadon and Basilio (1957) and Eisentraut (1968). Basilio (1963) has published an annotated checklist.

But while the species list for the island is now fairly complete, the ecology of the bird fauna has so far received little attention. There is published information on the distribution of some individual species but as in mainland Cameroun, except for Cameroun Mountain itself (Eisentraut 1963), the zonation of bird communities on Fernando Poo has not been directly analysed. The purpose of this paper is, therefore, to include data collected during a visit to the island from 23rd December 1966 to 12th January 1967 in a preliminary statement on the distribution of species in relation to vegetation zones (rather than to altitude alone) and to investigate the composition and interrelationships of the bird communities of these zones.

Geography and Bird Habitats

Fernando Poo, with an area of c. 2000 sq. km. (see Fig. 1), is an offshore outlier of the Cameroun montane system, separated from Cameroun Mt. on the opposite mainland by a sea gap

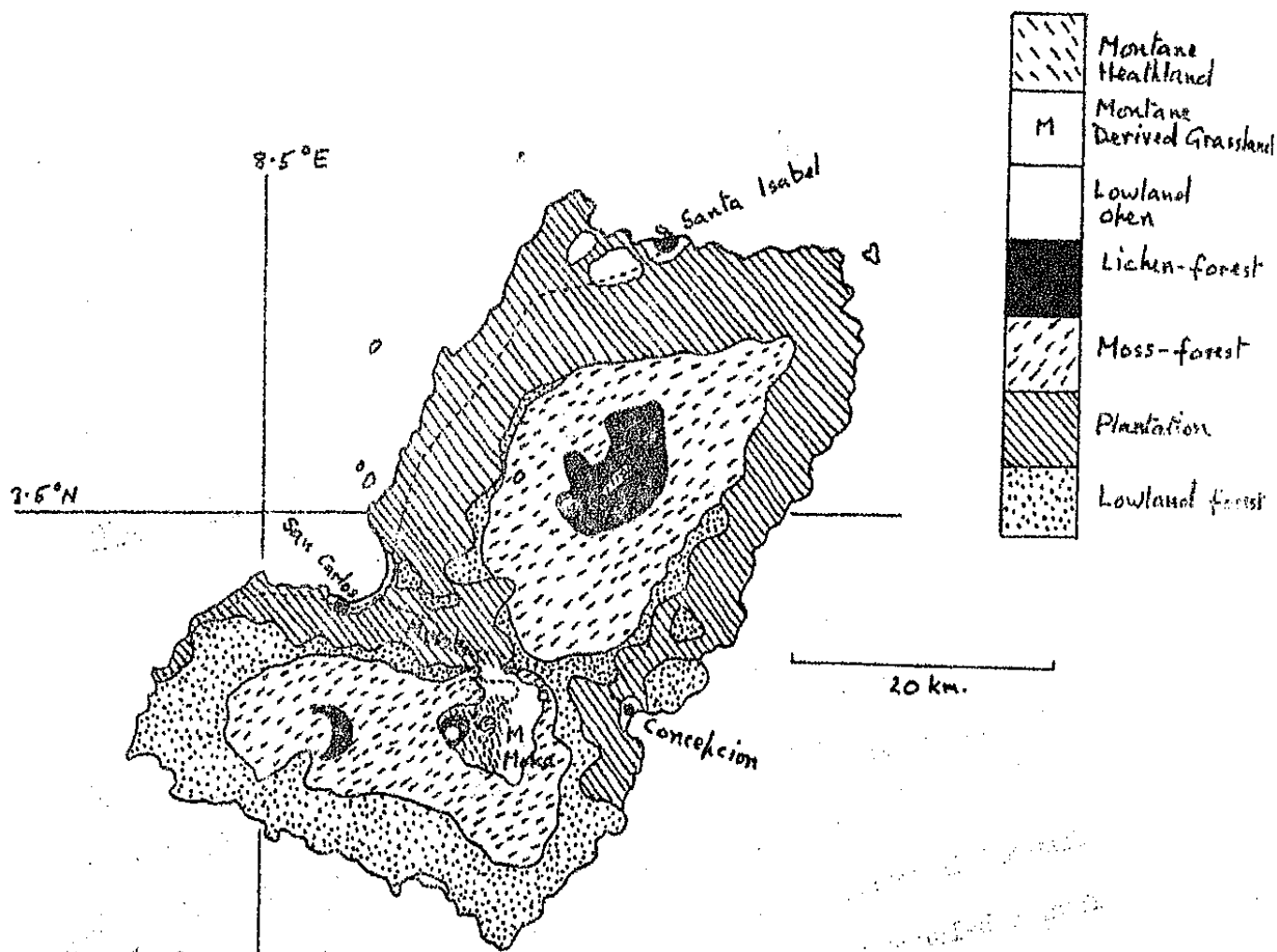


Figure 1 Sketch map of the main vegetation zones on Fernando Poo (in part from the Mapa Militar (1959)).

of 35 km. From a narrow coastal strip (widest in the north round Santa Isabel) the island is dominated by two mountain blocs, Pico S. Isabel in the north (3008 m.)<sup>1</sup> and the Moka-San Carlos highlands, with peaks at Biao crater (2009 m.) and San Carlos crater (2260 m.), in the south. The climax vegetation of all except the peak of S. Isabel and possibly parts of the Biao peak is tropical forest but with the exception of small areas on the west coast and the remote southern slope of the Moka-San Carlos highlands, which the 1959 map shows as forested to the shore, natural vegetation up to 750-800 m. a.s.l. has long been replaced by plantations. Undisturbed lowland forest could not be visited in the time available but most other major habitats were visited and are listed below:

<sup>1</sup> Heights according to the Mapa Militar, 1959 (Servicio Geografico del Ejercito).

(i) Lowland Open - a polyglot heading covering urban and village habitats; gardens and cultivation; lowland scrub, grassland and roadside verges; lowland open marsh and aquatic habitats; the shore.

(ii) Plantation - from sea level up to 750-800 m. On the lower slopes a cocoa/shade tree habitat (shade largely from a single, planted exotic but scattered lowland forest trees, Brythrina sp., Ceiba etc. survive as relics of the original vegetation). On the upper slopes cocoa gives way to coffee and bananas, with only scattered trees, and a dense herb layer.

(iii) Montane forest

a) Moss-forest zone - in all areas visited the montane forest started at around 800 m. a.s.l. and abutted on to plantation. Humid forest, in which medium-tall trees rapidly give way to smaller, characteristically gnarled, forms everywhere carrying abundant moss and epiphytes. On Pico S. Isabel it extends to c. 1900 m.; to a (?) similar altitude on the north slope of Pico San Carlos, and to the edge of derived montane grassland at av. 1200-1300 m. in the Moka region. Throughout the moss-forest pockets of high humidity (diurnal mist-belts, stream-courses etc.) are dominated by tree ferns. They form extensive stands above San Carlos and in the Moka region are present in many of the small moss-forest outliers of montane derived grassland.

b) Lichen-forest zone - comparatively dry and quite distinct in general aspect from moss-forest. There are relatively few tree species, and extensive areas of well-spaced trunks with broad, spreading crowns festooned in trailing lichens and club-mosses. Clearings dominated by bracken etc. are frequent and there is a dense forest understorey of a tall Mimulopsis sp. On Pico S. Isabel lichen-forest starts at c. 1900 m. and extends to the tree-line (at c. 2500 m. according to the map). It appears to cap the peak of San Carlos and in the Moka region it occurs in small forest outliers round the summit of Biao and extensively on the walls of the Biao crater. The boundary between moss- and lichen-forest zones may in part be related to the average annual altitude of the Inter-tropical Convergence Zone (ITCZ).

(iv) Montane heathland - natural montane heathland above the tree line on Pico S. Isabel could not be reached but the Moka highlands are largely open country and the top few hundred metres of Biao resemble natural heathland, with bracken, patches of low, lichen-covered scrub, brambles and a variety of montane flowers, notably Lobelia columnaris, a major nectar plant for the sunbird Cinnyris reichenowi. The rest of this area is a very recent derivative of cleared montane forest, is rather different in general aspect and is referred to here as montane derived grassland. A wide corridor of this grassland flanks the road down from Moka to meet the plantation and lowland open habitats.

#### Habitat range and faunal origin

The habitat range of all bird species for which data are available is summarised in Table 3. Observations made on the present trip are marked with an x and literatures references with an o. This table provides a

preliminary picture of the bird communities of the island though, with a limited number of observations, it was not possible to assess relative abundance either within or between zones. This means that vagrants and rare migrants have been included in communities on a par with commoner species - though some may represent either declining populations or future colonists (most are water birds or species of terrestrial lowland open habitats). Further, virtually nothing is known about seasonal vertical migration of resident species between zones, though this is unlikely to be of more than marginal significance in defining communities. In default of first-hand information, the community of the lowland forest is based (i) on direct published records and (ii) by inference, on 'probable faunal origin' (see below).

Communities have been analysed in terms of their faunal constituents by assigning each species a 'probable faunal origin', based on its major habitat(s) in West Africa. It is derived as far as possible from standard works of African ornithology, but is to some extent subjective. Particularly difficult to classify are those species that occur widely in both lowland and montane biomes (euryzone as opposed stenozone species by Eisentraut's 1963, 1965 classification). Since not all of these occur in all the mountain areas of Cameroun but all have a wide lowland distribution they have been classed as of probable lowland origin, but considering the apparent extent of the montane biome in Africa in the geologically recent past (Moreau 1966) it is not inconceivable that some had their origin in a montane environment.

Although the present classification is based on the probable immediate provenance of species as acquired by the island, these undifferentiated euryzone species remain of presumed lowland origin. But euryzone species that differentiated in a montane biome on the mainland and invaded as subspecifically distinct montane races are regarded as montane in origin. The following montane forms of euryzone species, Mesopicos (elliotti) johnstoni, Turdus libonyanus nigrilorum, Dyaphorophya (blissetti) ohalybea on the island all have identical parental stocks on Cameroun Mt. but Eisentraut (1963) points out that for past climatic reasons the corresponding lowland races, along with many lowland stenozone species, never reached Fernando Poo. A few species, Pogoniulus leucolaima, Symplectes amaurocephalus and Estrilda nonnula occupy a special position in that they are undifferentiated euryzones on the Cameroun mainland yet occur only in the mountains on Fernando Poo. On balance it seems more likely that they were derived from montane stocks and they may represent races in formation. Migrants to the island, both tropical and palaeartic, are classified according to their main habitat type in West Africa.

The abbreviations for faunal origin used in Table 3 are as follows:

lf = lowland forest.

lfe = lowland forest edge habitats and forest clearings.

li = lowland indeterminate: range covering both lowland forest and non-forest habitats.

lnf = lowland non-forest habitats

mf = montane forest

mfe = montane forest-edge habitats and forest clearings.

mi = montane indeterminate: range covering both montane forest and non-forest habitats.

mnf = montane heathland

The following abbreviations are used in the Notes column:

Pl = Plantation zone; MossF = Moss-forest; TF = Tree-fern; MDG = Montane derived grassland; MHL = Montane heathland. Question-mark records in the Habitat columns are conjectural and not included in the community totals; bracketed records are probables, but require confirmation. They have tentatively been included in the totals. Bird Nomenclature follows Bannerman (1953).

#### Composition and interaction of communities

##### Forest communities

A. Lowland Forest: as stated above the community list for this now restricted habitat is partly theoretical. 68 (lf) and 12 (lfe) species almost certainly inhabit (or recently inhabited) what is left of this zone and together constitute 92% of the community. 5 (li) species are provisionally included: the cuckoos Lamprolaima caprius and L. klaasi, 2 Palaearctic migrant warblers, Phylloscopus trochilus and P. sibilatrix, which typically penetrate at least forest-edge habitats, and the wagtail Motacilla clara. This is a torrent species recorded by Eisentraut (1968) along streams down through the forest to sea level at the south end of the island. Its classification as (li) is equivocal since although it is a euryzone species its range in lowland West Africa is restricted. One (mf) species, a forest floor thrush Cossypha insulana is reported from ? lowland forest by Eisentraut (1963), who also collected it at a low elevation on Cameroun Mt., but these records may represent wandering individuals.

B. Plantation: 18 indeterminate and non-forest species, many of which have penetrated clearings and the more open coffee areas along roads and access tracks account for 25% of the plantation community. The other 55 (75%) are forest derived forms and all except 2 are (lf) or (lfe) species, which have adapted to the cocoa-coffee and shade tree complex either in situ or, more likely, by reinvasion from lowland forest refugia. Since the shade trees of the very extensive plantations are planted exotics it is probable that the zone was at one time more open, and hence less acceptable to forest birds, than it is now.

Plantation can be regarded as an ecologically simplified lowland forest-edge habitat. Nonetheless, 65% of the total number of (lf) and (lfe) species recorded from Fernando Poo are known to occur in the habitat,

though predictably many of these occupy forest-edge as well as undisturbed forest habitats in their mainland ranges (31 of the 53 are, for example, listed by Elgood and Sibley (1964) from the forest edge at Ibadan, Nigeria). But at least the following 9 species, Psittacus erithacus, Chaetura cassini, Corythornis leucogaster, Galyptocichla serina, Batis poensis, Neocossyphus poensis, Apalis rufogularis, A. nigriceps and Nigrita fusconota which, according to the standard works, are typical of lowland undisturbed forest on the mainland have been recorded from plantation and some at least may have evolved a genuinely broader habitat tolerance under island conditions.

Only 3 montane species are known to occur in the plantation zone. There are isolated records of 2 (mf) estrildids; Nesocharis shelleyi reported from cocoa plantation at only 90m. a.s.l. by Amadon and Basilio (1957) and Cryptospiza reichenovii recorded by me in overgrown coffee plantation some 200m. below the edge of the montane forest. The roughwing swallow Psalidoprocne fuliginosa, which is basically an (mnf) species is, however, common in the more open coffee areas that border the montane forest and is probably the only montane species on the island that regularly enters the lowland biome. On the present trip it was not seen below 500-600m. and Basilio (1963) states that it is not found below 300m. If true this is odd in view of the fact that its only lowland hirundine competitor is Hirundo rustica, which is only a passage migrant. Moreau (1966) has suggested that in such situations swifts may occupy the lowland swallow feeding niche but Serle (1965) states that P. fuliginosa descends to sea level on the south slopes of Cameroun Mt., presumably sharing the aerial food resources with the same swift species that occur on Fernando Poo.

### C. Montane forest:

a) Moss-forest: this is the lower of the two montane forest zones. Floristically it is the more varied and it holds a bird community of 77 species,  $2\frac{1}{2}$  times larger than that of lichen-forest. Overlap with the plantation community is broad and 30 species are shared. Only 3 of these are of montane origin (see Plantation) and all the rest are (lf) or (lfe) species which have penetrated montane forest to varying extents. 15 additional (lf) and (lfe) species, Strix woodfordi, Turacus verreauxi, Corythaeola cristata, Smithornis sharpei, Illadopsis rufipennis, Macrosphenus flavicans, Trichophorus chloronotus, Pyrrhurus scandens, Phyllastrephus icterinus, Alseonax sethsmithi, Fraseria ocreata, Alethe castanea, A. poliocephala, Anthreptes fraseri and Mandingoa nitidula have been recorded in moss-forest but not in plantation and if these species have genuinely not adapted to plantation conditions montane populations, except at the south end of the island, are now largely isolated from their lowland range.

Lowland derived species penetrate montane forest for varying distances and while this group constitutes 56% of the moss-forest community at large, 24 of the 43 species involved actually do not occur

beyond the lower transition zone. Only 19 (or 25% of the community) reach the body of the moss-forest: Accipiter toussenelii, T. tympanistria, Vinago australis, Strix woodfordi, Bubo poensis, Psittacus erithacus (possibly a wanderer; a specimen collected at 1900m. by Wolff-Metternich), Turacus verreauxi, Corythaeola cristata, Chrysococcyx cupreus, Eurystomus gularis (according to Basilio 1963), Smithornis sharpei, Macrosphenus flavicans (possibly a wanderer to montane forest), Pyrhrurus scandens, (groups of 4-5 birds met with twice in one day on Pico San Carlos), Andropadus latirostris, Dyaphorophya castanea, Alethe castanea, A. poliocephala, Hylia prasina and the torrent-haunting euryzone wagtail Motacilla clara.

29 of the 34 montane species recorded in moss-forest are of (mf) or (mfe) origin (including 2 euryzone species, Pogoniulus leucolaima and Symplectes amaurocephalus - see p.74). 19 of these are shared with lichen-forest and Mesopicos johnstoni and Alseonax minimus were not, in fact, recorded much below the upper margin of the moss zone. Of the remaining 9, Heterotrogon vittatum, Campethera tullbergi, Dyaphorophya chalybea, Trochocercus albiventris, Seicercus herberti, Poliolais lopesi, Coracina caesia, Cyanomitra ursulae, Symplectes amaurocephala and Nesocharis shelleyi, the first 7 may be specific to this zone, but the list is tentative and little is known of the woodpecker, campephagid or sunbird. The 3 (mi) species Turdus libonyanus, Zosterops virens and Cinnyris reichenowi and the 2 (mf) species Psalidoprocne fuliginosa and Bradypterus lopesi are all widespread in the montane biome though Bradypterus was not recorded in moss-forest on the present trip.

b) Lichen-forest: lowland derived euryzone species penetrate to the limits of montane forest, but in reduced numbers and only 4, Vinago australis, Turacus verreauxi, Corythaeola cristata and Eurystomus gularis, are reported from the lichen forest zone. They constitute only 13% of the lichen-forest community as compared with 25% of the moss-forest community (lower transition zone species excluded), and if this element is deducted the two communities approach each other in size (see Table 1).

Habitat Faunal origin	Moss-forest		Lichen-forest
	lower edge	main	
lf + lfe	42	24	4
Other lowlands	1		0
mf + mfe	29		20
Other montanes	5		6
Montane totals	34		26

Table 1. Comparative importance of lowland euryzone species in the montane forest communities.



Qualitatively, the montane element of lichen-forest is little more than a slightly depauperate version of that of moss-forest. The only (mf/mfe) species possibly endemic to lichen-forest on the island is the babbler Illadopsis poliothorax, but this was not recorded on the present visit and it happens to be one of the 11 montane species regularly recorded down to the lower limit of montane forest on Cameroun Mt. by Serle (1965). The (mi) white-eye Speirops brunneus, a bird of the edges of forest clearings, almost certainly does not enter moss-forest but it does occur in montane heathland scrub beyond the tree-line on Pico S. Isabel. It has never been recorded on the southern mountains and unless it has become extinct there its absence suggests invasion and differentiation on the island post the last Pleistocene fluvial, after the N-S montane forests had separated. Bradypterus lopesi (mf) may only wander down into moss-forest but is fairly frequent in lichen-forest. It typically skulks in heathland bracken etc. and the Mimulopsis undergrowth, which forms a virtually continuous, dense understory in the lichen-, but not in the moss-zone, may provide an ecologically similar habitat.

#### Non-forest communities

A. Lowland Open: this habitat is of relatively small extent on Fernando Poo. It is largely man-made and, therefore, of comparatively recent origin and despite its polyglot nature it has a relatively small bird community (57 species). 41 (72% of the community) are (lnf) species and 22 of these (including 11 migrants), plus one (li) species, are shore-, water- or waterside birds, of habitats that have probably not been greatly altered by man. Conditions in lowland open terrestrial habitats have undoubtedly fluctuated. Probably no open country ever existed as a climax lowland environment but with clearance of the lowland forest for plantation agriculture the area available to non-forest invaders has varied and probably was previously greater than it is now. 19 terrestrial (lnf) species may occur in this habitat though the current status of some is obscure and there is evidence that populations of a few have undergone relatively rapid change.

As on other Gulf of Guinea Islands some non-forest species may have flourished under transiently favourable conditions but have subsequently declined or disappeared. Agapornis pullaria is recorded by Basilio (1963) but could not be found on the present visit; the savanna guineafowl Numida meleagris recorded (probably feral) by Eidemann (Amadon 1953) has almost certainly not survived; Quelea erythrops must now be very rare, if it has not already gone and there is evidence that the Vidua macroura population has drastically declined. Alexander (1903) found it common in both montane and lowland open areas; Basilio in his 1963 checklist states that it is regular in only a few localities round Santa Isabel and on the present visit it was only recorded once, when a small flock were located in the town. Why it should have declined is obscure since it thrives in

forest-edge areas in mainland West Africa and at least 2 recorded host estrildids are common on the island.<sup>1</sup>

3 (li) species are on record for the habitat: the finfoot Podica senegalensis, probably only as a vagrant; Motacilla clara which occurs round sub-coastal lagoons at the south end of the island (Eisentraut 1968) and the cuckoo Lampromorpha caprius which is universally common, even in Santa Isabel town, where it may parasitise the numerous Village Weaver colonies. The remaining 13 members of the community are (lf) and (lfe) species. 10 of these occur in edge habitats in their mainland ranges and one, the spintail swift Chaetura sabinii, is an aerial species that frequently hunts beyond forest but presumably must return to forest or to forest relics in plantation to nest (if not to roost). The bulbul Calyptocichla serina and the estrildid Nigrita fusconota may however, have extended their habitat tolerance to include semi-open areas (see also montane derived grassland). Several of the former were found in mango trees in coastal cassava gardens at Santa Isabel and the latter which, in Nigeria at least, is the only member of the genus not to penetrate forest edge habitats, was behaving as a confiding garden bird in the grounds of the town hospital.

B. Montane heathland: natural heathland above the tree-line on Pico S. Isabel could not be reached but the top few hundred metres of Pico Biao in the south have some of the floristic features of this habitat, though a lot of the montane grassland in the Moka region is derived and of recent origin. Clearance of montane forest along the Moka-San Carlos road has recently opened up a broad corridor of derived grassland connecting montane heathland, plantation and, via the road and numerous access tracks, lowland open habitats. From its general aspect and altitudinal relationship to montane forest this grassland corridor was included in the montane heathland category as a bird habitat, but its fauna proved to be quite different.

Of 27 species recorded specifically from the derived grassland corridor no less than 23 are of lowland origin. Moreover, 14 of these are (lf) or (lfe) species, most of which have penetrated along overgrown hedges that line the road. Many are among those lowland euryzone species that occur in montane forest (Chrysococcyx cupreus, Eurystomus gularis) or at least enter the lower transition zone of the moss-forest (Gypohierax angolensis, Ceuthmochares aereus, Melittophagus muelleri, Batis poensis, Tchitrea tricolor, Nigrita canicapilla and N. fusconota), but 4 species (Calyptocichla serina, Cameroptera chloronota, Chalcomitra rubescens and Anthreptes rectirostris), plus the (li) Lampromorpha caprius, were recorded nowhere else beyond the lowlands. Roadside hedgerows and relic forest trees bordering the grassland form relatively open habitats

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<sup>1</sup>The lowland open habitats may, nonetheless, be expected to receive most future invaders.

and, again, observations suggest that Calyptocichla, Nigrita fusconota and possibly Batis poensis have an extended habitat tolerance on the island.

The (lfe) estrildid Spermestes poensis, widespread in lowland open and plantation areas, is abundant in montane derived grassland and reaches well into the transition zone with natural heathland. In these montane areas it occurs in much more open and exposed habitats than are usual in its mainland range and it seems to occupy the niche of its (lnf) congener S. cucullatus which, though widespread in the lowlands, has yet to reach the montane biome (see also Fry 1961, Basilio 1963). Another (lnf) estrildid Estrilda astrild, however, is common well into montane heathland. Other (lnf) species recorded from the montane derived grassland corridor are Poliocephalus ruficollis (on crater lakes), Bubulcus ibis (previously known only from the lowlands but on the present visit recorded attending hill cattle), Coturnix delegorguei, Tringa ochropus, the swifts Colletoptera affinis, and Cypsiurus parvus (both only in the lower marginal area) and Corvus albus. A further 10 species: Hagedashia hagedash, Sarothrura elegans, Capella gallinago, Tringa glareola, Glottis stagnatalis, Tyto alba, Budytes flavus, Sylvia borin, Phylloscopus trochilus and Plesiositagra cucullatus are reported in the literature probably from this sub-habitat. Budytes at least is certain to occur but in the absence of direct confirmation this list has been excluded from the community total.

The montane element in the community is comparatively slight, and only 4 species were recorded, Psalidoprocne fuliginosa and Zosterops virens in the open areas, and Pogoniulus leucolaima and Symplectes amaurocephalus in hedgerows. The last two, which are montane representatives of euryzone species form the only obvious contribution of the montane forest to the grassland corridor community. There is also a marked distinction from the montane heathland community of Pico Biao and adjacent peaks in the Moka region. Of the 14 (lf) and (lfe) species that occur in derived grassland only 2 (Gypohierax angolensis and Spermestes poensis) cross the transition zone (above c. 1200-1300m.) into heathland, and the latter does not penetrate far. Three other (lf) species, Accipiter toussenelii, Vinago australis and Turacus verreauxi, which were not recorded in the derived grassland corridor, also occur. The last two at least are euryzone species which penetrate to the limit of montane forest and their presence in heathland, largely in association with forest outliers and patches of scrub, may be a relic of former continuous forest cover.

Against this total 5 lowland forest derivatives the following 10 (mf) and (mfe) species occur in the heathland habitat: Columba arquatrix (one record of a bird in display flight high over Pico Biao), Pseudoalcippe abyssinicus, Arizelocichla tephrolaema, Alseonax minimus, Urolais epichlora (one record), Onychognathus walleri, Cyanomitra oritis, Linurgus olivaceus, Heterophantes melanogaster, and Cryptospiza reichenovii.

Nearly all were found in more or less close association with forest outliers and scrub and their presence may also be a relic of former more continuous forest cover. But the montane indeterminates Turdus libonyanus, Zosterops virens and Cinnyris reichenowi (probably the commonest bird in the community) were widespread over open areas as well - Zosterops was found nesting in an exposed bush on the peak of Biao and Cinnyris was everywhere feeding on the flowers of Lobelia columnaris. The (mi) endemic Speirops brunneus is reported from heathland scrub on Pico S. Isabel.

Non-forest elements are more evenly balanced. 5 (lnf) species, Poliiocephalus ruficollis, Budytes flavus, Corvus albus and Estrilda astrild, plus Anthus trivialis recently recorded in (?) this habitat by Eisentraut (1968), cross into heathland though Budytes and Estrilda were not recorded above c. 1600m. (no observed altitudinal overlap between the ranges of Estrilda astrild and the (mnf) E. nonnula). 5 (mnf) species, Saxicola torquata, Bradypterus lopesi, Psalidoprocne fuliginosa, Euplectes capensis and Estrilda nonnula occur though Saxicola, Euplectes and Estrilda nonnula are the only species exclusive to heathland and of these Euplectes is probably a relative newcomer to the island (Amadon and Basilio 1957) since apparently it does not occur on Pico S. Isabel (but the point needs checking). In the Moka area both Euplectes and Estrilda seem to be confined to the region above 1600-1700m. and the latter was found to be common only on the summits.

Clearly, therefore, the derived grassland corridor and natural heathland communities cannot be lumped. Despite its altitudinal relationship to montane forest the derived grassland community is not montane since lowland derived elements constitute at least 85% of the species total (against only 37% of the heathland total) and the number of montane species known to occur in the habitat is hardly more than has been recorded in the plantation zone. The immediate source of the adaptable lowland derived euryzone species that have colonised derived grassland hedgerows is, however, difficult to pinpoint but the presence of both lowland stenozone species and the 2 montane forest forms suggests that both plantation and at least the lower transition zone of montane forest have contributed. Against this broad upward colonisation there has been virtually no downward colonisation from natural heathland and the only species that could conceivably have been derived from this habitat are Psalidoprocne fuliginosa (mnf) and Zosterops virens (mi).

While the derived grassland corridor community has been colonised primarily by species derived from lowland forest and lowland forest edge habitats montane heathland is dominated by montane forest and forest edge species. Its link with other communities is almost exclusively through upward penetration of lowland forms via the road and derived grassland corridor, or by overflying (all altitudinal zones are probably within the individual daily flight range of strong flying species such as Gypohierax and Corvus).

Summary

Each species is given a faunal origin designation which indicates as far as possible the most probable habitat community from which its stock invaded Fernando Poo. Analysis of the present habitat communities of the island in terms of this species designation (summary in Table 2) indicates the interrelation between communities and suggests how they have been built up.

Faunal origin	Lowland open	Lowland forest	Plantation	Moss forest	Lichen forest	Mont.deriv. grassland	Montane heathl.
lf	5(9)	68(78)	42(58)	37(48)	4(13)	9(33)	3(13)
lfe	8(14)	12(14)	11(14)	5(7)	-	5(19)	2(7)
lnf	41(72)	-	13(18)	-	-	8(30)	5(17)
li	3(5)	5(6)	4(5)	1(1)	-	1(4)	-
mf	-	1(1)	2(3)	28(36)	19(63)	2(7)	9(31)
mfe	-	-	-	1(1)	1(3)	-	1(3)
mnf	-	-	1(1)	2(3)	2(7)	1(4)	5(17)
mi	-	-	-	3(4)	4(13)	1(4)	4(15)
Species totals	57	86	73	77	30	27(?+10)	29

Table 2. The faunal components of bird communities on Fernando Poo. The left-hand figure is the number of species and the figure in parentheses this number as a percent. of the community total.

The broad pattern of interaction between communities that replace each other altitudinally is everywhere similar; a major upward invasion from communities below but little or no countering downward invasion from above (summary in Figure 2). This is true between the lowland and montane biomes (lowland forest/plantation  $\rightleftharpoons$  montane forest; plantation  $\rightleftharpoons$  montane derived grassland) and also within the montane biome (montane derived

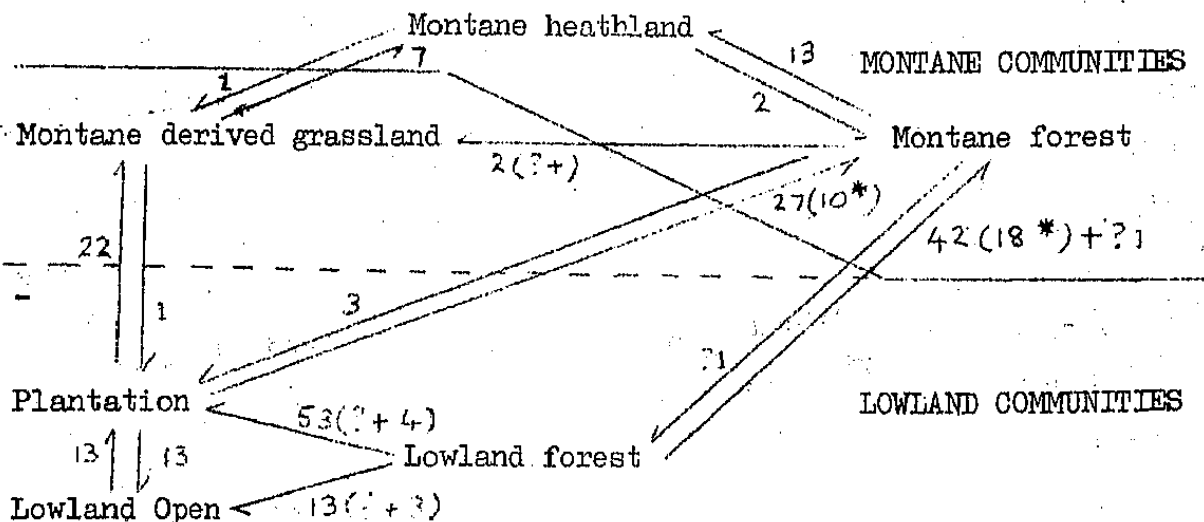


Figure 2. The interrelation of habitat communities on Fernando Poo

\* excluding lowland species that reach only the montane transition zone.

grassland ~~to~~ montane heathland; montane forest  $\Rightarrow$  montane heathland). In both lowland and montane biomes the original forest habitats have been (? are) an important source of inter-communal colonists.

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Table 1. Habitat range of bird species on Fernando Poo

SPECIES	HABITATS						NOTES
	Lowland open	Plantation	Lowland forest	Moss-forest	Lichen-forest	Montane heathland	
<i>Poliocephalus ruficollis</i>	o					o	lnf
<i>Phalacrocorax africanus</i>	o						lnf
<i>Anhinga rufa</i>	o						lnf
<i>Egretta garzetta</i>	o						lnf
<i>Demigretta gularis</i>	o						lnf
<i>Bubulcus ibis</i>	x					x	lnf MDG only
<i>Ardeola ralloides</i>	o						lnf
<i>Butorides striatus</i>	o						lnf
<i>Hagedashia hagedash</i>	o					o	lnf
<i>Pseudogyps africanus</i>	o						lnf
<i>Falco peregrinus</i>	x						lnf
<i>Milvus migrans</i>	o						lnf
<i>Pernis apivorus</i>			(o)				lf
<i>Gypohierax angolensis</i>	x	x	o	x		x	lfe
<i>Accipiter toussenelii</i>		x	o	x		x	lf
<i>Coturnix delegorguei</i>						o	lnf MDG only
<i>(Numida meleagris)</i>	?	?					lnf Feral ? extinct
<i>Crecopsis egregia</i>	o						lnf
<i>Sarothrura elegans</i>		o				o	lfe
<i>Porphyryla alleni</i>	o						lnf
<i>Gallinula angulata</i>	o						lnf
<i>Podica senegalensis</i>	o						li
<i>Charadrius hiaticula</i>	o						lnf
<i>C. dubius</i>	o						lnf
<i>Squatarola squatarola</i>	o						lnf
<i>Capella gallinago</i>						o	lnf
<i>Actitis hypoleucos</i>	x						lnf
<i>Tringa ochropus</i>						x	lnf
<i>T. glareola</i>						o	lnf
<i>T. totanus</i>	o						lnf
<i>Glottis nebularia</i>	o						lnf
<i>G. stagnatalis</i>						o	lnf
<i>Numenius phaeopus</i>	o						lnf
<i>Chlidonias nigra</i>	(o)						lnf
<i>C. leucopareia</i>	(o)						lnf
<i>Columba arquatrix</i>				x	x	x	mf
<i>Streptopelia semitorquata</i>		x					lnf
<i>Tympanistria tympanistria</i>	x	x	o	x			lf
<i>Turtur afer</i>		x	(o)	x			lfe
<i>Aplopelia simplex</i>				x	x		mf
<i>Vinago australis</i>		o	(o)	x	x	x	lf
<i>Psittacus erithacus</i>		o	o	o			lf 1 montane record
<i>Agapornis pullaria</i>	o	o					lnf
<i>Tyto alba</i>	o					o	lnf
<i>Strix woodfordi</i>			o	o			lf
<i>Bubo poensis</i>		o	o	x			lf
<i>(Turacus persa)</i>			?				lf
<i>T. verreauxi</i>			o	x	x	x	lf
<i>Corythaeola cristata</i>			o	x	x		lf
<i>Cuculus solitarius</i>		x	o				lf
<i>Chrysococcyx cupreus</i>		x	o	x		x	lf only MDG hedgerows
<i>Lampromorpha caprius</i>	x	x	(o)			x	li only MDG hedgerows
<i>L. klaasi</i>		x	(o)				li
<i>Ceuthmochares aereus</i>		x	o	x		x	lf only lower margin MossF; MDG hedgerows

	Lowland open	Plantation	Lowland forest	Moss-forest	Lichen-forest	Montane heathland	Faunal origin	
Caprimulgus (nigriscapularis)						(o)	lfe	? habitat
Cosmetornis vexillarius						(o)	lnf	
Micropus sladeniae	o						lnf	
M. unicolor		x					lnf	
Colletoptera affinis	x	x				x	lnf	only lower margin MDG
Cypsiurus parvus	x	x				o	lnf	MDG only
Chaetura cassini		x	o				lf	
C. sabini	x	x	o				lf	
Eurystomus gularis		x	o	o	o	x	lf	MDG only
Ceryle rudis	o						lnf	
Megaceryle maxima	(o)						lnf	
Corythornis leucogaster		o	o				lf	
Halcyon senegalensis	o	o					lnf	
H. badius			o				lf	
(H. malimbicus)							lf	occurrence dubious
Melittophagus muelleri		x	o	x		x	lfe	only MDG margins; lower margin MossF
Ceratogymna atrata			o				lf	
Heterotrogon vittatum				x			mf	
Pogoniulus leucolaima				x	x	x	mf	only MDG hedgerows
P. subsulphureus		x	o	o			lf	only lower margin MossF
P. scolopaceus		x	o	x			lf	only lower margin MossF
Indicator exilis			o				lf	
Campethera nivosa		x	o				lf	
C. tullbergi				o			mf	
Mesopicos johnstoni				x	x		mf	only upper margin MossF
Smithornis sharpei			o	o			lf	
Anthus trivialis						o	lnf	
Motacilla clara	o		o	o			li	
Budytes flavus	x	x				x	lnf	
Illadopsis rufipennis			o	x			lf	only lower margin MossF
I. poliothorax					o		mf	
I. cleaveri			o				lf	
Pseudoalcippe abyssinicus				x	x	x	mf	
Macrosphenus flavicans			o	o			lf	
M. concolor			o				lf	
Trichophorus chloronotus			o	x			lf	only lower margin MossF
Bleda eximia			o				lf	
Pyrrhurus scandens			(o)	x			lf	new for the island, but sight records only
Phyllastrephus poensis				o	o		mf	
P. icterinus			o	x			lf	only lower margin MossF
Calyptocichla serina	x	(o)	o			x	lf	only MDG hedgerows
Arizelocichla tephrolaema				x	x	x	mf	
Andropadus curvirostris		o	o				lf	
A. gracilirostris		o	o				lf	
A. latirostris		x	o	x			lf	
A. virens		x	o	x			lf	only lower margin MossF
Muscicapa striata	(o)						lnf	
Alseonax minimus				x	x	x	mf	only upper margin MossF
A. sethsmithi			o	x			lf	only lower margin MossF
Fraseria ocreata			o	o			lf	
Stizorhina fraseri		x	o	x			lf	only lower margin MossF
Megabyas flammulatus			o				lf	
Batis poensis		x	o	x		x	lf	only lower margin MossF; MDG hedgerows
Dyaphorophya castanea		x	o	x			lf	
D. chalybea				x			mf	
Trochocercus albiventris				x			mf	
Tchitrea tricolor		x	o	x		x	lf	only MDG hedgerows; lower margin MossF
Turdus libonyanus				x	x	x	mi	
Neocossyphus poensis		x	o				lf	
Saxicola torquata						x	mnf	



	Lowland open	Plantation	Lowland forest	Moss-forest	Lichen-forest	Montane heathland	Pannal origin	
<i>Cossypha insulana</i>			(o)	x	x		mf	
<i>Cossyphicula roberti</i>				x	o		mf	
<i>Stiphornis erythrothorax</i>		x	o				lf	
<i>Alethe castanea</i>			o	x			lf	
<i>A. poliocephala</i>			o	x			lf	
<i>Sylvia borin</i>						o	lnf	
<i>Phylloscopus trochilus</i>		x	(o)			o	li	
<i>P. sibilatrix</i>		o	(o)				li	
<i>Seicercus herberti</i>				x			mf	
<i>Bradypterus lopezi</i>				o	x	x	mnf	
<i>Calamoceter rufescens</i>	o	(o)					lnf	
<i>Apalis rufogularis</i>		x	o	x			lf	only lower margin MossF
<i>A. cinerea</i>				o	o		mf	
<i>A. nigriceps</i>		x	o	x			lf	only lower margin MossF
<i>Urolais epichlora</i>				x	x	x	mf	only MHL hedgerows, (?) forest outliers
<i>Eremomela badiiceps</i>		x	o				lf	
<i>Poliolais lopezi</i>				x			mf	commonest in TF stands
<i>Camaroptera chloronota</i>		x	o			x	lf	only MDG hedgerows
<i>C. superciliaris</i>		x	o				lf	
<i>Hirundo rustica</i>	o						lnf	
<i>Psalidoprocne fuliginosa</i>		x		x	x	x	mnf	only upper slopes Pl
<i>Coracina caesia</i>				o			mf	
<i>Dicrurus modestus</i>		x	o				lf	
<i>Laniarius poensis</i>				x	x		mf	
<i>Oriolus oriolus</i>							li	? habitat
<i>O. nigripennis</i>			o				lf	Oriole call heard in MossF ? this species
<i>Corvus albus</i>	x	x				x	lnf	
<i>Lamprocolius splendidus</i>		x	o				lf	
<i>Onychognathus fulgidus</i>	x	x	(o)				lfe	
<i>O. walleri</i>				x	x	x	mf	forest outliers in MHL
<i>Poeyptera lugubris</i>			o				lf	
<i>Zosterops virens</i>				x	x	x	mi	
<i>Speirops brunneus</i>					x	o	mi	MHL scrub
<i>Cinnyris reichenowi</i>				x	x	x	mi	
<i>C. chloropygius</i>	x	x	o				lfe	
<i>C. minullus</i>			o				lfe	
<i>Chalcomitra rubescens</i>	x	x	o			x	lfe	only MDG hedgerows
<i>C. ursulae</i>				x			mf	
<i>Cyanomitra oritis</i>				x	x	x	mf	forest outliers in MHL
<i>C. cyanolaema</i>		o	o	x			lf	only lower margin MossF
<i>C. olivacea</i>	o	x	o	x			lf	only lower margin MossF
<i>C. batesi</i>			(o)				lf	
<i>Anthreptes collaris</i>	x	x	o	x			lfe	only lower margin MossF
<i>A. rectirostris</i>		x	o			x	lfe	only lower margin MDG
<i>A. fraseri</i>			o	x			lf	only lower margin MossF
<i>A. seimundi</i>		(x)	o				lf	ident. tentative
<i>Hyllia prasina</i>		x	o	x			lf	
<i>Linurgus olivaceus</i>				x	x	x	mfe	
<i>Passer griseus</i>	x	x					lnf	
<i>Symplectes amaurocephalus</i>				x		x	mf	only MDG hedgerows
<i>Phormoplectes insignis</i>				o	o		mf	
<i>Heterophantes melanogaster</i>				x	x	x	mf	only forest outliers and hedgerows in MHL
<i>Melanopteryx albinucha</i>		x	o				lf	
<i>Plesiositagra cucullatus</i>	x	x				o	lnf	
<i>Hyphanturgus brachypterus</i>	x	x	o			x	lfe	only MDG hedgerows
<i>Malimbus rubricollis</i>		x	o				lf	
<i>(Quelea erythropis)</i>	?						lnf	? extinct
<i>Euplectes capensis</i>						x	mnf	MHL above c. 1600 m.

	Lowland open	Plantation	Lowland forest	Moss-forest	Lichen-forest	Montane heathland	Faunal origin	
<i>Spermestes cucullatus</i>	x	x					lnf	
<i>S. poensis</i>	x	x	(o)			x	lfe	
<i>Pholidornis rushiae</i>			o				lf	
<i>Nigrita canicapilla</i>		x	o	x		x	lf	only lower margin MossF; MDG hedgerows
<i>N. luteifrons</i>		x	o				lf	
<i>N. fusconota</i>	x	x	o	x		x	lf	only lower margin MossF; MDG hedgerows
<i>Cryptospiza reichenovii</i>		x		x	x	x	mf	upper slopes Pl
<i>Mandingoa nitidula</i>	o		(o)	x			lfe	only lower margin MossF
<i>Estrilda astrild</i>	x	x				x	lnf	MHL not over 1600m.
<i>E. nonnula</i>						x	mnf	MHL below 1700m.
<i>Nesocharis shelleyi</i>		o		o			mf	
<i>Vidua macroura</i>	x						lnf	1 flock in S. Isabel town only
Community totals	57	73	86	77	30	60		

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