

The Selection of Forest Plants As Feed Resources and Nesting Site of Dwarf Cuscus (*Strigocuscus celebensis*) and Nutrient Analysis in Wawonii Island, South-East Sulawesi

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ABSTRAK

Pemilihan Tumbuhan Hutan Sebagai Sumber Pakan dan Tempat Bersarang Kuskus kerdil (*Strigocuscus celebensis*) dan Analisa Nutrien di Pulau Wawoni, Sulawesi Tenggara. A study on feed plants selection and nesting site of dwarf cuscus (*Strigocuscus celebensis*) was conducted in Wawonii Island, South-East Sulawesi. The study was done in the lowland forest with the altitude of 1 - 200 m a.s.l. The results showed 45 species of plants consisting of 23 families was selected by dwarf cuscus as their feed resources and 11 species of plants as their nesting site. Parts of the feed plants being consumed were fruit, young leaves, flower, and topmost of trunk.

Keywords: Forest plant, feed resources, nesting site, *Strigocuscus celebensis* Wawonii Island

INTRODUCTION

Wawonii Island is an island included in District Kendari, a regency in the Province of South-East Sulawesi, located at 4° 08' S and 123° 06' E with the areas of 650 km². The forest in Wawonii Island is generally rain forest with the topography of lowland and hilly in the part of hinterland. The type of weather is D which is categorized as not too wet and dry, and the annual rainfall is approximately 1.600 mm. The rainy season happens during 4 to 6 months with the top happens in March while the top of dry season in August.

In 1995 this island is planned to be the plantation of cocoa, however, after the opening of a part of the forest, the

plantation is never developed (Anonymous 2000). The forest area in Wawonii Island is differentiated by several zones, namely protected forest located in the mid part of this island, production forest, limited production forest, and people production forest. The information about the biodiversity of Wawonii Island is still not unavailable hence that an exploration is needed.

Sulawesi defines the western most range of cuscus distribution, no cuscus are found across Wallace's line. Two species occur in Sulawesi: The Bear cuscus (*Ailurops ursinus*), the largest and most primitive of all cuscus, and Dwarf cuscus (*Strigocuscus celebensis*), which curiously represents the smallest and possibly most advanced

cuscus species. Dwarf cuscus or locally called “tongali” is a marsupial or pouched mammals which is endemic in Sulawesi and islands nearby, like Wawonii Island, and included in the family of Phalangeridae. In the East Indonesia, such as in Papua, Maluku and North Sulawesi, this cuscus is hunted for its meat, fur, and teeth by the local people. Habitat damage, hunting, catching, and trading which are uncontrollable can threaten the existence of this animal in its habitat. Nowadays, the family of Phalangeridae are already categorized as endangered and vulnerable. A big part of this family is legally protected and included in Appendix II of CITES (Baillie & Groombridge 1996).

The opening of forest and the activity of shifting cultivation still happened in Wawonii Island that can threaten the existence of wild animal and the availability of forest plants as feed resources. The intact of the habitat of dwarf cuscus and the existence of plant forests as feed resources for this animal are crucial and need to be preserved. This action is need for guaranteeing the existence of this animal in its habitat

The aim of this research was to collect data of the diversity of forest plants as feed resources and nesting site for dwarf cuscus (*Strigocuscus celebensis*), and to monitor its habitat condition and analysis of nutrient content

MATERIALS AND METHODS

Three weeks survey to Wawonii Island in Kabupaten Kendari, a regency in South East Sulawesi Province.

Surveyed selected based on the report of local people, and the researchers have observed the diversity of forest plants as feed resources and nesting site and the habitat condition of dwarf cuscus. Every tree found as feed resources and temporary nesting site is measured its height and diameter (at the chest height), then, is taken the samples of its trunk, branch, leaf, flower, and fruit. The samples are placed between used newspaper, moistened by methylated spirit as preservative, and arranged in orderly way. The identification of the forest plants, then, is conducted in Herbarium Bogoriense/Botanic Division, Research Centre for Biology, Indonesian Institute of Sciences (LIPI), Cibinong.

The plant samples in the form of leaves, fruit, and flowers are collected as many as possible and kept in plastic bag. In the base camp, the samples were dried under the sun for 1 - 2 days to avoid decaying until sun dried weight were achieved. The fruit collected is cut to small pieces to accelerate the drying process. In the Laboratory of Nutrition Testing at the Zoology Division, Research Center for Biology - LIPI in Cibinong, all the leaf samples were oven dried at 60°C for 12 hours and 18 hours for fruit samples. The dried samples were milled and analyzed (proximate analysis) of its nutrient contents based by Harris' method (1970).

For identification purposes, cuscuses captured in the west part of Wawonii Island were recorded their morphometry data, such as size of body's parts and weight. Their photographs were taken, and their features/characteristics also

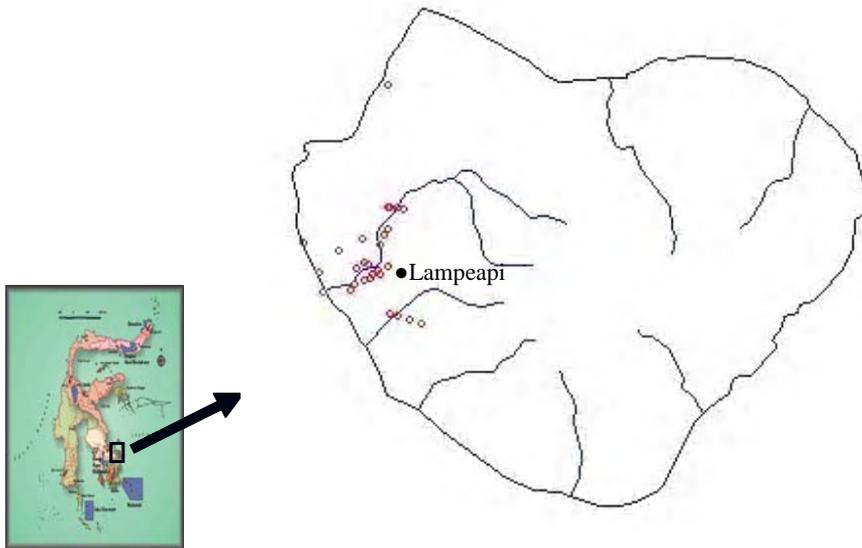


Figure 1. Study site Dwarf Cuscus (*Strigocuscus celebensis*)

noted. After all of these done, the cuscuses were released into the forest.

RESULTS

The survey found 11 types of trees selected by cuscus as temporary nesting site (Appendix 1). Based on interview of local people from west part of Wawonii Island, it is known that there is no hunting activity toward cuscus nowadays in that area, and there is no special or certain using of this animal for meat, fur, or teeth. This condition caused by the fact that Wawonii people can meet their need by the result of their field. Beside, almost all people in Wawonii Island are moslem: forbidden to eat the meat of cuscus and use parts of its body.

For local people, cuscus is only the animal often eating coconut on the

coconut tree owned by people and frightened by people for its sharp claws. Sometimes children accidentally captured a cuscus entering their unirrigated agricultural field. They keep that animal for several days before letting it leaving for the forest. In this island, the life of dwarf cuscus is still safe, its existence is not threaten yet.

People often find female cuscus with its young in between the sheath of sago palm tree when they are cutting the tree. They also often meet cuscus on onii tree (*Cocos nucifera*) because that animal likes young coconut fruit and eats the fruit by making holes on it. Cuscus generally selects its nesting site on the trees grown by creeping plants or on the trees grows side by side with other plant which is also feed resources for this animal. The condition of the forest,

Table 1. The List of Forest Plants as Temporary Nesting Site (Habitat)

No.	Scientific Name	Species	Local Name	Height (m)	Nest height (m)
1.	<i>Metroxylon sagu</i> Rottb.	Arecaceae	Sagu	12	8
2.	<i>Kleinhovia hospita</i> L.	Asteraceae	Tokulo		
3.	<i>Agathis alba</i> Foxw.	Pinaceae	Tantantulo	51	37
4.	<i>Syzygium discophorum</i> (K.&V.) Amsh.	Myrtaceae	Tombena +	34	15
	<i>Dalbergia rostrata</i> Hassk.	Fabaceae	Oyolabu	Climbing	
5.	<i>Syzygium acuminatissima</i> (Bl.) Merr. & Perry	Myrtaceae	Baru-baru	20	8
6.	<i>Tristaniopsis</i> sp.	Myrtaceae	Kolaka +	54	48
	<i>Drynaria sparsisora</i> (Desv.) T.Moore	Polypodiaceae	Kokapi +	Paku epifit	
	<i>Spatholobus ferrugineus</i> Benth.	Fabaceae	Tadandoke	Climbing	
7.	<i>Dillenia ovalifolia</i> Hoogl.	Dilleniaceae	Sangi +	12	10
	<i>Stenochlaena pallustris</i> (Binn.) Bedd.	Pteridaceae	Taribala	Climbing	
8.	<i>Artocarpus elasticus</i> Reinw. Ex Bl.	Moraceae	Teo	42	37
9.	<i>Lansium domesticum</i> Corr.	Meliaceae	Bebuno		
10.	<i>Dracontomelon dao</i> (Blanco) Merr. & Rolfe	Anacardiaceae	Rau	52	45
11.	<i>Cocos nucifera</i> L.	Arecaceae	Onii	29	26

including the habitat of cuscus, in the west part of Wawonii Island is still good enough. However, people have to walk 4-5 km to reach primary or secondary forest, because most of forests surrounding villages have been exploited as un-irrigated agricultural field with variety of plants such as cocoa, nutmeg, coconut, coffee, cashew nut, pepper, and cassava. There is a concern about the existence of the forest here due to the people's habit in shifting cultivation. This habit may drive people to open land for un-irrigated agricultural field. In the long time, this activity will penetrate secondary or primary forest, and in turn may threaten the existence of flora and fauna.

45 species of forest plants known as feed resources for dwarf cuscus have

been identified. All of them are grouped into 23 families (Table 2). Parts of plant eaten by cuscus are young leaves, flower, fruit, and innermost part of trunks (*umbut kayu*).

Analysis of nutrient content or proximate analysis divides feed into 6 fraction of feed substance, namely water, ash, protein, fat (ether extract), crude fiber, and extract material without nitrogen (McDonald *et al.* 1995). Analysis results of nutrient content of forest plants as feed resources for cuscus shown in Table 3.

DISCUSSION

By comparing the morphometry data of cuscuses captured from forest to

The Selection Of Forest Plants As Feed Resources and Nesting Site

Table 2. The List of Forest Plants as Feed Resources for Dwarf Cuscus

No	Scientific Name	Family	Local Name	Parts of Plant Eaten
1.	<i>Spondias dulcis</i> Soland. ex Forster	Anacardiaceae	Kadondo	Leaf, fruit
2.	<i>Spondias cytherea</i> Sonnerat		Olo	Leaf, fruit
3.	<i>Anacardium occidentale</i> L		Dambu mente	Fruit
4.	<i>Dracontomelon dao</i> (Blanco) Merr. & Rolfe		Rau	Fruit
5.	<i>Mangifera indica</i> L		Pongima/Pomanggasa	Fruit
6.	<i>Goniothalamus macrophyllus</i> Hook.f. & Thomson	Annonaceae	Keubenu	Fruit
7.	<i>Areca vestiaria</i> Giseke	Arecaceae	Kampu	Flower, fruit
8.	<i>Gronophyllum kjellbergii</i> Burret		Episi	Flower, fruit
9.	<i>Cocos nucifera</i> L		Onii	Fruit
10.	<i>Garcinia rigida</i> Miq.	Clusiaceae	Mandula	Leaf
11.	<i>Garcinia</i> sp.		Pangindalo	Fruit
12.	<i>Garcinia celebica</i> (Burm.) L		Buno	Fruit
13.	<i>Dillenia ovalifolia</i> Hoogl.	Dilleniaceae	Sangi	Fruit
14.	<i>Baccaurea racemosa</i> Muell.Arg.	Euphorbiaceae	Ahi	Fruit
15.	<i>Drypetes longifolia</i> Pax et Hoffm		Kaloba	Fruit
16.	<i>Catimbum malaccense</i> (Burm.f.) Holtt.	Fabaceae	Panamoloku	Flower, fruit
17.	<i>Dalbergia rostrata</i> Hassk.		Oyolabu	Fruit
18.	<i>Castanopsis buruana</i> Miq.	Fagaceae	Eha	Fruit
19.	<i>Barringtonia reticulata</i> (Bl.) Miq	Lecythidaceae	Putu	Leaf, flower, fruit
20.	<i>Dracaena angustifolia</i> Bak	Liliaceae	Tando	Fruit
21.	<i>Melastoma malabathricum</i> L.	Melastomataceae	Orodu	Flower, fruit
22.	<i>Lansium domesticum</i> Corr.	Meliaceae	Bebuno	Fruit
23.	<i>Xylocarpus granatum</i> D. Koenig		Kontawu	Fruit
24.	<i>Parartocarpus</i> v. nenusus	Moraceae	Kadai-dai	Fruit
25.	<i>Artocarpus heterophyllus</i> Lmk.		Dai	Fruit
26.	<i>Artocarpus elasticus</i> Reinw. ex Bl.		Teo	Fruit
27.	<i>Artocarpus elasticus</i> Reinw. ex Bl.		Tipulu	Fruit
28.	<i>Syzygium malaccense</i> (L.) Merr.	Myrtaceae	Mongupa	Leaf, fruit
29.	<i>Syzygium bantaamense</i> Merrill		Ruruhi putih/merah	Leaf, fruit
30.	<i>Knema cinerea</i> (Poir.) warb.	Myristicaceae	Keurea	Fruit
31.	<i>Averrhoa bilimbi</i> L.	Oxalidaceae	Takule	Fruit
32.	<i>Pandanus tectorius</i> Parkinson ex Z.	Pandanaceae	Tole	Fruit
33.	<i>Passiflora foetida</i> L.	Passifloraceae	Pate-patele	Fruit
34.	<i>Citrus macroptera</i> Mautz	Rutaceae	Lemo sungka	Fruit
35.	<i>Citrus nobilis</i> Laour		Lemo sina	Fruit
36.	<i>Citrus medica</i> L.		Lemo waranga	Fruit
37.	<i>Citrus maxima</i> Linn.		Lemo kina	Fruit
38.	<i>Citrus</i> sp.1		Lemo walanda	Fruit
39.	<i>Citrus</i> sp.2		Lemo sari	Fruit

No	Scientific Name	Family	Local Name	Parts of Plant Eaten
40.	<i>Pometia pinnata</i> J.R. & G. Forster	Sapindaceae	Kase	Fruit
41.	<i>Sonneratia alba</i> J.E. Smith	Sonneratiaceae	Padada	Fruit
42.	<i>Theobroma cacao</i> L.	Sterculiaceae	Sokolati	Fruit
43.	<i>Nicolaia speciosa</i> Horan	Zingiberaceae	Sikala	Flower, fruit
44.	<i>Etilingera punicea</i> (Roxb.) R.M. Sm.		Daru	Fruit, topmost of trunk
45.	<i>Etilingera</i> sp.		Kondupi	Fruit

those of cuscus' specimen in the Zoology Division, Research Centre for Biology – LIPI, and observing features/characteristics and body's size of them, we confirm that cuscus living in Wawonii Island are *Strigocuscus celebensis* or dwarf cuscus which is endemic for Sulawesi and islands nearby (Flannery 1995).

It is known from survey that dwarf cuscus in lowland forest in Wawonii Island make nests in between sheath of sago palm tree (*Metroxylon sagu*), and tall trees growing side by side or trees grown by fern such as kokapi (*Drynaria sparsisora*), creeping plants such as tadandoke (*Spatholobus ferrugineus*), oyolabu (*Dalbergia rostrata*), and taribala (*Satenochlaena palustris*). The trees selected by cuscus as its temporary nesting site or habitat are tokulo (*Kleinhovia hospita* L.), kolaka (*Tristaniopsis* sp.), and sangi (*Dillenia ovalifolia*), and also holes on the trunks of the trees like Tantulo (*Agathis alba*), Tombena (*Syzygium discophorum*) and baru-baru (*Syzygium acuminastissima*).

Nesting site of cuscus is a place in between branches and built from leaves as both floor and roof which is used as a temporary place for taking a rest and

hiding, especially in the day time. As reported by Farida *et al.* (1999), cuscus chooses its nesting site generally on trees grown by creeping plants or on trees grow side by side with other trees which their fruit or flowers are also its feed resources. Conform to its life habit: living on the trees (arboreal) and active in the night (nocturnal), in the day time cuscus hides and sleeps (George 1973).

It is almost impossible to see directly the activities of dwarf cuscus in the day time because this animal is nocturnal and active in the night only. The information about plants which is selected by cuscus as feed resources is obtained from interview with local people/hunters. They are invited to go along with researcher into the forest to find the location where they can see cuscus. They can find and show the rests of plant parts eaten by cuscus such as traces of a jerk on leaves, bitten on fruit, and scratched on a trunk.

Table 2 shows that plant consumed by dwarf cuscus consist of 33 types of fruit (73.33%), 1 type of leaf only (2.22%), 4 types of leaf and fruit (8.89%), 5 types of flower and fruit (11.12%), 1 type of leaf, flower, fruit (2.22%), and 1 type fruit and innermost part of trunk

The Selection Of Forest Plants As Feed Resources and Nesting Site

Table 3. Nutrient contents of Forest Plants as Feed Resources for Dwarf Cuscus

Scientific Name	DM	OM	Ash	Protein	Fat	Crude fiber	NFE	Gross Energy
 (%)							Kal/g
Young leaf + trunk:								
<i>Barringtonia reticulata</i>	95,81	93,07	6,93	17,15	0,09	23,20	52,63	3970
<i>Syzygium malaccense</i>	96,11	96,48	3,52	5,96	0,37	26,63	63,52	3867
<i>Syzygium bantaa-nense</i> (white)	95,74	96,24	3,76	7,90	0,16	25,89	62,29	4213
<i>Garcinia rigida</i>	91,40	95,59	4,41	6,75	0,04	35,05	53,75	3504
<i>Spondias dulcis</i>	93,44	93,41	6,59	15,53	0,94	33,33	43,61	3590
<i>Spondias cytherea</i>	92,73	94,21	5,79	14,12	0,76	17,75	61,58	3773
<i>Syzygium bantaa-nense</i> (red)	91,77	95,70	4,30	12,86	0,82	30,81	51,21	4008
Flower :								
<i>Barringtonia reticulata</i>	92,61	96,08	3,92	7,46	0,24	20,21	68,17	3699
<i>Catimbium malaccense</i>	94,09	91,49	8,51	8,78	0,80	29,76	52,15	3879
<i>Areca vestiaria</i>	86,55	96,44	3,56	6,79	0,03	30,73	58,89	4071
<i>Melastoma malabathricum</i>	91,94	95,59	4,41	7,12	0,70	30,20	57,57	3712
<i>Nicolaia speciosa</i>	92,20	87,48	12,52	10,32	1,85	37,23	38,08	3999
Topmost of trunk:								
<i>Etilingera punicea</i>	90,00	84,07	15,93	9,32	2,55	25,07	47,13	3596
Fruit :								
<i>Barringtonia reticulata</i>	94,61	96,91	3,09	8,46	0,47	33,05	54,93	4000
<i>Syzygium malaccense</i>	93,77	93,15	6,85	5,23	0,53	30,80	56,59	3783
<i>Pandanus tectorius</i>	91,89	94,79	5,21	4,43	0,67	36,40	53,29	3847
<i>Catimbium malaccense</i>	91,53	96,93	3,07	6,05	0,59	37,13	53,16	4344
<i>Dracaena angustifolia</i>	94,60	91,55	8,45	7,37	0,07	26,55	57,56	3990
<i>Dillenia ovalifolia</i>	90,21	94,52	5,48	4,78	1,12	30,31	58,31	3334
<i>Citrus macroptera</i>	90,33	94,80	5,20	6,67	0,60	21,33	66,20	3817
<i>Citrus</i> sp.1	85,99	95,53	4,47	5,59	0,55	36,78	52,61	3674
<i>Parartocarpus v. nenusus</i>	94,80	96,51	3,49	2,46	0,53	25,89	67,63	4054
<i>Syzygium bantaa-nense</i>	87,05	95,38	4,62	6,77	*)	*)	*)	*)
<i>Areca vestiaria</i>	93,21	94,90	5,10	4,46	1,19	29,44	59,81	4011
<i>Melastoma malabathricum</i>	95,38	94,05	5,95	8,91	0,79	30,14	54,21	3736
<i>Theobroma cacao</i>	96,40	92,24	7,76	12,27	0,66	30,74	48,57	3782
<i>Nicolaia speciosa</i>	91,50	88,76	11,24	15,77	3,18	31,15	38,66	4467
<i>Spondias dulcis</i>	88,58	97,22	2,78	2,04	0,36	22,21	72,61	3449
<i>Etilingera punicea</i>	92,51	94,03	5,97	9,55	0,74	30,80	52,94	3596
<i>Passiflora foetida</i>	91,85	93,36	6,64	10,20	4,35	29,78	49,03	4319
<i>Sonneratia alba</i>	94,16	94,38	5,62	5,48	0,31	30,14	58,45	3724
<i>Cocos nucifera</i>	94,48	91,70	8,30	9,45	0,17	37,83	44,25	3998
<i>Citrus nobilis</i>	86,75	95,04	4,96	7,18	2,46	37,09	48,31	3781

*) sample is not enough; DM = Dry matter; OM = Organic matter; NFE = Nitrogen free extract

(*umbut kayu*) (2.22%). Survey result of Dwyahreni *et. al.* (1999) states that bear cuscus (*Ailurops ursinus*) which is also endemic for Sulawesi island tend to consume more young leaves than fruit. What is known is that bear cuscus spends most of its life in the trees, eats leaves and occasionally fruit (Weston & Wieland 2002). Previous survey done by Farida *et al.* (1999, 2005) show that parts of plants consumed by cuscus are fruit, young leaf, flower, and innermost part of trunk (*umbut kayu*). This fact is seemingly caused by the fact that the plants contain alkaloid which is can not be approved by dwarf cuscus. It is known that some plants protect their leaves toward herbivore by producing compounds such as tannin and phenol. Wild animals with its sharp sense of smell avoids such plants and prefers plants and leaves not containing compound (Kinnaird 1995). Table 2 shows that all kinds of leaves consumed by dwarf cuscus are young leaves plus their young trunks because they are still soft and palatable, easy to digest, and contain low level of tannin and lignin (Waterman 1984). The variety of feed selected by cuscus show that the majority of them are plants/trees. It is apparent that cuscus is arboreal animal. Survey results show that cuscus is herbivore, however some literatures report that cuscus, in its habitat, also consumes bird egg, young bird, lizard, or young of small mammal (Menzie's 1991; Petocz 1994).

The nutrient contents of forest plants selected by dwarf cuscus as feed sources are varied widely (Table 3). Organic matter contents are 84.07% –

96.93% with average $93.96 \pm 2.81\%$; ash contents was 2.78%-15.93% ($6.05 \pm 2.81\%$); protein contents was 2.04%–15.77% ($8.33 \pm 3.55\%$; ether extract contents was 0.04%–4.38% ($1.05 \pm 1.19\%$); crude fiber contents was 17.75%-37.13% ($28.73 \pm 7.05\%$); nitrogen free extract contents was 38.08%–68.17% ($53.38 \pm 12.01\%$) and total energy was 3334 cal/g–4344 cal/g 3775.56 ± 700.88 cal/g. The analysis of nutrient contents of forest plant selected by dwarf cuscus as feed resources is conducted to find alternative diets with nutrient contents which are relatively similar as those of forest plants. These alternative diets will be needed to feed dwarf cuscus in captive breeding for both research and commercial purposes so that the nutrient requirement of the wild animal can be met as in its habitat.

The analysis results of nutrient contents shows that nutrient need of dwarf cuscus has contain protein, crude fiber, and nitrogen free extract contents range which are wide so that the preparation of feed for these animals in captive breeding (*ex situ*) will be relatively easier. This is also supported by the fact that plant selected by the dwarf cuscus as feed resources are very diverse.

CONCLUSION

This survey shows that the order/sequence of parts of forest plants selected by dwarf cuscus are fruit, leaf, flower, and (in less quantity) topmost of trunk. Nutrient content of forest plants has content a wide range of protein, crude

fiber, and nitrogen free extract, so that the application of feeding in captive breeding (*ex situ*) with alternative feed will be relatively easier. Dwarf cuscus preferred tall trees grow side by side or grown by fern and sago palm trees as its nesting site.

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Appendix 1. osition of Survey Location in Wawonii Island

LATD	LATM	LATS	DIRLAT	LONGD	LONGM	LONG	DIRLON	ALT (m ASL)	LOCATION
4	1	125	S	122	59	278	E	1	Port of Langara, Kec. Wawonii Barat, Kab. Kendari
4	8	810	S	122	58	121	E	5	Lampe Api, here found young female cuscus
4	7	548	S	122	58	219	E	10	Labekoro
4	7	488	S	122	58	415	E	12	S. Lampe Api, Labeto
4	7	418	S	122	58	545	E	20	Labeto
4	7	356	S	122	58	572	E	20	Bose-bose
4	7	264	S	122	59	101	E	37	Witamemea
4	7	365	S	122	59	148	E	42	Witatetura
4	5	199	S	122	59	300	E	129	Forest to G. Putih
4	5	218	S	122	59	493	E	115	Puukikima
4	5	228	S	123	0	5	E	94	Small river Lampe Api, Puukikima
4	5	220	S	122	59	340	E	192	Forest of G. Putih
4	6	493	S	122	57	480	E	10	Wawo Indah
4	8	575	S	122	59	508	E	5	Wungkolo, here found mother cuscus and its son
4	9	62	S	123	0	135	E	18	Onepute
4	9	156	S	123	0	358	E	55	Forest to G. Episi
4	8	532	S	122	59	321	E	60	Wungkolo bridge
4	7	243	S	122	58	262	E	28	Small river Leboea
4	7	131	S	122	58	399	E	25	Small river Leboeamoare
4	7	138	S	122	58	498	E	51	Small river Anggolomoare
4	7	178	S	122	59	300	E	45	Peapetio
4	6	225	S	122	58	388	E	90	Tampaopa
4	5	220	S	122	59	340	E	40	Tawasai
4	6	363	S	122	59	124	E	35	Watuapi
4	6	167	S	122	59	197	E	45	Lowibuene
4	6	39	S	122	59	285	E	45	Estuary of Latambaga of river Lampe Api
*	*	*	S	*	*	*	E	90	Water fall of Latambaga
4	8	104	S	122	57	197	E	1	Lamongupa beach
4	7	319	S	122	57	109	E	10	Beabeau
4	6	334	S	122	56	389	E	1	Tumbu-tumbu beach
4	10	330	S	122	54	95	E	1	Cempedak (1) island
4	9	255	S	122	53	511	E	1	Cempedak (2) island

Remarks: * GPS failed showing coordinate position in that location