The nutritional content of some fruits as feeding sources of Sumatran orangutans

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Abstract. Orangutans are classified as frugivore that most of their feeding sources come from fruits. Bukit Lawang forest (BLF) as part of Gunung Leuser National Park (GLNP) is known as the first center for orangutan rehabilitation (COR) established in 1973 and then closed in 1991. To date, the BLF is the orangutan viewing center (OVC). This study aimed to assess the nutritional content of some fruits feed by Sumatran orangutan (SOU) in BLF and to determine the energy adequacy from fruits eaten by SOU. The nutritional content was analyzed by proximate method. There were nine fruits from different tree species as SOU food sources analyzed in this study. According to the nutritional content, the best fruit for orangutan feed was P. lateriflora which the highest content of the fruit was water content (62.13%), followed by carbohydrate (23.81%), protein (13.72%), ash (0.21%) and fat (0.10%). This study indicated that the nutritional requirements of SOU at the BLF were categorized as sufficient. Therefore, no additional feed is needed for SOU in the area, and feeding time session can be eliminated in the OVC Bukit Lawang of GLNP.

1. Introduction

Orangutans are only great ape in Asia. Globally, Sumatran orangutan (Pongo abelii) (SOU) is categorized as critically endangered species [1], and the distributions are limited to the northern tip of Sumatra with declining the population from time to time. The main drive of SOU extinction is forest conversion, degradation and fragmentation [2–4] where the Sumatran forest as the habitat of SOU has the highest loss area compared to the other islands in Indonesia [5]. It is estimated that the declining of SOU population will continue as forests within the distribution range remain under great threat [4].

Orangutans generally live semi-solitary, diurnal and mostly arboreal [1] in forests that produce fruit as their main source of food [1, 6]. SOUs are frugivore; however, they also eat a small of other tree/plant part, such as bud and mature leaves, barks, flowers, piths and seeds as well as insects [6, 7] and sometimes eat the meat of slow lorises (Nycticebus coucang) [8–10]. The factor that causes the habit of orangutans eating is the availability of food sources. The feed is a primary source that has a strong influence on individual primates, groups, populations, and various types in ways that vary in behavior [6, 7, 11]. Therefore, diet greatly affects the biological conditions and regimens of SOU.

Bukit Lawang Forest (BLF) of Gunung Leuser National Park (GLNP) is the first center for orangutan rehabilitation (COR Bukit Lawang) in Indonesia established in 1973. Subsequently, the COR Bukit Lawang was officially closed by the Indonesian government on 23 April 1991 due to change of visitor orientation. After 1995, the BLF was functioned as orangutan viewing center (OVC Bukit Lawang) with twice feeding times a day. Most of the SOU population in BLF is habituated, and recovery to natural conditions will be allegedly difficult to achieve if the feed is allowed to continue. On the other hand, there is a lack of data related to the adequacy of feed from natural food sources, especially fruits as food.
sources of SOU in BLF. Therefore, this research aimed to assess the nutritional content of some fruits eaten by SOU in BLF and to determine the energy adequacy from fruits eaten by SOU.

2. Materials and methods

The survey for the SOU feed source diversity was carried out in BLF of GNLP from August 2017 to April 2018 using observation method. Fruits eaten by SOU were collected and then sent to the Laboratory of Food Technology, Faculty of Agriculture, Universitas Sumatera Utara to calculate the nutritional composition [7] using proximate analysis method based on Indonesian National Standard (SNI 01-2891-1992) [12], such as water content, carbohydrate, protein, fat, and ash. The caloric value of each nutritional (carbohydrate, protein, and fat) content was converted based on Drummond & Brefere [13]. Total calories of each fruit were calculated by summing up the calorie value of carbohydrates, proteins, and fats from each fruit.

3. Results and discussions

3.1. Food sources diversity

In total, 150 tree species were recorded as SOU food sources during the survey period which about 84% of them (126 tree species) provided fruits eaten by SOU (Appendix A). The remaining tree species provided other parts of trees, such as leaves, buds, barks, and flowers either both each part or together for SOU foods. This result supports the previous studies on orangutan diet [6, 7, 9, 11, 14–15], although it is sometimes different in terms of the composition of the part of the tree eaten by an orangutan.

Because this research period was carried out on a shortage of fruits, only nine fruits from different tree species had sufficient samples for analysis of nutrient content. The species were Calophyllum inophyllum, Garcinia celebica, Ficus fistulosa, Buchanania arborescens, Gardenia tubifera, Leea indica, Garcinia microcarpa, Diospyros truncata and Polyalthia lateriflora (figure 1). The other fruit trees (115 tree species) did not have enough fruit samples for analysis.

3.2. Nutritional content of fruits

Table 1 shows the nutritional composition of some fruits eaten by SOU in BLF of GLNP. The highest composition of the fruits was water content varied from 62.13% to 72.74%, followed by carbohydrate content (13.58%-23.81%), protein (9.39-13.77%) and fat (0.01-8.43%). Ash had the lowest content of the fruits, i.e., between 0.01%-0.22%.

According to table 1, the fruit of Gardenia tubifera (Rubiaceae) was recorded as the highest water content (72.74%), followed by Garcinia microcarpa (Clusiaceae) (72.27%) and Garcinia celebica (Clusiaceae) (70.20%). On the other hand, the lowest content of water was Polyalthia lateriflora (Annonaceae). Because the fruit water content is more than 60%, it is appropriate to meet the water needs of the SOU [16]. The water content in the feed ingredients determines acceptability, freshness, and greatly affects the shelf life, because water can affect physical properties or the presence of chemical changes such as examples. Subsequently, the water content can affect the texture, appearance, and taste of feed ingredients [17].

The highest content of carbohydrate was Diospyros truncata (Ebenaceae) (23.81%), followed by Diospyros truncata (Ebenaceae) (22.84) and Buchanania arborescens (Anacardiaceae) (22.26%). On the other hand, the lowest content of carbohydrate was Gardenia tubifera (13.58%). It is indicated that the content of carbohydrates in each feed has fulfilled the carbohydrate nutrition of SOU [16]. Carbohydrates are the main energy sources for the animal including SOU.

Diospyros truncata was recorded as the highest content of protein (13.77%), followed by Polyalthia lateriflora (13.71%) and Buchanania arborescens (12.23%). Then, the lowest content of protein was Calophyllum inophyllum (9.39%) and Gardenia tubifera (9.40%). Based on the National Resource Council [16], orangutans need 6.1% to 26.0% protein in each gram of feed. Protein has an important role in nutritional needs after carbohydrates. If energy consumption is not sufficient, the protein from feed consumption will be processed and used to meet energy needs at the expense of the formation and repair of body tissues.
Figure 1. Fruits of SOU food sources analyzed for nutritional contents: (a) Calophyllum inophyllum, (b) Garcinia celebica, (c) Ficus fistulosa, (d) Buchanania arborescens, (e) Gardenia tubifera, (f) Leea indica, (g) Garcinia microcarpa, (h) Diospyros truncata, (i) Polyalthia lateriflora.

Table 1. Nutritional composition of fruits of some tree species eaten by Sumatran orangutan.

| No | Species                    | Water (%) | Carbohydrate (%) | Protein (%) | Fat (%) | Ash (%) |
|----|----------------------------|-----------|-----------------|------------|--------|--------|
| 1  | Buchanania arborescens     | 65.06     | 22.26           | 12.23      | 0.64   | 0.11   |
| 2  | Calophyllum inophyllum     | 64.40     | 17.56           | 9.39       | 8.43   | 0.21   |
| 3  | Diospyros truncata         | 63.27     | 22.84           | 13.77      | 0.01   | 0.09   |
| 4  | Ficus fistulosa            | 64.98     | 16.53           | 10.26      | 1.79   | 0.01   |
| 5  | Garcinia celebica          | 70.20     | 19.61           | 9.58       | 0.56   | 0.15   |
| 6  | Garcinia microcarpa        | 70.27     | 18.15           | 9.93       | 1.60   | 0.02   |
| 7  | Gardenia tubifera          | 72.74     | 13.58           | 9.40       | 4.05   | 0.22   |
| 8  | Leea indica                | 69.62     | 19.83           | 9.58       | 0.95   | 0.01   |
| 9  | Polyalthia lateriflora     | 62.13     | 23.81           | 13.72      | 0.10   | 0.21   |

The highest fat content was found in the Calophyllum inophyllum fruit of 8.43% and the lowest was in the Diospyros truncata fruit (0.01%). According to the National Resource Council [16], orangutans need 2.9% to 9.8% fat. The result showed that the fat content that meets the orangutan feed needs was found in Gardenia tubifera and Calophyllum inophyllum fruits. Fat in the body functions as a food reserve if carbohydrates is completely overhauled as energy. Besides, the function of fat is a suspension for vitamins A, D, E, and K which are useful for biological processes shocks to protect vital organs, and protect the body from outside temperatures that are less supportive [18].

The highest ash content was found in Gardenia tubifera fruit of 0.22%, and the lowest was in Leea indica fruit of 0.01%. In the body, minerals are only needed in small amounts. If they are consumed in large quantities, they can be toxic. Minerals function as the body's metabolism and facilitate digestion. In addition to maintaining the osmotic pressure of body fluids, maintaining muscle and nerve concentrations, and regulating the transport of nutrients in cells are very important. Besides, it serves to repair and grow tissue such as in teeth and bones, repair of hair, horns, nails, soft tissue and blood cells.

3.3. Caloric value of fruits

According to Drummond & Brefere [13], each 1 gram of carbohydrates, fats, and proteins will produce 4 kcal, 9 kcal, and 4 kcal of energy, respectively. Based on the conversion, the caloric values of fruits eaten by SOU at BLF of GLNP are shown in table 2.
Table 2. Calorie values produced by fruits eaten by Sumatran orangutan.

| No | Species                          | Protein % | Carbohydrate % | Fat % | Total Calorie |
|----|----------------------------------|-----------|----------------|-------|---------------|
| 1  | *Buchanania arborescens*         | 12.23     | 110.13         | 22.26 | 358.71        |
| 2  | *Calophyllum inophyllum*         | 9.39      | 84.59          | 17.56 | 448.66        |
| 3  | *Diospyros truncata*             | 13.77     | 124.00         | 22.84 | 366.43        |
| 4  | *Ficus fistulosa*                | 10.26     | 92.38          | 16.53 | 306.13        |
| 5  | *Garcinia celebica*              | 9.58      | 86.27          | 19.61 | 303.96        |
| 6  | *Garcinia microcarpa*            | 9.93      | 89.45          | 18.15 | 314.97        |
| 7  | *Gardenia tubifera*              | 9.40      | 84.60          | 13.58 | 315.93        |
| 8  | *Leea indica*                    | 9.58      | 86.25          | 19.83 | 314.37        |
| 9  | *Polyalthia lateriflora*         | 13.72     | 123.56         | 23.81 | 377.76        |

Based on table 2, the *Callophylum inophyllum* fruit has the highest calorific value of 448.66 cal, while the *Garcinia celebica* fruit has the lowest calorific value of 303.96 cal and *Ficus fistulosa* fruit has a calorific value of 306.13 cal. *Ficus fistulosa*, one of the trees that produce fig fruit is included in the key species which is the most important source of orangutan food that can be fruitful throughout the year. Fig fruit is not always selected by orangutans during the fruit mass season. However, orangutans choose fig fruits as a food source during the fruit shortage season.

When field research was conducted (from August 2017 to April 2018), fruit production was not abundant, so the availability of sources of feed ingredients from fruit was low. The fruit is the main source of food for orangutans, so fruit consumption is still high even though fruit production is declining. The preference of orangutans to plants fruiting is very high even though the amount is small. Fruits have high fat and carbohydrate content compared to other food categories, so orangutans choose fruit as the main food which is always eaten every month to meet energy needs [20]. In the other part of GNLP, namely Ketambe forest, GLNP, plant phenology data show that the highest fruit production occurs in July (dry season), while the lowest fruit production is in January (early dry season). The results are similar to Van Schaik [21], which shows the highest fruit production occurs between July and August, the highest leaf production occurs between December and February and the highest flower production occurs between February and April.

According to Knott [19], an average of total daily energy expenditure (TDEE) in wild orangutan is estimated for adult females to be 2300 kcal/d, including reproductive costs and 1850 kcal/d excluding reproductive costs, and 3250 kcal/d for flanged males. Therefore, to meet their needs, orangutans eat enough fruit. If the availability of fruit decreases in a season, as in this study period, the orangutan will combine it by eating other parts of the plant.

4. Conclusions and recommendations

BLF of GNLP has a rich diversity of SOU food sources both fruits and other part of trees/plants. Most of the nutritional content of fruits eaten by SOU is sufficient to support the daily activities of SOU. During the low session of fruit production, SOU combines fruits by eating other parts of plants/trees, such as young leaves, bud, flowers, and barks. This result indicated that the feeding time in the OVC Bukit Lawang of GLNP can be eliminated. This decision is expected that the cessation of this feeding can improve semi-wild SOU ability to possibly behave as wild orangutans.

Acknowledgments

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5. Appendix

Appendix A. List of tree species as Sumatran orangutan food sources at the Bukit Lawang Forest of Gunung Leuser National Park, Indonesia.

| No | Species                  | Family          | Plant part eaten by SOU |
|----|--------------------------|-----------------|-------------------------|
| 1  | Actinidia sp.            | Actinidiaceae   | fruit                   |
| 2  | Alangium javanicum       | Alangiaceae     | fruit                   |
| 3  | Buchanania arborescens   | Anacardiaceae   | fruit                   |
| 4  | Dracontomelon dao        | Anacardiaceae   | fruit                   |
| 5  | Mangifera foetida        | Anacardiaceae   | fruit                   |
| 6  | Mangifera quodrifida     | Anacardiaceae   | fruit                   |
| 7  | Cyathocalyx sumatranana  | Annonaceae      | fruit                   |
| 8  | Polyalthia lateriflora   | Annonaceae      | fruit                   |
| 9  | Polyalthia sumatranana   | Annonaceae      | fruit                   |
| 10 | Durio zibethinus         | Bombacaceae     | fruit                   |
| 11 | Canarium denticulatum    | Burseraceae     | fruit                   |
| 12 | Canarium indicum         | Burseraceae     | fruit                   |
| 13 | Canarium sp.             | Burseraceae     | fruit                   |
| 14 | Protium javanicum        | Burseraceae     | fruit                   |
| 15 | Calophyllum inophyllum   | Cluciaceae      | fruit                   |
| 16 | Calophyllum rigidum      | Cluciaceae      | fruit                   |
| 17 | Calophyllum sp.          | Cluciaceae      | fruit                   |
| 18 | Calophyllum sp. 2        | Cluciaceae      | fruit                   |
| 19 | Garcinia celebica        | Clusiaceae      | fruit                   |
| 20 | Garcinia dioica          | Clusiaceae      | fruit                   |
| 21 | Garcinia microcarpa      | Clusiaceae      | fruit                   |
| 22 | Dillenia                 | Dilleniaceae    | fruit                   |
| 23 | Dillenia indica          | Dilleniaceae    | fruit                   |
| 24 | Dillenia reticulata      | Dilleniaceae    | bark, young leave       |
| 25 | Dipterocarpus caudatus   | Dipterocarpaceae| fruit                   |
| 26 | Dipterocarpus cornutus    | Dipterocarpaceae| fruit                   |
| 27 | Dipterocarpus elongatus  | Dipterocarpaceae| fruit                   |
| 28 | Dipterocarpus sp.        | Dipterocarpaceae| fruit                   |
| 29 | Shorea ovalis            | Dipterocarpaceae| young leave             |
| 30 | Diospyros celebica       | Ebenaceae       | fruit                   |
| 31 | Diospyros sp.            | Ebenaceae       | fruit                   |
| 32 | Diospyros truncata       | Ebenaceae       | fruit                   |
| 33 | Antidesma bunius         | Euphorbiaceae   | fruit                   |
| 34 | Antidesma gahaesembilla  | Euphorbiaceae   | fruit                   |
| 35 | Antidesma sp.            | Euphorbiaceae   | fruit                   |
| 36 | Aporosa elliptifolia     | Euphorbiaceae   | young leave, fruit      |
| 37 | Aporosa frutescens       | Euphorbiaceae   | young leave, fruit      |
| 38 | Aporosa sp.              | Euphorbiaceae   | young leave, fruit      |
| 39 | Baccaurea macrocarpa     | Euphorbiaceae   | fruit                   |
| 40 | Baccaurea sp.            | Euphorbiaceae   | fruit                   |
| 41 | Baccaurea stipulata      | Euphorbiaceae   | fruit                   |
| 42 | Baccaurea sumatranana    | Euphorbiaceae   | fruit                   |
| 43 | Croton argyratus         | Euphorbiaceae   | flower                  |
| 44 | Endospermum diadenum     | Euphorbiaceae   | fruit, young leave, bark|
| 45 | Macaranga bancana        | Euphorbiaceae   | fruit                   |
| 46 | Macaranga indica         | Euphorbiaceae   | bark                    |
| 47 | Macaranga punctulata     | Euphorbiaceae   | fruit                   |
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| No | Species | Family     | Plant part eaten by SOU                  |
|----|---------|------------|-----------------------------------------|
| 48 | *Macaranga gigantea* | Euphorbiaceae | fruit                                   |
| 49 | *Mallotus peltatus*  | Euphorbiaceae | fruit                                   |
| 50 | *Psychopyxis arborea* | Euphorbiaceae | fruit                                   |
| 51 | *Sesbania grandiflora* | Fabaceae     | young leave, flower                     |
| 52 | *Cactanopsis tungurut* | Fagaceae     | fruit, young leave, bark                 |
| 53 | *Castanopsis inermis* | Fagaceae     | fruit                                   |
| 54 | *Castanopsis sp.*    | Fagaceae     | Fruit                                   |
| 55 | *Castanopsis sp. 1*  | Fagaceae     | fruit                                   |
| 56 | *Castanopsis sp. 2*  | Fagaceae     | fruit                                   |
| 57 | *Castanopsis sp. 3*  | Fagaceae     | fruit                                   |
| 58 | *Castanopsis sp. 4*  | Fagaceae     | fruit                                   |
| 59 | *Lithocarpus elegans* | Fagaceae     | fruit                                   |
| 60 | *Lithocarpus glochidium* | Fagaceae | fruit                                   |
| 61 | *Lithocarpus gracilis* | Fagaceae     | fruit                                   |
| 62 | *Quercus icata*      | Fagaceae     | young leave, fruit                      |
| 63 | *Quercus sumatrana*  | Fagaceae     | young leave, fruit                      |
| 64 | *Quercus turbinata*  | Fagaceae     | young leave, fruit                      |
| 65 | *Callicarpa tomentosa* | Lamiaceae  | young leave                             |
| 66 | *Actinodaphne angustifolia* | Lauraceae | young leave, fruit                     |
| 67 | *Actinodaphne glabra* | Lauraceae    | young leave, fruit                      |
| 68 | *Actinodaphne glomerata* | Lauraceae   | young leave, fruit                      |
| 69 | *Actinodaphne sp.*   | Lauraceae    | young leave                             |
| 70 | *Alseodaphne bancana* | Lauraceae    | young leave                             |
| 71 | *Alseodaphne glabra* | Lauraceae    | young leave                             |
| 72 | *Cinnamomun javanicum* | Lauraceae  | flower                                  |
| 73 | *Cryptocarya elliptifolia* | Lauraceae | fruit                                   |
| 74 | *Lauraceae*          | Lauraceae    | young leave                             |
| 75 | *Litsea angulat*     | Lauraceae    | young leave                             |
| 76 | *Litsea castanea*    | Lauraceae    | young leave                             |
| 77 | *Litsea firma*       | Lauraceae    | leave                                   |
| 78 | *Litsea lanceolata*  | Lauraceae    | leave                                   |
| 79 | *Litsea sp.*         | Lauraceae    | leave                                   |
| 80 | *Litsea tomentosa*   | Lauraceae    | leave                                   |
| 81 | *Phoebe grandis*     | Lauraceae    | leave                                   |
| 82 | *Phoebe lanceolata*  | Lauraceae    | young leave                             |
| 83 | *Plantochia sp.*     | Lecythidaceae| flower                                  |
| 84 | *Leea indica*        | Lecaeceae    | fruit                                   |
| 85 | *Parkia javanica*    | Leguminaceae | young leave, fruit                      |
| 86 | *Archidendron ellipticum* | Leguminosae | fruit                                   |
| 87 | *Archidendron pauciflorum* | Leguminosae | fruit                                   |
| 88 | *Magnolia lasia*     | Mangnoliaceae | fruit                                  |
| 89 | *Pternanda dumosa*   | Melastomataceae| fruit                           |
| 90 | *Pternanda rostrata* | Melastomataceae| fruit                        |
| 91 | *Pternandra coerulescens* | Melastomataceae| fruit                           |
| 92 | *Aglaia argenta*     | Meliaceae    | young leave, fruit                      |
| 93 | *Aglaia elliptica*   | Meliaceae    | young leave, fruit                      |
| 94 | *Aglaia sp.*         | Meliaceae    | young leave                             |
| 95 | *Aglaia sp. 1*       | Meliaceae    | young leave                             |
| 96 | *Aglaia tomentosa*   | Meliaceae    | young leave, fruit                      |
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| No | Species           | Family       | Plant part eaten by SOU |
|----|-------------------|--------------|-------------------------|
| 97 | Aglaia edulis     | Meliaceae    | young leave, fruit      |
| 98 | Chisocheton patens| Meliaceae    | young leave, fruit      |
| 99 | Dysoxylum caulisforum | Meliaceae | fruit                   |
| 100| Dysoxylum sp.     | Meliaceae    | fruit                   |
| 101| Artocarpus dadah  | Moraceae     | fruit                   |
| 102| Artocarpus elasticus | Moraceae | fruit                   |
| 103| Artocarpus lanceifolia | Moraceae | fruit                   |
| 104| Artocarpus nitidus | Moraceae    | fruit                   |
| 105| Ficus glomerata   | Moraceae     | fruit                   |
| 106| Ficus religiosa   | Moraceae     | fruit                   |
| 107| Ficus stupenda    | Moraceae     | fruit                   |
| 108| Ficus sumatrana   | Moraceae     | fruit                   |
| 109| Ficus fistulosa   | Moraceae     | fruit                   |
| 110| Horsfieldia irya  | Myristiceaece | fruit                  |
| 111| Horsfieldia wallichii | Myristiceaece | fruit                  |
| 112| Knema galeata     | Myristiceaece | fruit                  |
| 113| Knema latericia   | Myristiceaece | fruit                  |
| 114| Myristica iners   | Myristiceaece | fruit                  |
| 115| Ardisia tomentosa | Myrsinaceae  | fruit                   |
| 116| Eugenia sp.       | Myrtaceae    | young leave, fruit      |
| 117| Eugenia sp. l     | Myrtaceae    | young leave, fruit      |
| 118| Eugenia tetraptera| Myrtaceae    | fruit                   |
| 119| Rhodamnia cinerea | Myrtaceae    | fruit                   |
| 120| Syzygium claviflora| Myrtaceae   | young leave, fruit      |
| 121| Syzygium cumini   | Myrtaceae    | young leave, fruit      |
| 122| Syzygium rostratum| Myrtaceae    | young leave, fruit      |
| 123| Syzygium sp.      | Myrtaceae    | young leave, fruit      |
| 124| Syzygium triata   | Myrtaceae    | young leave, fruit      |
| 125| Podocarpus imbricatus | Podocarpaceae | fruit                 |
| 126| Gardenia tubifera | Rubiaceae    | fruit                   |
| 127| Nauclea sp.       | Rubiaceae    | bark, fruit             |
| 128| Nauclea subdita   | Rubiaceae    | bark, fruit             |
| 129| Rubiaceae         | Rubiaceae    | fruit                   |
| 130| Melicope glabra   | Rutaceae     | fruit, flower           |
| 131| Nephelium cuspidatum | Sapindaceae | fruit                  |
| 132| Nephelium maingayi| Sapindaceae  | fruit                  |
| 133| Nephelium mutabile| Sapindaceae  | fruit                  |
| 134| Pometia pinnata   | Sapindaceae  | fruit                  |
| 135| Palaquium gutta   | Sapotaceae   | fruit                  |
| 136| Palaquium sp.     | Sapotaceae   | fruit                  |
| 137| Palaquium sumatranum | Sapotaceae | fruit                  |
| 138| Planchonella firma| Sapotaceae   | young leave             |
| 139| Planchonella obovata | Sapotaceae | young leave             |
| 140| Smilax sp.        | Smilaceae    | fruit                  |
| 141| Smilax sp. l      | Smilaceae    | fruit                  |
| 142| Scaphium macropodum | Sterculiaecae | fruit           |
| 143| Sterculia coccinea| Sterculiaecae | bark, young leave, fruit|
| 144| Sterculia foetida  | Sterculiaecae | fruit                  |
| 145| Sterculia rubiginosa| Sterculiaecae | fruit                  |
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| No  | Species                  | Family          | Plant part eaten by SOU |
|-----|--------------------------|-----------------|-------------------------|
| 146 | Sterculia sp.            | Sterculiaceae   | fruit                   |
| 147 | Styrax benzoin           | Styraxaceae     | fruit                   |
| 148 | Symlocos sp.             | Symlocaceae     | fruit                   |
| 149 | Microcos crassifolia     | Tiliaceae       | fruit                   |
| 150 | Rinorea macrocarpa       | Violaceae       | fruit                   |

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