Management Recommendations
for Wildlife Saltlicks
with Particular Reference to
Sira Air Hangat at
Ulu Muda Forest Reserve, Kedah

November 2005

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by

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Executive Summary

Wildlife saltlicks are generally found in large, relatively undisturbed forested, such as Taman Negara National Park and Royal Belum State Park. Saltlicks play an important role in providing many species of wildlife, especially herbivorous mammals, with minerals for their health and digestion of food. However, saltlicks in Peninsular Malaysia have not been studied in detail apart from mineral analyses carried out in conjunction with geological investigations.

Ulu Muda Forest Reserve in Kedah is an outstanding area for wildlife conservation and has been particularly noted for its high concentration of wildlife saltlicks. One of the largest and certainly most unique saltlick at Ulu Muda is Sira Air Hangat, which is a combination of a saltlick (or sira in Malay) and a hot water spring. However, it is also facing various pressures and threats including poaching and unregulated tourism activities.

This study was initiated principally to collate existing knowledge on wildlife saltlicks and recommend practical management guidelines for saltlicks with a special reference to the very important and unique Sira Air Hangat.

Based on the available data, it can be concluded that many wildlife species, including those that are endangered and rare, depend on saltlicks in forested areas to supplement their diet. As such, saltlicks are especially important for wildlife conservation. Although there are provisions within existing laws in Malaysia for the protection of saltlicks, i.e. the Protection of Wild Life Act 1972 (Peninsular Malaysia) and the Wildlife Conservation Enactment 1997 (Sabah), increased enforcement of these laws should be accorded the highest priority.

Saltlicks are also sites with high tourism potential because of the relatively high probability of wildlife sightings in their vicinity. This potential has been exploited in many locations around the world (including Taman Negara in Malaysia), as the literature review in this study has shown.

Nature tourism based on visitation to saltlicks should be promoted in a responsible manner so that there is minimal disturbance to the saltlicks and the wildlife. Construction of well-designed wildlife observation hides is a common approach in which to achieve this. This report contains recommended specifications for building such a wildlife hide.

Revenue generated from tourism can encourage the protection of saltlicks and associated habitats. However, it is important to note that saltlicks require active management in order to maintain their crucial ecological function and to minimise human impacts.

Finally, this report should be seen as an initial effort in shedding more light on wildlife saltlicks and their management in Malaysia. It is hoped that it will serve as a baseline reference for other more comprehensive studies on saltlicks.
Ringkasan Eksekutif

Sira ataupun jenut secara amnya dijumpai di kawasan hutan yang luas dan tidak terganggu, seperti Taman Negara dan Taman Negeri Royal Belum. Ia memainkan peranan yang penting dalam membekalkan garam galian kepada pelbagai spesis hidupan liar, terutamanya mamalia herbivor, untuk menjaga kesihatan dan membantu penghadaman makanan. Sira di Semenanjung Malaysia belum lagi dikaji dengan terperinci, selain daripada analisa-analisa mineral yang telah dijalankan berhubungan dengan siasatan geologi.

Hutan Simpan Ulu Muda di Negeri Kedah merupakan suatu kawasan yang amat istimewa untuk pemuliharaan hidupan liar dan telah mendapat perhatian oleh kerana kepadatan siranya yang tinggi. Salah satu sira yang terbesar dan paling unik di Ulu Muda ialah Sira Air Hangat, yang merupakan gabungan sira dan punca air panas. Bagaimanapun, ia menghadapi berbagai tekanan dan ancaman termasuk kegiatan pemburuan haram dan aktiviti pelancongan yang tidak terkawal.

Kajian ini diadakan khususnya untuk memberi syor-syor yang praktikal berhubung garispanduan pengurusan sira, dengan tumpuan khusus kepada Sira Air Hangat.

Berpandukan maklumat yang diperolehi, satu kesimpulan yang boleh dibuat ialah pelbagai spesis hidupan liar, termasuk spesis nadir dan terancam, bergantung kepada sira di dalam kawasan berhutan untuk melengkapi pemakanan mereka. Oleh yang demikian, sira memainkan peranan yang amat penting dalam pemuliharaan hidupan liar. Walaupun terdapat peruntukan dalam undang-undang di Malaysia untuk perlindungan sira, khususnya Akta Perlindungan Hidupan Liar 1972 (Semenanjung Malaysia) dan Enakmen Pemuliharaan Hidupan Liar 1997 (Sabah), keutamaan harus diberikan kepada peningkatan dalam penguatkuasaan undang-undang tersebut.

Sira juga mempunyai potensi pelancongan yang tinggi oleh kerana kebarangkalian melihat hidupan liar di situ adalah agak tinggi. Potensi ini telah dieksploitasi di pelbagai lokasi di merata dunia (termasuk di Taman Negara), berdasarkan analisa bahan rujukan yang dijalankan di bawah kajian ini.

Pelancongan berlandaskan alam semulajadi yang melibatkan pengunjungan ke sira boleh dipromosikan dengan cara yang bertanggungjawab untuk memastikan gangguan yang minima kepada sira dan hidupan liar. Dalam pada itu, pembinaan ran ataupun menara pandang dengan rekabentuk yang sesuai adalah suatu langkah yang kerap digunakan. Laporan ini mengandungi cadangan spesifikasi untuk pembinaan ran.

Pulangan daripada kegiatan pelancongan boleh menggalakkan usaha untuk melindungi sira dan habitat berkaitan. Bagaimanapun, perlu dipertekankan bahawa sira memerlukan pengurusan aktif untuk mengekalkan fungsi ekologinya dan untuk mengurangkan impak oleh manusia kepada tahap minima.

Akhirnya, laporan ini harus dianggap sebagai suatu usaha awal dalam memahami sira hidupan liar dan pengurusannya di Malaysia. Adalah diharap agar laporan ini akan menjadi bahan rujukan asas untuk kajian-kajian lain yang lebih menyeluruh.
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Mike H. N. Chong
1. INTRODUCTION

1.1 Objective

The main objective of this study is to formulate management recommendations for saltlicks with a special reference to Sira Air Hangat in Ulu Muda Forest Reserve, Kedah.

1.2 Definition of Saltlick

In Peninsular Malaysia, the definition of “saltlick” includes “any mineral spring or ground containing or bearing salt or any other mineral (whether of the same genus or not), the consumption of which is conducive to the health or well being of wild animals”. This is a definition according to the Protection of Wild Life Act 1972 (Peninsular Malaysia). The Sabah Wildlife Enactment 1997 contains a similar definition for saltlicks (see Section 1.6.2).

Natural saltlicks are found in the tropical as well as the temperate regions of the world. Saltlicks play an important role in the ecology of wildlife in tropical rain forests of South-east Asia. Many mammals and other wildlife depend on saltlicks as a source of minerals in their diet and for the digestion and metabolism of food. There are several types of saltlicks found throughout the tropical and temperate regions of the world. There are generally two types of spring saltlicks found in Peninsular Malaysia.

1.3 Spring Saltlicks

One type is formed when natural springs with a high content of various minerals seep out from the ground and form shallow pools of water within a general area. Minerals from this type of saltlick are ingested by animals when they drink the mineral-soaked water.

Hot spring saltlicks are formed by thermal springs forming shallow and hot mineral pools. A good example of a hot spring saltlick is Sira Air Hangat saltlick at the Ulu Muda Forest Reserve in Kedah. This saltlick (or sira in Malay) derives its name from the hot spring pools and stream found there.

Jones (1970) mentioned that the waters in hot springs are probably of juvenile character associated with the final cooling phase of the magmatic activity responsible for the intrusion of the granite. These waters eventually seep to the surface along regional lines of deeply embedded structural weakness. Although there is no demonstrative proof, it is a fact that all thermal springs are located either in, or close to, granite and groups of them are found distributed along major faults and shear zones (Jones, 1970).

1.4 Dry-land Saltlicks

Dry-land saltlicks may be formed when minerals are deposited and absorbed into the earth and soils from natural thermal spring processes (Jones, 1970). Mammals and other wildlife take the minerals from these saltlicks by ingesting the soils. From analyses of minerals in soils, Jones (1970) mentions that it is possible that the heavy concentration of mineral salts in the soil at dry-land saltlicks were deposited from thermal seepages formerly active at these saltlicks. However, this formation theory was inconclusive when analyses were made of several saltlicks found around Grik in Perak (see Appendix I). Several examples of dry saltlicks may be found at the Taman Negara National Park, Pahang.

1.5 Provisions for the Protection of Wildlife and Saltlicks in Wildlife Laws

Provisions for the protection of saltlicks can be found in the Protection of Wild Life Act 1972 (Peninsular Malaysia) and the Wildlife Conservation Enactment 1997 (Sabah).
1.5.1 Protection of Wild Life Act 1972 (Peninsular Malaysia)

Under Part VI – Offences and Penalties, Chapter 1: General Protection, item 79, it is stated that every person who “…

a) shoots, kills or take any wild animal or bird within a quarter of a mile of any salt lick;

b) is in possession of any firearm bow and arrow, blowpipe, spear, catapult or any other weapon (whether of the same genus or not) which is capable of shooting killing or taking any wild animal or wild bird within a quarter of a mile of any salt lick; or

c) waits at any place, builds any platform or shelter or sets or places any unlawful snare, poison, poisoned bait, birdlime or net for the purpose of shooting, killing or taking any wild animal or wild bird within a quarter of a mile of any salt lick or within a quarter of a mile of any approach to any salt lick,

is guilty of an offence and shall on conviction be liable (in addition to any other penalty provided for any other offence) to a fine not exceeding two hundred thousand ringgit or to a term not exceeding one year or to both.”

In Chapter 4: Miscellaneous of the same Act, under section 91, it is mentioned that: “…

(1) Save as otherwise provided in this section, every person who knowingly disturbs any salt lick or the land in the immediate vicinity of any salt lick (which land if disturbed would render the salt lick unattractive or unsafe to any wild animal) is guilty of an offence and shall on conviction be liable to a fine not exceeding five thousand ringgit or to a term of imprisonment not exceeding two years or to both.

(2) For the purposes of this section "disturb" includes to remove or agitate any soil, mineral, water, tree, undergrowth or other vegetation in or on the salt lick or in or on the land in the immediate vicinity of salt lick.

(3) This section shall not apply to

(a) the Government of the Federation;

(b) the Government of any state; or

(c) any corporation, company, firm or individual authorised or permitted by the Government of the Federation or of any state acting or to act (as the case may require) in pursuance of any rural development scheme, urban development scheme or industrial undertaking.”

Given the above, it can be concluded that the Act provides for the protection of saltlicks found in all forests, whether protected or otherwise. However, it is not clear how the “quarter of a mile” figure was decided upon. This law is enforced by the Department of Wildlife and National Parks (DWNP) and is only applicable in Peninsular Malaysia.

1.5.2 Wildlife Conservation Enactment 1997 (Sabah)

Under this enactment, “salt lick” is defined as including “…a mineral spring or any ground containing salt or another mineral sought by animals as a part of their diet” (Enactment No. 6 of 1984. Cap. 68).

A list of prohibited activities in wildlife reserves is included in Part IV: Protection of Animals and Hunting: Prohibited methods of hunting under Section 33 (1) (g). Under the same section, there is a provision that “No person except with the authorisation of the Director, shall… for the purposes of hunting, approach or build any platform or hide within five hundred metres of any salt lick or mud wallow.”

The Sabah Wildlife Department enforces this law which is only applicable in Sabah. As in the case of the Protection of Wild Life Act, the rationale for setting a 500-metre restriction zone around
saltlicks is not apparent. However, this figure does not differ greatly from the quarter-mile figure provided for in the Protection of Wild Life Act.

1.6 Importance of the Ulu Muda Forest Reserve for the Conservation of Wildlife and Saltlicks

The Ulu Muda Forest Reserve is an area of very high biodiversity value (WWF-Malaysia, 2002). Due to its location in the northern-most part of Peninsular Malaysia, the forest contains elements of Thai and Burmese flora. A special feature of the Ulu Muda Forest Reserve is the abundance of wildlife saltlicks that are found in the general area.

The Ulu Muda Forest Reserve in Kedah has long been identified as an area with a very high potential for conservation and nature tourism. The significance of Ulu Muda as a key area for biodiversity conservation has been acknowledged in studies carried out from as early as in the 1960s. Stevens (1968) in his report on wildlife conservation in West Malaysia, proposed that a Wildlife Reserve be established in the Ulu Muda area including the Pedu Dam area, covering an area of 445 sq. miles.

Wildlife surveys conducted within and around the Ulu Muda Forest Reserve have revealed that the area is one of the richest in Malaysia in terms of wildlife. Mammalian surveys carried out in the Sungai Weng sub-catchment of the Ulu Muda Forest Reserve (Nor Azman, 1997; Saiful & Nordin, 1997; Norsham et al., 1998; Norsham et al., 1999) before the area was logged revealed that there were at least 109 species of mammals (representing about 55% of the mammal species in Peninsular Malaysia). Another study carried out in the Ulu Muda area in April 2001 focused on the diversity of avifauna (Noramly & Lim, 2002) of which there were at least 174 species of birds (including seven species of hornbills). 54 species of reptiles (more than recorded for either Belum or Endau-Rompin) and 33 species of freshwater fishes have also been reported to be present in the Ulu Muda Forest Reserve and surrounding forested areas (WWF-Malaysia, 2002).

Large mammals that exist in the area include the Asian elephant (*Elephas maximus*), gaur or seladang (*Bos gaurus*), the Malayan tapir (*Tapirus indicus*) and the Malayan tiger (*Panthera tigris jacksoni*), all of which are endangered species (Baillie et al., 2004) and are Totally Protected (except for the Asian elephant which is Protected) under the Protection of Wild Life Act 1972. It is also one of the few places in Malaysia where both the white-handed gibbon (*Hylobates lar*) and agile gibbon (*Hylobates agilis*) can be observed.

Over the last decade, different agencies (including DWNP, the Forestry Department, Peninsular Malaysia, and WWF-Malaysia) have carried out various studies to document the biodiversity richness of the area with an emphasis to propose the conservation of the Ulu Muda Forest Reserve, to the Kedah State Government. Based on the outstanding biodiversity importance and its enormous conservation value, the area has been proposed as the Ulu Muda National Park (DWNP, 1991) and as a State Park (WWF-Malaysia, 2002).
2. METHODOLOGY

2.1 Literature Review

A literature review on saltlick studies, saltlick management and related issues was conducted using secondary data from scientific papers, technical reports and other credible sources either published or unpublished. Internet searches were also carried out involving various websites for information related to saltlicks.

Additional information on the Ulu Muda area and general designs of observation hides were obtained from officers from the DWNP at Taman Negara and Krau Wildlife Reserve. Data on mammals and wildlife found at saltlicks at various locations were compiled from published material, the author’s personal unpublished observations and information from a tourist at Taman Negara.

2.2 Documentation of Existing Wildlife Hides at Taman Negara

A site visit to Taman Negara National Park was carried out from 26 to 28 February 2005. The main objectives for this visit were to:

- View the designs of the existing wildlife hides at Taman Negara for application to Sira Air Hangat in Ulu Muda, Kedah.
- View the design specifications and location of the hides related to the existing saltlicks.
- Take photographs of the designs of hides that are open to the public.
- Document records of wildlife observed at the hides.
- Conduct interviews with locals, visitors and park officials.

2.3 Rapid Assessment of Sira Air Hangat in Ulu Muda Forest Reserve

A second site visit was carried out at Sira Air Hangat, Ulu Muda Forest Reserve, Kedah from 14-16 March 2005 to conduct a rapid assessment of the saltlick. The Ulu Muda site survey was assisted by Surin Suksuwan of WWF-Malaysia, Joanna Tang Soo Hui and our guide, Rohani Rahmani of Ronn’s Adventures. The geographical location and elevation of the saltlick was determined using a hand-held Garmin Global Positioning System (GPS) unit. Measurements of the physical dimensions of the saltlick were made using a measuring tape.

In situ water quality parameters were measured at three sites at the location of Sira Air Hangat. The equipment and test kits used, with their related parameters, are shown in Table A-1 of Appendix 1.
3. RESULTS

3.1 Records of Wildlife Known to Visit Sira Air Hangat

Records of animals which are known to have visited the saltlick were compiled from evidence of animal tracks and droppings found at the saltlick during the survey at Sira Air Hangat saltlick on 16 March 2005. Additional records of animals were sourced from an inventory carried out by the Department of Wildlife and National Parks, Peninsular Malaysia at saltlicks in Ulu Muda in 1993 (DWNP, 1993). The combined records of wildlife which are known to have visited Sira Air Hangat saltlick are shown in Table 1.

<table>
<thead>
<tr>
<th>Species</th>
<th>Track evidence and location of tracks</th>
<th>Source / date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian elephant (<em>Elephas maximus</em>)</td>
<td>Evidence of numerous foot prints and dung found around saltlick.</td>
<td>This study, DWNP (1993).</td>
</tr>
<tr>
<td>Sambar deer (<em>Cervus unicolor</em>)</td>
<td>Tracks were observed at the edge of saltlick.</td>
<td>This study, DWNP (1993).</td>
</tr>
<tr>
<td>Barking deer (<em>Muntiacus muntjac</em>)</td>
<td>Tracks observed at saltlick.</td>
<td>DWNP (1993).</td>
</tr>
<tr>
<td>Wild pig (<em>Sus scrofa</em>)</td>
<td>Tracks observed at saltlick.</td>
<td>DWNP (1993).</td>
</tr>
<tr>
<td>Cat species (<em>Prionailurus bengalensis?</em>)</td>
<td>Tracks of a small wild cat found around saltlick and the bank of Sungai Muda.</td>
<td>This study.</td>
</tr>
<tr>
<td>Mousedeer species (<em>Tragulus sp.</em>)</td>
<td>Tracks observed at the edge of saltlick.</td>
<td>This study.</td>
</tr>
<tr>
<td>Pigeon species (possibly <em>Treron sp.</em>)</td>
<td>Feathers found on sand at saltlick indicate a pigeon may have visited the saltlick or was carried there by a predator.</td>
<td>This study.</td>
</tr>
</tbody>
</table>

3.2 Estimated Number of Human Visitors to Sira Air Hangat

Although Ulu Muda FR is well known to those living near the area due to the creation of the Muda Dam, however it is still little-known among domestic and foreign tourists. Most of the tourists who visit Ulu Muda FR area are probably those who have visiting the Pedu Lake area which is a more popular area for nature- and general-tourism. It is assumed that most tourists going to Ulu Muda FR will visit Sira Air Hangat saltlick or other saltlicks in the area, as one of the activities in their tour itinerary.

According to a local nature guide, Mr. Rohani Rahmani of Ronn’s Adventure, who organises nature tours to Ulu Muda area, he does not get a steady flow of tourists and there are about one to two tours per month during the peak seasons (May-August). The exact number of visitors who visit Ulu Muda area each year could not be ascertained but may be less than 100 per year. This relatively low number of visitors may be due to the lack of publicity and facilities available at Ulu Muda. Other sources of visitors to Ulu Muda could not be determined due to a lack of published data.
3.3 Location and Size of Sira Air Hangat

The geographical location of Sira Air Hangat is N 06° 06.537’, E 100° 57.598’. The size of Sira Air Hangat is approximately 48 m long and 24 m wide. This area includes all the exposed sandy areas, a small stream, various hot springs emanating from the ground and thermal pools found at the saltlick (see Figures 1 and 2). The largest portion of the saltlick is dominated by an extensive area of exposed whitish sand.

Figure 1. General view of Sira Air Hangat showing the extent of the sandy area (note the elephant dung scattered in the area).

Figure 2. View of a small rocky outcrop area with several hot springs.
3.4 Topography of Sira Air Hangat

Sira Air Hangat saltlick is found in the Ulu Muda Forest Reserve at an altitude of approximately 89 metres a.s.l. It is situated at about 150 m from the right bank of Sungai Muda (when traveling upriver). The main access to the saltlick is via a small trail starting from the bank of Sungai Muda and leading in a more or less straight path to the saltlick. The main area of Sira Air Hangat consists of a large 48 m x 24 m open area covered by deposited sand, and it is roughly oval in shape (Figure 1 and Figure 3). This area is bordered, and surrounded about halfway along the left boundary, by a small and shallow clear-water stream which flows along the periphery of the saltlick. The stream, which is cold at its original course, flows and joins the hot spring water at the lower end of the saltlick, thus making the stream water hot, and this section continues its course as a ‘hotspring stream’ into Sungai Muda (Figure 3). The sand covering the main area is presumably deposited by the small stream carrying sediments from logged-over forests upstream. This is quite evident as the stream flows in a meandering loop at the lower end of the saltlick, and a thick layer of sand has been deposited on the saltlick over a long period of time.

One of the main features of the saltlick is a large rock about 2 m by 1 m in dimension at the top right end of the area (Figure 2 and Figure 3). There are also three holes or wallows at the top end dug by animals. These were presumably dug by elephants looking for mineral water from the saltlick.

There are numerous ‘thermal-springs’ emerging from the ground at Sira Air Hangat saltlick. These thermal-springs are the main elements that constituted and created Sira Air Hangat as one of the important saltlicks in the Ulu Muda Forest Reserve. The main hot springs which contribute to the hot water condition in the small stream appear to be located at the rocky area; the area where the cold stream meets the hot stream; and the lower left end of the saltlick (Figure 2 and Figure 3). The accumulated water from the natural hot-springs are enriched with minerals which attract wild animals to the saltlick.

The terrain of the saltlick is generally flat, with much of the sandy area gently sloping towards the small stream which borders it on the lower part. All the hot springs emerging from the ground appear to flow into the small stream bordering the saltlick. The saltlick terrain also generally slopes towards the main river and after leaving the saltlick, the hot-water stream becomes a fast-flowing
stream into Sungai Muda. The hot-water stream’s fast flow is due to the sloping ground with a total drop of approximately 1.5 m at the bank of Sungai Muda.

3.5 Surrounding Vegetation/Habitat

The habitat surrounding Sira Air Hangat was originally tropical lowland rainforest below 100 m a.s.l. The present vegetation found here is secondary forest characterised by thick undergrowth and the lack of tall emergent trees. The secondary forest was formed following logging activities that were carried out in the 1980s.

3.6 Preliminary Water Quality Analysis at Sira Air Hangat

Due to the rapid nature of the field survey at Ulu Muda Forest Reserve, only a preliminary water quality analysis was carried out at Sira Air Hangat, with only a few parameters measured. Three sampling sites were chosen at Sira Air Hangat (see Figure 3). The description of sampling sites and the full report on the preliminary water quality analysis of Sira Air Hangat are provided in Appendix 1. This section presents the summary of the report.

The physical and chemical parameters measured for the three sites are shown in Table A-4 of Appendix 1. However, dissolved oxygen could not be measured by the equipment used, most probably because it was affected by the high temperature of the water.

Conductivity for the three sites, sampled during this study, ranged from 3.1 to 4.9 μS. This is higher than the average of 0.13μS recorded by Mohd. Kamil et al. (2005) for 16 sampling sites along Sg. Lasor at Ulu Muda.

Salinity for the stations was very low, ranging from 0.0 ppt to 0.1 ppt, which is typical of freshwater rivers. The sampling sites at Sira Air Hangat were located downstream from the confluence of a cold, freshwater stream with the thermal stream. Therefore, a dilution effect may have resulted in the low salinity reading.

High turbidity of water prevents light penetration and inhibits growth of organisms. Turbidity for the sites, which ranged between 0.37 to 0.67 NTU, was very low compared to results obtained elsewhere in Ulu Muda. For example, turbidity ranged from 14 to 36 NTU within the Sungai Teliang Catchment and 19 to 65 NTU in the Sungai Muda Catchment (Anon., 2002).

The stream was alkaline as the pH level at all three stations was recorded to be 8.4.

The level of sulphide (H₂S, HS⁻, S⁻) at Sites 1 and 2 was relatively high at 0.5 mg/L but the level dropped to zero at the confluence of the stream and Sungai Muda, most probably due to the diffusive loss of hydrogen sulphide gas.

The amount of calcium and magnesium in the stream at Sira Air Hangat can be inferred from the hardness of the water. Site 2, which is closest to the hot spring, had the highest calcium and magnesium content while Site 1 and Site 3 had more moderate levels of the two minerals.
3.7 Wildlife Hides at Taman Negara and Wildlife Records from Saltlicks

Presently, there are six wildlife hides available for visitor use at the Taman Negara National Park. Five of these hides are open to visitors for overnight accommodation, while one is only open for day visits. The five overnight hides are at Kumbang, Tabing, Cegar Anjing, Blau and Yong saltlicks, and the day-visit hide is the Tahan saltlick. Five of the hides are built at natural saltlicks except at Cegar Anjing and Tahan saltlicks where artificial salt had been introduced to the sites (DWNP, pers. comm.).

3.7.1 Tahan Hide (Tahan Saltlick)

Tahan hide is the most accessible hide, situated very close to the Park Headquarters and is within walking distance from the visitor facilities at the park headquarters (Figure 4). The hide overlooks an artificial saltlick and grass clearing with a constructed waterhole. Salt blocks are regularly put out in the middle of the clearing to attract animals such as sambar deer, barking deer and wild pig. Birds may also be seen in the clearing and the surrounding trees around the hide, especially in the morning and evening (pers. obs.).

Figure 4. View of Tahan saltlick from Tahan Hide, Taman Negara

3.7.2 Kumbang Hide (Kumbang Saltlick)

Kumbang Hide is the furthest hide from the park headquarters and can be reached by a 45-minute boat ride up the Sungai Tembeling (Tembeling River) followed by a one-hour walk. The most sought-after mammal that visits this saltlick is the Malayan tapir which is seen here quite regularly (including the author’s pers. observations). According to a Park officer, other mammals that are less commonly seen here include the Asian elephant and the black morph leopard (Panthera pardus). Mammals known to regularly visit this saltlick are sambar deer and barking deer. The Malay civet (Viverra tangalunga) is often seen below the hide looking for food (author’s pers. obs.). Several species of jungle rats visit the hide in search of food brought by visitors to the hide.
3.7.3 Blau Hide and Yong Hide (Blau and Yong Saltlicks)

Blau and Yong hides are situated quite close to each other and both are located long the tributary of Sungai Yong. Both of these hides are accessed by means of a 10-minute boat ride down Sungai Tembeling followed by an approximately 15-minute brisk walk. Sambar deer, barking deer and civets may be seen here. The Malayan tapir may also be seen here (including author’s pers. observation) but this mammal is uncommon.

3.7.4 Tabing Hide (Tabing Saltlick)

Tabing hide is located at a natural saltlick and can be accessed via an hour’s walk from Kuala Tahan (Figure 5). It is good to visit the hide during early morning as birdlife is very active around the hide during the early hours of the morning. This hide can also be reached by a 15-minute boat ride up Sungai Tahan followed by a 5-minute walk. Barking deer and wild pigs are regular visitors here, but the Malayan tapir is an uncommon visitor to the saltlick.

Figure 5. View of Tabing saltlick from Tabing Hide.

3.7.5 Designs of Existing Wildlife Hides at Taman Negara National Park

During the site visit at Taman Negara from 26 until 28 February 2005, it was learnt that all of the original wildlife hides have been replaced with new ones except for Tabing Hide. Two hides, Tahan and Tabing Hides, were visited to study their designs and structures. Tabing Hide was in the process of being replaced with a new hide, and was probably the only old hide still in use (Figure 6).
The new wildlife hides at Taman Negara except for Tahan Hide were more or less standardised in their structures, in that they were all designed to accommodate overnight visitors. All the hides were mostly constructed with wood and corrugated iron/zinc roofs. Only the landing and toilet areas were of thin concrete and overlaid with terrazzo tiles. The general design of the old hides (Tabing Hide) at Taman Negara is shown in Figure 6. A general view of the new Tahan hide at Taman Negara is shown in Figure 7.

**Figure 6.** General view of the back portion of Tabing Hide

**Figure 7.** General view of the back portion of the new Tahan Hide.
3.7.5 Basic Facilities at Wildlife Hides

The facilities in the hides are very basic and include three to four wooden double-bunk beds and a toilet for overnight visitors. Most of the hides were previously provided with mattresses, but these were taken out due to damp conditions in the hides. Presently, only the basic wooden bunk-beds are left in the hides. Bed sheets have to be hired and brought to the hides from the park headquarters. The toilet is located outside the hide and water for flushing is collected from rain water via the roof and gutters.

3.8 Records of Wildlife Sighted at Selected Hides

All the six wildlife hides at Taman Negara are known to be visited by wildlife during the course of the day and night, more so during the early hours of the morning. One of the hides, Kumbang Hide used to be provided with a log book for visitors to record wildlife they have observed at the saltlick. However, during the site visit to Taman Negara in February 2005, the log book could not be traced. It is very useful for a log book to be placed in a hide if a new hide is to be constructed at Sira Air Hangat saltlick in Ulu Muda.

3.9 Wildlife Recorded at Saltlicks at Taman Negara

Interviews and discussions with DWNP staff and visitors to Taman Negara were conducted to ascertain wildlife that has been seen at saltlicks in the park. Based on these interviews, the following list of wildlife was compiled:

- **Asian elephant** – Individuals and foot prints had been seen near Kumbang Hide saltlick but animals have not actually been seen at the saltlick itself.
- **Seladang** – used to visit grassy areas and saltlicks at Tabing and Tahan Hides in the 1950s to 1960s. The last known visit by this mammal at Tahan saltlick was in the 1970s. There was a recent report that a Seladang was seen at Kumbang Hide saltlick sometime in December or January 2005.
- **Malayan tapir** – frequently seen at some saltlicks and especially at Kumbang Hide.
- **Sambar deer** – frequently seen at most saltlicks including at the Tahan Hide.
- **Barking deer** – may be occasionally seen at some saltlicks.
- **Wild pig** – frequently seen at the Tahan Hide.
- **Leopard/black Panther (Panthera pardus)** – had been seen and photographed at Kumbang Hide in the daytime. A photo of the leopard used to hang in the former DWNP reception office at Kuala Tahan. According to a British tourist interviewed at the park on 28 February 2005, he had seen and startled a leopard while approaching near Kumbang Hide in the late afternoon. The leopard spotted below the hide and was apparently stalking some wild pigs drinking at the saltlick, when it was stumbled upon.
4. DISCUSSION

4.1 Limitations of Literature Review

The literature search revealed that most of the related information available mainly featured saltlicks and wildlife hides in nature tourism promotion and nature tourism sites in various countries throughout the world. An annotated bibliography of published papers, related literature and website articles on saltlicks and hides is provided in Appendix I.

There were very few scientific publications that were related directly to saltlick studies or management of saltlicks. Where saltlicks were mentioned in published papers, these were generally on mammals visiting saltlicks during the course of carrying studies on wildlife, or analyses of minerals in soil conducted in geological surveys. However, these related papers are useful as references on locations of saltlicks and their use in wildlife management and for nature tourism. For example, Jones (1970) provided valuable information on the various hot springs and saltlicks found in the Grik area, Upper Perak.

4.2 Importance of Saltlicks for Wildlife

Salt and minerals are crucial in the diet of mammals and wildlife for their health. Studies by Howard & Murphy (2003) in the USA has shown that during spring and early summer, deer experience a sodium deficiency due to high potassium and water content of the forage. This interferes with efficient sodium conversion in the body and increases the need for sodium intake. This makes deer seek out concentrated sodium sources such as natural and man-made saltlicks. During this period, saltlicks will attract deer of all ages and sexes. The University of Georgia study detected 11 different minerals in the Whitetail deer antlers. Apart from calcium (19.0%) and phosphorus (10.13%), the next two most common elements found were magnesium (1.09%) and sodium (0.50%). Lesser amounts of other minerals found included potassium, barium, iron, aluminium, zinc, strontium and manganese (Howard & Murphy, 2003).

Natural saltlicks, including mineral hot spring saltlicks, are undoubtedly very important to the survival of mammals and other wildlife. The literature review in this study shows that saltlicks have a crucial role in providing necessary minerals for many species of wildlife in their natural habitats. The study by Jones (1970) at the Gerik area in Upper Perak, showed that saltlicks have comparatively high contents of sodium, potassium, fluorine, chlorine and the carbonate radical (including bicarbonate). Similarly, data collected during the preliminary chemical analysis of water at Sira Air Hangat in this study indicated that calcium, magnesium and sulphur were present in relatively high concentrations.

The importance of saltlicks for wildlife conservation is also apparent from the many examples of wildlife which frequent saltlicks. At the Taman Negara National Park, many species of wildlife visit the natural and artificial saltlicks found there (DWNP, undated). At the Grik area, Jones (1970) recorded many saltlicks visited by wild animals. Mohd. Khan Momin Khan (1976) studied a herd of nine elephants which visited numerous saltlicks in the Upper Perak area. Stickland (1976) recorded three Sumatran rhinoceroses (Diceros bicornis sumatrensis) tracks leading to a saltlick in the Ulu Selama forest, Perak. In his study, Ebil Yusof (1981) discovered that herds of Seladang frequented saltlicks in Ulu Lepar, Pahang and in the Sungkai Game Reserve in Perak. Studies using camera traps and identification of wildlife tracks at the Deramakot Forest Reserve in Sabah (Sabah Wildlife Department website), revealed that 13 species of mammals including the Banteng (Bos javanicus) visit the saltlicks found there. Field observations made during this study found evidence of wildlife, including elephants, visiting Sira Air Hangat at the Ulu Muda Forest Reserve (see Table 4).

Based on the comparative chemical composition of soils by Jones (1970) and chemical analysis of water from hot springs and saltlicks in Grik, there is a possibility that most mineral saltlicks originated from hot springs. This transformation could be due to the process of evapotranspiration which is accelerated by relatively high temperatures from the hot springs (Jones, 1970). Hot spring
saltlicks are much less frequently encountered compared to “dry” saltlicks and this makes Sira Air Hangat especially important in terms of conservation.

### 4.3 Threats to Saltlicks

Natural saltlicks are important components of wildlife conservation areas. The conservation value of a forest is enhanced by the presence of natural saltlicks. This is due to the fact that many wild mammals and other wildlife are attracted to saltlicks to take mineral water and soils to supplement their dietary needs.

Although many known saltlicks are found in National Parks and wildlife reserves, for example in Taman Negara National Park and Krau Wildlife Reserve, many more can be found in Permanent Forest Estates (PFEs) managed by the Forestry Department. The majority of areas under PFEs are production forests where logging activities are carried out. In Peninsular Malaysia, provisions for the protection of saltlicks under the Protection of Wild Life Act 1972 are not applicable when parties authorised by State or Federal government undertake development projects (see Section 1.5.1). These development projects could arguably include logging and land-clearing activities which could severely damage or even totally destroy saltlicks.

Current logging practices claim to take into consideration the need for wildlife conservation. For example, Principle Six (Environmental Impact) of the Malaysian Criteria and Indicators for Forest Management Certification 2002 states that: “Forest management shall conserve biological diversity and its associated values, water resources, soils and unique and fragile ecosystems and landscapes, and by so doing, maintain the ecological functions and the integrity of the forest.” (MTCC, 2002). However, there is no specific mention of saltlicks in the document. Some logging concessionaires do take saltlicks into consideration when planning for their logging operations, as in the case of FMU14 in Sabah (Sinoh Environmental, 2005) where saltlicks are considered to be “sensitive areas” (ibid., pg. A1-41 of Annex 1), but no specific recommendations for protecting these sensitive areas were provided. Therefore, there is no guarantee that saltlicks in forest reserves are free from risk of disturbance and degradation during logging operations.

While Sira Air Hangat is protected under the provisions for saltlicks under the Protection of Wild Life Act 1972, Ulu Muda Forest Reserve where the saltlick is located does not enjoy the same legal protective status as a national park, a state park or a wildlife reserve. In the case of a national park, there is usually a single management authority which oversees all aspects of biodiversity protection including all flora and fauna found in the park and their habitats. Logging is also not allowed in a national or state park and there is greater legal security in that areas designated as a national or state park cannot easily be degazetted, as in the case of forest reserves.

Accessibility is another factor which poses a threat to many saltlicks, including Sira Air Hangat. Permission from the Kedah State Forestry Department is required in order to enter the Ulu Muda Forest Reserve but it is possible for poachers to enter illegally via boat from the KOPAM Jetty near Gubir and navigate up Sungai Muda to reach the many saltlicks in the forest reserve.

Natural saltlicks are valuable assets that may be proposed and promoted as nature tourism attractions where appropriate. However, their promotion has to be approached in a responsible manner. Ulu Muda Forest Reserve is now promoted as a nature tourism destination and its saltlicks are one of the main attractions. Currently, there are no guidelines to control the conduct of visitors at saltlicks and this is yet another threat to the saltlicks as these visitors are not always accompanied by enforcement officers from the Department of Wildlife and National Parks or from the State Forestry Department.

Many hot springs in Malaysia have been converted into recreational areas and modified into bathing pools so that visitors are able to benefit from the widely-believed curative properties of the hot springs. Hot springs that are still in their natural conditions, such as Sira Air Hangat are increasingly rare and should therefore be conserved.

Ideally saltlicks should be left in their original state for the benefit of wildlife that are dependant on them. However, most State governments in Malaysia still rely on natural resources for revenue and
there is tremendous pressure to exploit forest resources, mainly for timber. Nature tourism based on visitation to forested areas is increasingly seen as a viable compromise that would allow for economic activities while retaining forests in a relatively undisturbed state. Wildlife-watching is a major component of nature tourism and saltlicks offer perhaps the best opportunities for this. However, given the fact that very little is known about the ecology of saltlicks, any kind of tourism involving saltlicks should be approached with caution.

In view of the conservation importance of saltlicks and the various threats they face, recommendations for their better management and protection were formulated, as follows.

4.4 General Recommendations

4.4.1 Compilation of Data on Wildlife Species and Saltlicks

- A comprehensive survey needs to be carried out on the wildlife species that are known to visit saltlicks regularly, including if possible, their numbers. This is crucial in creating a database of animals that are dependant on the saltlick for mineral intake. Data on the conservation status of these species should be included, following the IUCN Red Data lists for endangered and threatened species. This is useful when there is a need to focus on flagship species for future efforts aimed at the conservation and management of saltlicks.

- Surveys and mapping of the vegetation and other features around a particular saltlick and animal trails in the area should be carried out. This will help to determine the extent of good or viable forest habitats that surround the saltlick, document the network of existing wildlife trails leading to the saltlick, and indicate if access by wildlife species to the saltlick is being hampered or disrupted. These data could also be used in deciding the alignment for an access trail, for recreation or tourism purposes, leading to a proposed wildlife hide at the saltlick, assuming that a hide is appropriate for the saltlick (see 4.4.5).

4.4.2 Creation of Wildlife-Sensitive Areas and Buffer Zones

- The core forest areas immediately around saltlicks, up to a radius of 400m, should be designated as wildlife-sensitive areas as there is considerable movement of wildlife species visiting the saltlicks. These areas are to be approached with caution. This 400m mark roughly correspond with the quarter-mile prohibition zone as specified in the Protection of Wildlife Act 1972.

- Activities should be restricted in the wildlife-sensitive areas, as these activities may disturb wildlife inhabiting the areas or wildlife which may want to visit the saltlick. These activities include starting fires, making noise, cooking, disturbing surrounding vegetation, digging, removal of the minerals and other activities that would render the saltlick unattractive or unsafe to any wild animal. In the case of Sira Air Hangat saltlick which is located very close to Sungai Muda, part of the river would be included in the wildlife-sensitive area. Boat travel along Sungai Muda in this wildlife-sensitive area has to be regulated, when boats approach close to the saltlick area.

- A generous buffer zone, encompassing the area just outside the wildlife-sensitive areas to a radius of 1 km from the saltlick, should be created to provide additional protection for animals that visit the saltlick. The buffer zones may be larger depending on the possible disturbance or threat facing the saltlicks. No intensive tourism activities and construction of permanent structures (except for wildlife-observation hides), should be allowed in the buffer zone. An example of a saltlick with a generous buffer zone, is the Kumbang saltlick

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* It is not known how the quarter-mile figure stated in the Protection of Wild Life Act 1972 was derived. No known in-depth studies have been carried out in Peninsular Malaysia to determine the optimum size for wildlife-sensitive zones and buffer zones. The figures provided here are only preliminary and based on the precautionary principle in the absence of hard scientific data.
and hide at Taman Negara National Park. The saltlick is located about 1.5 km from its access point at Kuala Trenggan and may only be reached via a 1-hour walk from Kuala Trenggan or a 4- to 6-hour walk from Kuala Tahan. With its natural “buffer zone” and undisturbed surroundings, many species of wildlife have been seen at this saltlick including the seladang, Malayan tapir and leopard.

4.4.3 Enforcement

- As natural saltlicks attract a large number of wildlife, these animals are bound to be exposed to various pressures and threats, such as poaching. All saltlicks in Peninsular Malaysia are protected by the Protection of Wild Life Act 1972. Therefore, these threats could be minimised through regular monitoring and enforcement by the DWNP. Unregulated entry into forest reserves and prohibited activities within these reserves could also be countered using the relevant provisions under the National Forestry Act 1984 enforced by the respective State Forestry Departments.

- Considering that forests still cover a large proportion of Malaysia’s land areas, local communities should be roped in to play a more significant role in monitoring and enforcement. In certain areas in Sarawak, selected members of local communities are conferred the status of honorary wildlife rangers who are supposed to work closely with enforcement officers in curbing incidences of illegal hunting and encroachment. This system should be studied in detail for possible implementation at the national level.

- The Forestry Department and the Department of Wildlife and National Parks should seriously consider carrying out joint enforcements in order to maximise the limited resources available for their enforcement activities. Currently, the Forestry Department focuses their efforts on enforcing the National Forestry Act 1984 and rarely, if ever, take action on offences related to wildlife.

4.4.4 Education and Information

- Notice boards and signposts with appropriate information should be put in place at various access points to the saltlicks and wildlife-sensitive areas. These notice boards are to inform visitors of the sensitive areas that they are approaching or entering, and of the do’s and don’ts. The information displayed should also include the protection status of the area (e.g. Forest Reserve, Wildlife Reserve, etc.), identity of the State or Federal authority administering these area and the laws governing the areas. These laws may include the National Forestry Act 1984 and Protection of Wild Life Act 1972 under the jurisdiction of the Forestry Department and Department of Wildlife and National Parks Department respectively.

- At the Ulu Muda FR, notice boards and posters should be put up at the main entry points such as the KOPAM jetty at Muda Lake near Gubir, and at the start of the old logging trail from Gulau to Kuala Lasor.

- Nature Interpretive Centres (NICs) or Nature Education Centres (NECs) can be established at main entry points to areas where saltlicks are found. These centres can play very practical and positive roles in educating locals and visitors on wildlife laws and protected wildlife species. At Ulu Muda FR a suitable location would be at the office of the Department of Wildlife and National Parks at Gubir.

- At Sira Air Hangat in Ulu Muda FR, notice boards and sign-posts should be erected at the general area and access points to the saltlick. These may include the access points from Sungai Muda and other overland access points situated within the wildlife-sensitive areas.

- Logbooks for recording details of wildlife observed at saltlicks should be a standard feature of wildlife observation hides. The data contained in such logbooks can be very useful for the purposes of biodiversity monitoring.
4.4.5 Nature Tourism

- Any kind of nature tourism, no matter how well-intentioned or well-managed, is bound to have some impacts on the natural environment. As such, the costs and benefits of introducing tourism at a saltlick should be weighed out first. It would not be advisable to introduce tourism at all saltlicks; only a handful of saltlicks should be opened for tourism and even then, some forms of control should be implemented. For example, a “closed” season lasting a few months each year could be enforced so that saltlicks are not overly stressed. Another control measure is the introduction of a rotation system so that no one saltlick would experience continuous visitation. This could also increase the chances for the visitor to observe wildlife as some wildlife species are known to avoid a particular location if they detect recent human presence.

- As the Ulu Muda FR has a very high potential for tourism but is vulnerable to a range of pressures and threats, only sustainable nature tourism should be encouraged and promoted by the relevant authorities. The natural saltlicks in Ulu Muda are prime locations where tourists may observe wildlife in specially constructed wildlife-observation hides. Regular visits by tourists to observation hides would generate revenue for the State authorities and agencies as well as enable monitoring of saltlicks on a long-term basis.

- Data on visitors to the saltlicks at Ulu Muda FR should be compiled by the Kedah Forestry Department and analysed. Currently, visitors are required to obtain entry permits from District Forest Officer of Kedah Tengah based at Sungai Petani.

- Sira Air Hangat is one of the areas where a wildlife-observation hide could be built for tourists to observe wildlife in their natural habitat. However, wildlife hides should be properly sited and carefully constructed based on appropriate designs and using appropriate materials (see Section 4.5).

4.5 Proposed Specifications for the Design and Construction of a Wildlife Observation Hide at Sira Air Hangat

Presently, there is an old observation hide at Sira Air Hangat which may have been poorly designed and is now in a dilapidated condition (see Figure 8). If a new wildlife hide is to be built at Sira Air Hangat, the suggested specifications for the design and construction of the hide are as follows.

Figure 8. A view of the old hide (partly hidden, top centre) at Sira Air Hangat
4.5.1 Location, Orientation and Measurements of the Hide

The existing hide is located to the right of the bottom edge of the saltlick (see Figure 9). The location of the new hide is proposed at the middle of the bottom edge of the saltlick; approximately 10 m left of the old hide. This recommendation takes into consideration the orientation of existing animal trails in the areas surrounding the saltlick. The new location would also provide observers with a better view of the whole length of the saltlick, and enable a wider coverage towards the front, far left and far right sides of the saltlick.

4.5.2 Orientation of the Hide

For practical reasons, the front of the hide should be positioned with the viewing area towards the centre of the saltlick, with two windows opening to the left and right of the hide. This would enable observers to observe wildlife that may be below and at the sides of the hide, and thus maximise observations.
4.5.3 Proposed Design, Construction Materials and Estimated Cost

A wildlife observation hide should ideally be built at an elevated height to allow maximum angles in the observation of wildlife visiting saltlicks. For this purpose, the hide should be built on strong stilt supports with a very stable base. Good examples of observation hides can be found in the Taman Negara National Park where wildlife observation has been successful for many years. These hides can cater for relatively small groups of visitors of up to about seven people.

The proposed basic design specifications and suggested materials for a wildlife observation hide at Sira Air Hangat saltlick are shown in Table 2.
Table 2. Suggested specifications, measurements and construction materials for a hide at Sira Air Hangat

<table>
<thead>
<tr>
<th>Proposed specifications for construction of the hide</th>
<th>Amount</th>
<th>Height</th>
<th>Suggested materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main wooden stilt support for hide</td>
<td>4</td>
<td>5 m (16.6 ft.)</td>
<td>Heavy hardwood or treated wood.</td>
</tr>
<tr>
<td>Concrete base for stilt support</td>
<td>4</td>
<td>75 cm (2.6 ft.)</td>
<td>Cement mix</td>
</tr>
<tr>
<td>Concrete flooring</td>
<td></td>
<td></td>
<td>Cement mix</td>
</tr>
<tr>
<td>Wooden ladder-staircase (A)</td>
<td></td>
<td></td>
<td>Heavy hardwood or treated wood</td>
</tr>
<tr>
<td>Alternative 2-tier wooden staircase (B)</td>
<td></td>
<td></td>
<td>Heavy hardwood or treated wood</td>
</tr>
<tr>
<td>Walls of hide</td>
<td></td>
<td>3 m</td>
<td>Treated wood</td>
</tr>
<tr>
<td>Roofing latticework</td>
<td></td>
<td></td>
<td>Treated wood</td>
</tr>
<tr>
<td>Roofing</td>
<td></td>
<td></td>
<td>Metal or concrete tiles</td>
</tr>
</tbody>
</table>

The estimated cost for the construction of the hide is shown in Table 3.

Table 3. Estimated cost for the construction of a wildlife observation hide

<table>
<thead>
<tr>
<th>Item</th>
<th>Application</th>
<th>Estimated cost (RM)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction materials</td>
<td>hide</td>
<td>30,000.00</td>
<td>Including transport of materials to site and labour</td>
</tr>
<tr>
<td>Skilled craftsman</td>
<td>manpower</td>
<td>8,750.00</td>
<td>5 skilled craftsmen x RM 250 p/day p/p x 7 days</td>
</tr>
<tr>
<td>Architect’s fees, permits, processing fees, etc</td>
<td>consultancy</td>
<td>10,000.00</td>
<td>Including plan, design, etc.</td>
</tr>
<tr>
<td>Total estimated cost</td>
<td></td>
<td>48,750.00</td>
<td></td>
</tr>
</tbody>
</table>

The proposed design specifications for the hide’s front view and back view are shown in Appendix III and Appendix IV respectively. The proposed design specifications for the hide’s plan and suggested layout are shown in Appendix V.

4.5.4 Main Specifications for the Construction of a Hide

- Height of hide and main stilt supporting the hide: 5 m (c16.6 ft.) – the height of the hide should be adequate to observe wildlife above the trees surrounding the hide. Elevation may also reduce the risk of animals sensing human presence.
- Length of hide: 5 m (c16.6 ft.) – the length of the hide is long enough to accommodate at least 6 single bunk-beds and an observation bench.
• Flooring in the hide is to be thin concrete – this is to avoid wear and tear to the floor and avoid excessive noise when visitors are in the hide. Wooden flooring may be too noisy and may be susceptible to fire hazards.

• Roofing material for the hide should be of a durable tile material to ensure long-term use and protection from rain.

• Height of the walls: 3 m – this is to promote good air-circulation in the hide.

• Staircase – the main staircase proposed is a ladder staircase that climbs straight to the hide (Appendix III). As an alternative a 2-level staircase may be built, if the ladder staircase proves too steep to climb.

• Concrete columns support for stilts – the four main wooden support frames are to be embedded in concrete column bases to ensure stability of the stilts (Appendix V). The columns are to be buried underground to give added support to the hide.

**Note:** The above are only suggested specifications. Accurate measurements and details of the concrete columns and concrete flooring must be according to a qualified engineer’s or architect’s specifications and advice.
References


APPENDIX I:
A Preliminary Water Quality Analysis of Sira Air Hangat, Ulu Muda

Review of Previous Studies at Other Natural Saltlicks

Geothermal streams (including what are commonly referred to as hot springs) occur when the water, or part of it, originates from a subterranean aquifer whereby the heat source is telluric. They are associated with faulting where water can often percolate to greater than usual depths. These streams differ in many physical, chemical and biological aspects from generalised rivers (Castenholtz & Wickstrom, 1975).

Jones (1970) recorded two hot springs at Kampung Ayer Panas and Kampung Sira both near Grik, Perak and provided results of mineral content analyses of these two hot springs (Table A-1). The waters of the two hot springs were clear and sparkling and had a pH of 7.00. The hot spring water at Kampung Ayer Panas had a slight sulphurous smell and taste, with a temperature of 62 °C. This hotspring was located southwest of Grik and originated from bedded tuff (geological formation composed of compressed volcanic ash).

The hot spring of Kampung Ayer Panas was considered more saline than Kampung Sira. This was due to the higher quantities of sodium (Na) and chlorine (Cl) found in the hot spring of Kampung Ayer Panas. The analysis showed comparatively high contents of sodium, potassium, fluorine, chlorine and the carbonate radical (including bicarbonate). According to Brady (1988), most of the chlorine in soils occurs in the form of chloride ion, which leaches rather freely from humid region soils. Chlorine is considered the most soluble anion and is also added to soils in considerable quantities through rainwater.


<table>
<thead>
<tr>
<th>Mineral composition</th>
<th>Parts per million (equivalent to mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kampung Ayer Panas (southwest of Grik)</td>
</tr>
<tr>
<td>Fe (total)</td>
<td>0.02</td>
</tr>
<tr>
<td>Mn</td>
<td>nil</td>
</tr>
<tr>
<td>Ca</td>
<td>4.00</td>
</tr>
<tr>
<td>Mg</td>
<td>0.20</td>
</tr>
<tr>
<td>Na</td>
<td>95.00</td>
</tr>
<tr>
<td>K</td>
<td>4.50</td>
</tr>
<tr>
<td>HCO₃</td>
<td>115.50</td>
</tr>
<tr>
<td>CO₃</td>
<td>19.00</td>
</tr>
<tr>
<td>SO₄</td>
<td>0.30</td>
</tr>
<tr>
<td>Cl</td>
<td>9.20</td>
</tr>
<tr>
<td>F</td>
<td>15.00</td>
</tr>
<tr>
<td>NO₃</td>
<td>nil</td>
</tr>
<tr>
<td>Total residue after evaporation at 108°C</td>
<td>334.00</td>
</tr>
<tr>
<td>Total hardness as CACO₃</td>
<td>334.00</td>
</tr>
</tbody>
</table>
The hot spring at Kampung Sira, near Bersia, emanated directly into Sungai Lebey (1970). Due to this, the exact temperature of the thermal water was not confirmed and the analysis in Table A-1 was regarded as only approximate. The higher calcium content was probably derived from limestone which occurred in the immediate area (Jones, 1970).

Roe (1951) in Jones (1970) gave probable compositions of mineral contents in the hot spring waters of north Selangor (probably Rawang hot springs) as CaCO₃, MgCO₃, Fe(Al)CO₄, (KNa)HCO₃, and SiO₂.

For comparison purposes, Jones (1970) showed analyses of soil samples collected from the Ayer Chepam (Air Chepam) saltlick, the hot spring from Grik, and another sample taken at a point some distance from both these locations. The chemical analyses of the seven soil samples are shown in Table A-2. The analyses showed the soils of the saltlicks to be richer in alkalis than the normal soil. This was indicated in particular by relatively higher contents of Al₂O₃, Na₂O and K₂O in soils of saltlicks.

Results from a study by Juday (1998) conducted at the Big Windy Creek Hot Springs in the USA indicated that soils at a geothermal site had a higher pH and calcium level compared to a saltlick not associated with a hot spring.

According to Jones (1970), it was possible that heavy concentration of mineral salts in the saltlicks were deposited from thermal seepages formerly active at the sample locations. Animals were probably attracted to the saltlicks, and to the hot-spring at Sungai Kenering, due to the concentrations of soda (sodium carbonate, Na₂CO₃) and potash (potassium oxide, K₂O).

Based on the comparative chemical composition of soils by Jones (1970) and chemical analysis of water from hot springs and saltlicks in Grik, there is a possible link between the formation of saltlicks to hot springs. This could be due to the process of evapotranspiration which is accelerated by high temperatures from the hot springs.

Observations at Big Windy Hot Springs in Alaska by Keith and Foster (1979) concluded that the gradual accumulation of mineral precipitate, in the long run, constricted the flow of hot water from specific individual vents while forcing hot water to emerge at other vents, either new or re-activated. The occurrence of dormant vents containing decomposing mineral precipitate crusts in addition to an absence of live mats of high temperature-dependent algae and bacteria were evidence of this redirected flow.
Table A-2. Chemical analysis of soils taken from the saltlick, hot spring and a neutral location from Grik, Perak (after Jones, 1970).

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Sample percentages (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Saltlick</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>3.23</td>
</tr>
<tr>
<td>Al₂O₃</td>
<td>16.10</td>
</tr>
<tr>
<td>CaO</td>
<td>0.33</td>
</tr>
<tr>
<td>MgO</td>
<td>0.52</td>
</tr>
<tr>
<td>Na₂O</td>
<td>2.25</td>
</tr>
<tr>
<td>K₂O</td>
<td>6.10</td>
</tr>
<tr>
<td>Cl</td>
<td>0.04</td>
</tr>
<tr>
<td>SO₄</td>
<td>0.01</td>
</tr>
<tr>
<td>CO₂</td>
<td>0.03</td>
</tr>
<tr>
<td>H₂O⁺</td>
<td>3.10</td>
</tr>
<tr>
<td>H₂O</td>
<td>1.76</td>
</tr>
<tr>
<td>Loss on ignition</td>
<td>4.98</td>
</tr>
</tbody>
</table>

Key:
Specimen A: from saltlick Ayer Chepam
Specimen B: from saltlick Ayer Chepam
Specimen C: from near saltlick, Ayer Chepam
Specimen D: 3/4 mile away from saltlick, Kuala Ayer Chepam
Specimen E: from stream bank near Grik hot-spring
Specimen F: from adjacent to Grik hot-spring
Specimen G: from floor of Grik hot-spring

Methodology

Due to the rapid nature of the field survey at Ulu Muda Forest Reserve, only a preliminary water quality analysis was carried out at Sira Air Hangat, with only a few parameters measured.

In situ water quality parameters were measured at three sites at the location of Sira Air Hangat. The equipment and test kits used, with their related parameters, are shown in Table A-3.

Table A-3. Equipment and test kits used in the samplings and the parameters investigated

<table>
<thead>
<tr>
<th>No.</th>
<th>Equipment / Test Kit</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>YSI Model 85 Handheld System</td>
<td>Oxygen, conductivity, salinity and temperature.</td>
</tr>
<tr>
<td>2.</td>
<td>Hach 2100P Turbidimeter</td>
<td>Turbidity.</td>
</tr>
<tr>
<td>4.</td>
<td>Aquacheck Select Test Strips</td>
<td>Total hardness, pH, total alkalinity.</td>
</tr>
</tbody>
</table>
Three sampling sites were chosen at Sira Air Hangat (see Figure A-1). The descriptions for each site are provided below.

**Figure A-1.** Diagram showing Sira Air Hangat and its main physical features.

**Sampling Site 1**

At Sampling Site 1, the shallow stream at this location had a series of small pools (see Figure A-2). Small fish were found in the bigger pools while some sections of very shallow beds had high growth of various types of algae. A strong smell of sulphur was detected in the atmosphere.
**Sampling Site 2**

Sampling Site 2 was located downstream of Site 1. Here, the stream was fringed by shrubs and overhanging canopy of trees on one side of the banks (Figure A-3). On the opposite side was an open area with elephant footprints and dung on the bank. Vapour emanated from some sections of the stream and smell of sulphur was more prevalent. Algae growth was observed as dark green and orange filamentous mats on the streambed particularly along the water fringe.

**Sampling Site 3**

Sampling Site 3 was located near the confluence of the small stream that emerged from the hot spring, and Sungai Muda (see Figure A-4). Here, the stream meandered across a sandy strip
(measuring about 5m wide) along the bank of Sungai Muda. The surrounding area was relatively open with a section of grassy bank and shrubs. Mats of green algae growth were observed on the streambed. A very faint smell of hydrogen sulphide could be detected.

Figure A-4. General view of Sampling Site 3

Results and Discussion

The physical and chemical parameters measured for the three sites are shown in Table A-4.

Temperature

The temperature of all three sites was relatively high, ranging between 41.5 °C and 60.3 °C. As a comparison, the stream temperatures recorded by Mohd. Kamil et al. (2005) along Sg. Lasor at Ulu Muda, upstream of Sira Ayer Hangat, ranged between 23.3 °C and 25.7 °C.

Dissolved Oxygen

In general, concentration of dissolved oxygen is inversely correlated to water temperature. However, dissolved oxygen could not be measured because the main display of the YSI Model 85 Meter read "OVEr" for dissolved oxygen. The high temperature affected the measurement of dissolved oxygen, resulting in an error message in the equipment, which occurred when the dissolved oxygen temperature is >46°C. Dissolved oxygen parameter recorded during the earlier-mentioned study by Mohd. Kamil et al. (2005) ranged between 6.23 and 7.86 mg/L. Under average stream conditions, 5 mg/L dissolved oxygen is required for fish fauna.

Conductivity

Conductivity indicates the total content of electrolytes present and is usually taken as an index of dissolved salts without regard to temperature. Specific conductivity is also referred to as temperature-compensated conductivity. It automatically adjusts the reading to a calculated value which would have been read if the sample had been at 25°C.

Conductivity for the three sites sampled during this study ranged from 3.1 to 4.9 μS. This was higher than the average of 0.13μS recorded by Mohd. Kamil et al. (2005) for 16 sampling sites along Sg. Lasor at Ulu Muda.
Salinity

Salinity for the stations was very low, ranging from 0.0 ppt to 0.1 ppt, which is typical of freshwater rivers. This is in contrast with observations by Jones (1970) who noted that both the hot springs of Kampung Ayer Panas and Kampung Sira were saline. The sampling sites at Sira Air Hangat were located downstream from the confluence of a cold, freshwater stream with the thermal stream. Therefore, a dilution effect may have resulted in the low salinity reading.

Table A-4. Physical and chemical parameters measured for three sampling sites at Sira Air Hangat

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width of stream (m)</td>
<td>1.0 - 2.5</td>
<td>1.5 - 2.0</td>
<td>1-1.5</td>
</tr>
<tr>
<td>Depth of stream (m)</td>
<td>0.20 - 0.30</td>
<td>0.15 - 0.25</td>
<td>0.15-0.20</td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>41.5</td>
<td>60.3</td>
<td>49.1</td>
</tr>
<tr>
<td>Dissolved oxygen (mg/L)</td>
<td>OVEr</td>
<td>OVEr</td>
<td>OVEr</td>
</tr>
<tr>
<td>Conductivity (μS)</td>
<td>3.2</td>
<td>3.1</td>
<td>4.9</td>
</tr>
<tr>
<td>Specific conductivity (μS)</td>
<td>2.7</td>
<td>2.4</td>
<td>3.5</td>
</tr>
<tr>
<td>Salinity (ppt)</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>0.67</td>
<td>0.55</td>
<td>0.37</td>
</tr>
<tr>
<td>Hydrogen sulphide (mg/L)</td>
<td>0.5</td>
<td>0.5</td>
<td>0</td>
</tr>
<tr>
<td>Total hardness (mg/L)</td>
<td>100</td>
<td>250</td>
<td>100</td>
</tr>
<tr>
<td>PH</td>
<td>8.4</td>
<td>8.4</td>
<td>8.4</td>
</tr>
<tr>
<td>Total alkalinity (mg/L)</td>
<td>180</td>
<td>240</td>
<td>240</td>
</tr>
</tbody>
</table>

Turbidity

Turbidity is caused by colloidal suspension of sediment, precipitates and other small particles. High turbidity of water prevents light penetration and inhibits growth of organisms. Turbidity for the sites, which ranged between 0.37 to 0.67 NTU, was very low compared to results obtained elsewhere in Ulu Muda. For example, turbidity ranged from 14 to 36 NTU within the Sungai Teliang Catchment and 19 to 65 NTU in the Sungai Muda Catchment (Anon., 2002).

pH

Alkalinity (pH) is a measure of the concentration of hydrogen ions, hence the strength and amount of acid present. The main source of hydrogen ions in natural waters is carbonic acid. The pH value for all the sites sampled was very high, at 8.4, indicating that the geothermal stream was alkaline. Alkalinity is caused primarily by bicarbonates and hydroxides. High alkalinity is usually associated with high pH, hardness and dissolved solids.

According to Castenholtz and Wickstrom (1975), there is much higher mineral content in geothermal streams as compare to non-thermal streams. This is because the hot water has greater capacity to leach minerals from the wall rocks and carry these in solutions. Therefore, it is often enriched in normally rare constituents, and may stand far higher or lower in pH than the usual 6-8 range of non-thermal streams.

The geology of the Ulu Muda Forest Reserve comprised igneous and four types of sedimentary rocks (Kamal & Che Aziz, 2005). The igneous rock consists of granites which are coarse while some are porphyritic. The composition ranged from alkaline granite to adamelite and also granodiorite. Due to the alkaline nature of the granite, the pH of the hot spring is also alkaline.
Sulphide
Sulphide (H₂S, HS⁻, S⁻) is one of the highly-enriched solutes in some hot springs. Due to the diffusive loss of hydrogen sulphide gas, it is the most easily noticed. In fact, the odour in the air can be detected at a concentration of 0.002 mg/L (Castenholtz and Wickstrom, 1975)

Hardness
In most waters, hardness is due to the calcium and magnesium content. Waters of hardness up to 60 mg/L are considered to be soft, 61 to 120 mg/L moderately hard, 121 to 180 mg/L hard and more than 180 mg/L very hard (Florida Geological Survey, 1997). Therefore, water samples from Site 1 and Site 3 were considered moderately hard while Site 2 is very hard.

Suggestions for Additional Parameters
Due to the rapid nature of this assessment, only certain parameters of water quality at Sira Air Hangat were measured. Additional parameters that could be considered in future studies include ammoniacal nitrogen. This includes nitrogen in the form of NH₃ and NH₄⁺. It is found in very low concentrations in many waters. Toxicity of ammoniacal nitrogen is found in waters carrying sewage and other organic wastes. Toxicity of ammoniacal nitrogen to fish is dictated by the pH of water. For example, 2.5 mg/L ammoniacal nitrogen is harmful in the pH range of 7.4 to 8.5. Presence of ammoniacal nitrogen in surface or groundwater indicates organic pollution. However, waters from hot springs may naturally contain high concentrations. Other parameters include levels of calcium and magnesium. This is because hardness in water is attributed to calcium and magnesium content. The sodium and chloride contents could be measured to verify the salinity of water at Sira Air Hangat and the occurrence of dilution effects from the cold stream.

Conclusion
Many hot springs in Malaysia have been converted into recreational areas and modified into man-made pools so that visitors are able to benefit from the curative properties of the hot springs. Therefore, hot springs that are still in their natural condition, such as the one found at Sira Air Hangat should be conserved.
APPENDIX II:
Annotated Bibliography of Published Literature and Websites related to Saltlicks.

Published literature:


Abstract: While sodium (Na) is likely the element sought at mineral licks, little is known regarding the influence of other minerals [e.g., sulfur, (S); calcium, (Ca); magnesium, (Mg)] in attracting white-tailed deer (*Odocoileus virginianus*). To determine whether deer display a preference for minerals when visiting licks, we monitored visitation rates with remote-triggered cameras. We recorded a total of 620 deer-visits to licks (i.e., natural seep, salt, mineral mix) in southern Indiana between April and September of 1999. Females preferred mineral licks in the spring and saltlicks in the summer. Males preferred saltlicks in the summer. In areas where mineral concentration of forage is below dietary requirements, the presence of artificial licks may ameliorate potential negative impact of mineral demand on antlerogenesis and lactation.


Notes on the sighting of a herd of 14 seladangs (*Bos gaurus*) at the Tahan Hide saltlick over a four-day period in April 1966, at Taman Negara National Park, Malaysia. A photo of the seladangs was also depicted. Also mentions sighting of two Malayan tapirs at the Kumbang Hide (Jenut Trenggan) near Kuala Trenggan.


A pair of marbled cat (*Pardofelis marmorata*) was observed walking in a large (100 x 50 m) saltlick and was photographed by Narong Suwannarong at the Phu Khieo Wildlife Sanctuary. According to authors, the saltlick situated in primary hill evergreen forest habitat was also frequented daily by seladangs.


A herd of 9 elephants (*Elephas maximus*) studied over a period of 5 years, was known to visit several saltlicks namely Sira Chepam and Sira Kulim and about 20 other saltlicks in the area


A survey of Malay tapir density was carried out at Taratak village near Padang, West Sumatra. In the surveys of four habitats, 63 % of tapir tracks were found near saltlick habitat compared to 22 % in secondary forest, and 15 % in primary forest. This finding shows that saltlicks habitats appear to be important for Malay tapir in the study area.


BD-IN-A-016; BD-IN-A-017. (details of paper not available online)
Source: TReeS-Peru Library (September ’03)
URL: http://www.geocities.com/treesperu/Library.doc.


In the article two photos were depicted of seladang (Bos gaurus) feeding in clearings at Taman Negara NP. One photo showed seladangs in an open clearing with a sandy patch in the middle which may have been a man-made(?) saltlick.


The author mentions that while working in Ulu Selama, Perak, he observed the tracks of three different rhinoceroses leading to a saltlick, although the name of the saltlick was not mentioned.

Websites:

MALAYSIA
Malayan tapir at saltlicks.
Malayan tapir are described as solitary animals that behave aggressively towards each other when they meet. However, recent observations of tapirs at saltlicks in Malaysia indicate that this is not entirely true. Instead there may exist a hierarchy among the animals and that they are fully able to co-exist at the saltlicks without any signs of overt aggression.
Source: Copenhagen Zoo website.
Website: http://www.malaytapir.org/eco.htm

Perak
Bintang Range forest, Perak.
Article featuring a Sumatran rhinoceros seen at a saltlick at the forest in the Bintang Range, Perak. According to an assistant forest warden of Belum Valley who is an ex-staff of the Department of Wildlife & National Parks, he managed to observe and take photos of Sumatran Rhinoceroses at the saltlick
Source: Driven by passion for wildlife: The Star Online - 30 December 2001
Website: http://thestar.com.my/

Pahang
Krau Wildlife Reserve, Pahang.
At Krau Wildlife Reserve, it was found that tapirs seem to visit saltlicks significantly more often than other animals, often visiting a lick 2-3 times a week.
Source: IUCN Tapir Specialist Group, Draft 2004 IUCN Red List for *Tapirus indicus* (Desmarest, 1819)

Krau Wildlife Reserve, Pahang.
Article on researcher who caught a Malayan tapir for radio-collar monitoring at the Wan Bulan saltlick, in the Krau Wildlife Reserve, Pahang.
Source: Raising the tapir’s profile: The Star Online – 16 September 2003
Website: http://thestar.com.my/

**Sabah**

Deramakot Forest Reserve, Sabah.
Surveys at Deramakot FR and camera-trapping revealed that many mammals visited the saltlicks in this area. The mammals recorded by camera-trapping and identified by hoof prints and droppings included Asian elephant, tembadau (or banteng), sambar deer (*Cervus unicolor*) bearded pig (*Sus scrofa*), greater mouse deer (*Tragulus napu*), clouded leopard (*Neofelis nebulosa*), leopard cat (*Prionailurus bengalensis*), wild boar, Malay badger (*Mydaus javanensis*), barking deer (*Muntiacus muntjak*), orangutan (*Pongo pygmeus*), sun bear (*Helarctos malayanus*) and Malay civet (*Viverra tangalunga*). Water and soil samples collected at the saltlicks and analysed were found to contain high amounts of Ca, Mg, Na and K.
Source: Sabah Wildlife Department website:
URL: http://www.deramakot.sabah.gov.my/wildlife.htm

**Sarawak**

Loagan Bunut National Park, NE Sarawak.
A saltlick was discovered about 100 m from the park’s headquarters during an expedition. An old hunting platform was also found on a tree overlooking the saltlick.
Source: All Malaysia Info – Star Publications (M) Sdn. Bhd.

**LAOS**

URL: http://wcs-old.atlasworks.com/home/wild/Asia/laos/laoslibrary.

**Information from Tourism Websites Promoting Saltlicks and Wildlife Lodges near Saltlicks:**

**MALAYSIA**

*Taman Negara National Park, Pahang*

The world famous park features several hides and overnight facilities with wildlife observation at saltlicks at Tahan, Tabing, Belau and Kumbang hides. Information provided by the Malaysian Tourism Promotion Board.
Website: http://www.asia-planet.com/
Ulu Muda Forest Reserve, Kedah

Feature in a web travel guide, mentions that there are well-trodden tracks made by elephants and rhinoceros visiting favourite saltlicks or bathing pools. A number of saltlicks and hot mineral springs scattered around are important sources of mineral and vitamin supplements and are frequented by a variety of wildlife. Sira Hangat is also said to be possibly the largest mineral spring in Malaysia.

Source: Journey Malaysia website
URL: http://www.journeymalaysia.com

Bersia Grazing Reserve, Grik, Perak

The Bersia Grazing Reserve, run by farmers of Kampung Bersia, offers facilities for experiencing life in traditional farmer’s hut surrounded by tropical virgin jungle, cattle grazing reserve and the dammed-up Perak River. This is a relatively unknown and little-visited area of Grik with surrounded by tropical rain forests, rivers, fish spawning grounds and flora and fauna. The website also mentions that there are “numerous saltlicks” found in this area. The Bersia Grazing Reserve with an area of 300 hectares could only be reached by boat from Kg. Bersia, 15 km from Grik along the East-West Highway via a 30 minutes boat ride along the dam-flooded Perak River.

Website: 1998-2003 TourMalaysia / Impressions Holiday for agro-based tourism

THAILAND

Khao Yai National Park

Khao Yai National Park was established in 1961, the oldest national park in Thailand; it covers 2,172 sq km and includes one of the largest intact monsoon forests in mainland Asia. Grasslands in the park do not provide enough minerals for the animals so they must supplement their diet from saltlicks. The minerals in a saltlick depend on its location. Wild elephants, which reside some 200 to 300 within the park boundaries, are sometimes spotted at saltlicks. This is Thailand's third largest National Park and is located within the Dongrek Mountain Range with altitudinal ranges from 200 to 1,351m above sea level. Considered by many park experts to be among the world's best national parks, Khao Yai was recently designated an Association for South East Asian Nations (ASEAN) National Heritage Site and has been nominated for international status by the United Nations.

Source: Geocities, Japan. Silk Road/Thailand/Khao Yai National Park
URL: http://www.geocities.co.jp/SilkRoad-Oasis/2701/thai/KhaoYaiTxt.htm

INDIA

Bandipur Tiger Reserve

Bandipur Tiger Reserve situated in Mysore District, Karnataka State, India was among the first nine Tiger Reserves created in India at the launch of Project Tiger in 1973. It is contiguous with Madhumalai Wildlife Sanctuary in Tamil Nadu state to the south and Wynad Wildlife Sanctuary in Kerala state to the south-west. To the north-west lies Nagarhole National Park. The main species of wildlife found here are tiger (Panthera tigris), leopard, elephant, gaur, sambar deer, spotted deer (Axis axis), sloth bear (Melursus ursinus), mousedeer (Tragulus spp.), wild dog (Cuon alpinus) and four-horned Antelope (Tetracerus quadricornis). There are a few natural and artificial saltlicks available in the Reserve and are being regularly used by the wild animals. This park is part of the Nilgiri Biosphere Reserve - the first 'Biosphere Reserve' of India. A Sanctuary of 90 km² area was created in Bandipur Reserve Forest in 1931. Venugopala Wildlife Park was constituted in 1941, extending over 800 km². Bandipur Tiger reserve was formed by including most of the forest area of the then Venugopala Wildlife Park in the year 1973 and named Bandipur National Park. All the forests included in the Reserve are reserved forests notified prior to independence. Notification for the proposed Bandipur National Park was issued in 1985.
AFRICA

Aberdare National Park

The Aberdare National Park in the Aberdare Mountain range, Kenya, situated at an altitude of 1,825-3,995 m, is known for its mountain vegetation, scenic views, waterfalls and the rare Bongo in addition to other wildlife. It was created in 1950 and has an area of 770 km². The park has elevated mountain lodges built near watering holes and saltlicks, which also serve as wildlife observation “hides” in the park. In the evening waterholes and saltlicks near the lodges attract wildlife such as elephant, buffalo, lion and rhino that are drawn to the saltlick, offering excellent night game-viewing.


Tsavo West National Park, Kenya

The Salt Lick Lodge is located on the outskirts of Tsavo West National Park, Kenya. This is a unique lodge built on stilts overlooking a waterhole and game sanctuary. Its name is taken from its setting - a natural saltlick which was a congregating place for the area's salt-hungry mammals. More than 50 species of mammals, including elephants, buffalos, lions and cheetahs are found in this area including almost 300 species of birds. Both local and international tourists frequent the lodge, due to its close proximity to the Indian Ocean and Mombasa town.

Source: 2001-2005 African Mecca Inc. website
Website http://www.africanmeccasafaris.com/kenya/safaris/lodges/saltlicklodge.asp

SOUTH AMERICA

Manu National Park, Peru

Wildlife saltlicks are included in tour itineraries as areas of interest to visit for the possibility of observing mammals such as tapirs and other wildlife.

APPENDIX III:
Diagram of a Proposed Design for a Wildlife Observation Hide
Showing the Front View of the Hide and Proposed Measurements

Concrete tile roof

Open observation space

Concrete / wooden floor

Main wooden stilt support

Concrete column base

3 m

5 m

5 m
APPENDIX IV:
Diagram of a Proposed Wildlife Observation Hide Showing the Back View and Optional Staircases.
APPENDIX V:
Diagram Showing the Proposed Plan of a Wildlife Observation Hide and Layout of Basic Facilities

- Concrete columns
- Front side of hide
- Landing
- Single bunk beds
- ‘Ladder’ staircase
- Door
- Wildlife observation bench (L = 2 m)
- Single bunk beds
- Back of hide
- Toilet w/c
- 3 m
During the site visit to Sira Air Hangat from 15 to 17 March 2005, some birds were recorded on a casual and opportunistic basis at the Ulu Muda Forest Reserve. Not many birds were recorded during the 3-day period and this was probably due to the prolonged dry spell in the Ulu Muda area.

A total of 61 species of birds were recorded during the short period. From this total, 21 species of birds have not been recorded before by other observers in previous bird surveys, in a list compiled by Noramly and Lim (2002). The low number of species does not reflect the actual diversity of birds at Ulu Muda Forest Reserve during that period, as the survey was not concentrated on birds. A higher number of species may have been recorded if an actual bird survey was carried out. However, the long dry spell experienced at the Ulu Muda area may have affected the number of birds recorded and not many birds were calling in the morning and evening in the forest area.

**Key**

Species listed in **bold** text are those that have presumably not been recorded in previous surveys, as mentioned in the bird checklist by Noramly and Lim (2002).


<table>
<thead>
<tr>
<th>No.</th>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>Malayan Peacock Pheasant</strong></td>
<td><em>Polypelectron malacense</em></td>
<td>Forest</td>
</tr>
<tr>
<td>2.</td>
<td>Great Argus</td>
<td><em>Argusianus argus</em></td>
<td>Forest</td>
</tr>
<tr>
<td>3.</td>
<td><strong>White-bellied Woodpecker</strong></td>
<td><em>Dryocopus javensis</em></td>
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<td>Great Slaty Woodpecker</td>
<td><em>Mulleripicus pulverulentus</em></td>
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<td>5.</td>
<td>Blue-eared Barbet</td>
<td><em>Megalaima australis</em></td>
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<td>6.</td>
<td>Oriental Pied Hornbill</td>
<td><em>Anthracoceros albirostris</em></td>
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<td>7.</td>
<td>Rhinoceros Hornbill</td>
<td><em>Buceros rhinoceros</em></td>
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<td>8.</td>
<td>Helmed Hornbill</td>
<td><em>Buceros vigil</em></td>
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<td>9.</td>
<td>Bushy-crested Hornbill</td>
<td><em>Annorhinus galeritus</em></td>
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<td>10.</td>
<td><strong>Cinnamon-rumped Trogon</strong></td>
<td><em>Harpactes orrhophaeus</em></td>
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<td>11.</td>
<td><strong>Common Kingfisher</strong></td>
<td><em>Alcedo atthis</em></td>
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<td>12.</td>
<td>Stork-billed Kingfisher</td>
<td><em>Halcyon capensis</em></td>
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<td>Common Name</td>
<td>Habitats</td>
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<td>Black-capped Kingfisher</td>
<td><em>Halcyon pileata</em></td>
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<td>14.</td>
<td><strong>Indian Cuckoo</strong></td>
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<td>Raffle’s Malkoha</td>
<td><em>Phaenicophaeus chlorophaeus</em></td>
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<td>Blue-rumped Parrot</td>
<td><em>Psittinus cyanurus</em></td>
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<td>17.</td>
<td><strong>Silver-rumped Needletail</strong></td>
<td><em>Rhipidura leucopygialis</em></td>
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<td>Grey-rumped Treeswift</td>
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<td>19.</td>
<td><strong>Brown-backed Needletail</strong></td>
<td><em>Hirundapus giganteus</em></td>
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<td><strong>Oriental Bay Owl</strong></td>
<td><em>Phodilus badius</em></td>
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<td><strong>Reddish Scops Owl</strong></td>
<td><em>Otus rufescens</em></td>
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<td>22.</td>
<td>Brown Hawk Owl</td>
<td><em>Ninox scutulata</em></td>
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<td><strong>Javan Frogmouth</strong></td>
<td><em>Batrachostomus javensis</em></td>
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<td><strong>Malaysian Eared Nightjar</strong></td>
<td><em>Eurostopodus temminckii</em></td>
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<td>Thick-billed Green Pigeon</td>
<td><em>Treron curvirostra</em></td>
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<td><strong>Brahminy Kite</strong></td>
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<td>White-bellied Sea Eagle</td>
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<td><strong>Oriental Honey-Buzzard</strong></td>
<td><em>Pernis ptilorhyncus</em></td>
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<td><em>Ichthyophaga Ichthyaeus</em></td>
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<td>Striated Heron (Little Heron)</td>
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<td>Cinnamon Bittern</td>
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<td>Greater Racket-tailed Drongo</td>
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<td>Black Magpie</td>
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<td>Slender-billed Crow</td>
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<td>Large Woodshrike</td>
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<td>Asian Brown Flycatcher</td>
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<td>White-rumped Shama</td>
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<td>Hill Myna</td>
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<td>52</td>
<td>Barn Swallow</td>
<td>Hirundo rustica</td>
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<td>Striated Swallow</td>
<td>Hirundo striolata</td>
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<td>59</td>
<td>Moustached Babbler</td>
<td>Malacopterum magnirostre</td>
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<td>Paddyfield Pipit</td>
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<td>Yellow Wagtail</td>
<td>Motacilla flava</td>
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</table>
WWF is the world’s largest and most experienced conservation organisation. It has 4.7 million regular supporters and a global network active in 96 countries.

WWF’s mission is to stop the degradation of the planet’s natural environment and to build a future in which humans live in harmony with nature, by:

- Conserving the world’s biological diversity
- Ensuring that the use of renewable natural resources is sustainable
- Promoting the reduction of pollution and wasteful consumption

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