

Asrama Raya Sdn Bhd
(ARSB)

Environmental
Monitoring
Plan

ENVIRONMENTAL MONITORING PLAN

1. MONITORING OF VULNERABLE AND STEEP AREAS AND ENCROACHMENT IN THE CONCESSION

Monitoring activities for vulnerable and steep areas within the ARSB HS Petuang concession are carried out through the following approaches:

i. Topographic Mapping

- Satellite imagery and digital topographic maps are utilized to assess the topography and land conditions of the concession area.
- Prior to any harvesting operations, Forest Manager must examine the maps to identify sensitive areas, particularly steep slopes exceeding 40 degrees. These areas must be strictly avoided for forest road construction and harvesting activities.
- In addition, periodic reviews of satellite images and digital maps are conducted to detect any unusual land cover changes or patterns that may indicate illegal encroachment or unauthorized land use within the concession area. Early detection through remote mapping helps facilitate timely investigation and enforcement actions.

ii. Field Examination

- The Forest Manager must continuously monitor the construction of forest roads and all harvesting operations to ensure that activities are not conducted on sensitive or steep slopes (more than 40 degrees).
- ARSB also collaborates with the Terengganu State Forestry Department (TSFD) to carry out field inspections and ground-based observations of vulnerable soil conditions and steep terrain.
- Field visits must conduct regularly to detect and verify any signs of encroachment, such as illegal land clearing, farming, or unauthorized settlements.
- Any identified encroachments are documented and reported using the '***Borang Pelaporan Pencerobohan atau Aktiviti Haram dalam Konsesi ARSB***' (Appendix 1 and 2), a reporting form provided to forest workers and members of the local community. This form allows for systematic reporting of suspected encroachment or illegal activities within the concession.
- Once a report is received, the forest management team conducts site verification, gathers supporting evidence (e.g., photos, GPS coordinates), and submits a complete report to TSFD for further investigation and enforcement action. ARSB will also follow up on the outcome and cooperate fully with TSFD to ensure appropriate legal or remedial actions are taken.

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2. LOGGING CAMP AND LOGGING WORKSHOP MONITORING

- Forest manager and forest supervisor monitor the cleanness of the logging camp and logging workshop to ensure they are well maintained.
- Forest manager and forest supervisor monitor and ensure the forest workers will follow the standard of procedure (SOP) for handling, storage and disposal used hazardous substances for timber harvesting operations.
- Forest supervisor and forest supervisor monitor, control and record the conditions and usage of fuel tank and lubricant oil.
- Forest manager and forest supervisor monitor and ensure all the wastes and schedule wastes are taken out from concession to be disposed.

3. WATERCOURSE AND WATER QUALITY MONITORING

- Forest manager monitor the buffer zones of watercourse and identified watercourses which needed for protection. Forest manager regular check on the field to ensure the trees located along the border of buffer zones are not harvested.
- Forest manager and forest supervisor monitor and ensure all the buffer zones of watercourse are established in accordance with the Forestry Department Peninsular Malaysia (FDPM) standard and Garis Panduan Jalan Hutan 2024

Table 1. Recommended buffer zones based on width of watercourse.

Width (m)	Buffer zone (m)
≤10	10
10-20	20
20-40	40
>40	45

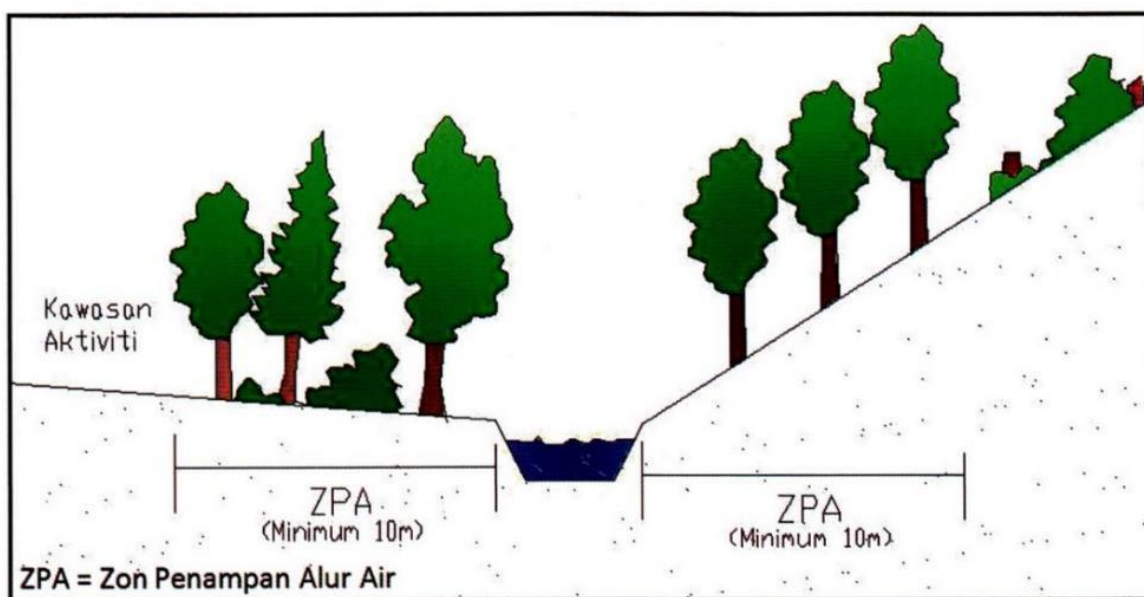


Figure 1. Cross section of buffer zone.

- ARSB also collaborate with Forest Department Peninsular Malaysia / Forest Research Institute Malaysia (FRIM) / expert team in conducting water quality analysis to monitor the quality and health status of the watercourse.
- ARSB also monitor water quality of river in ARSB HS Petuang concession by conducting water quality analysis once per year.

3.1 WATERCOURSE AND WATER QUALITY ANALYSIS PROCEDURE

1. Collect water samples at two sections, which are upstream and downstream.
2. Conduct in situ measurement for temperature, pH and dissolved oxygen (DO) and turbidity.
3. Measure temperature and pH using Horiba LAQUA pH210 pH/ temperature meter.
4. Measure dissolved oxygen (DO) using YSI 550A dissolved oxygen instrument.
5. Measure turbidity using Eutech Tn100 turbidity meter.
6. Use plastic bottles to collect water samples for total suspended solid (TSS), chemical oxygen demand (COD) and ammoniacal-nitrogen ($\text{NH}_3\text{-N}$) analysis.
7. Place water samples in ice box before taken the samples to the laboratory for analysis.

8. Formula used for WQI calculation is shown at below:

$$WQI = 0.22(\text{siDO}) + 0.19(\text{siBOD}) + 0.16(\text{siCOD}) + 0.15(\text{siAN}) + 0.16(\text{siTSS}) + 0.12(\text{siPH})$$

siDO-subindex is for dissolved oxygen, siBOD-subindex is for biochemical oxygen demand, siCOD-subindex is for chemical oxygen demand, siAN-subindex is for ammoniacal-nitrogen, siTSS-subindex is for total suspended solid, siPH-subindex is for pH.

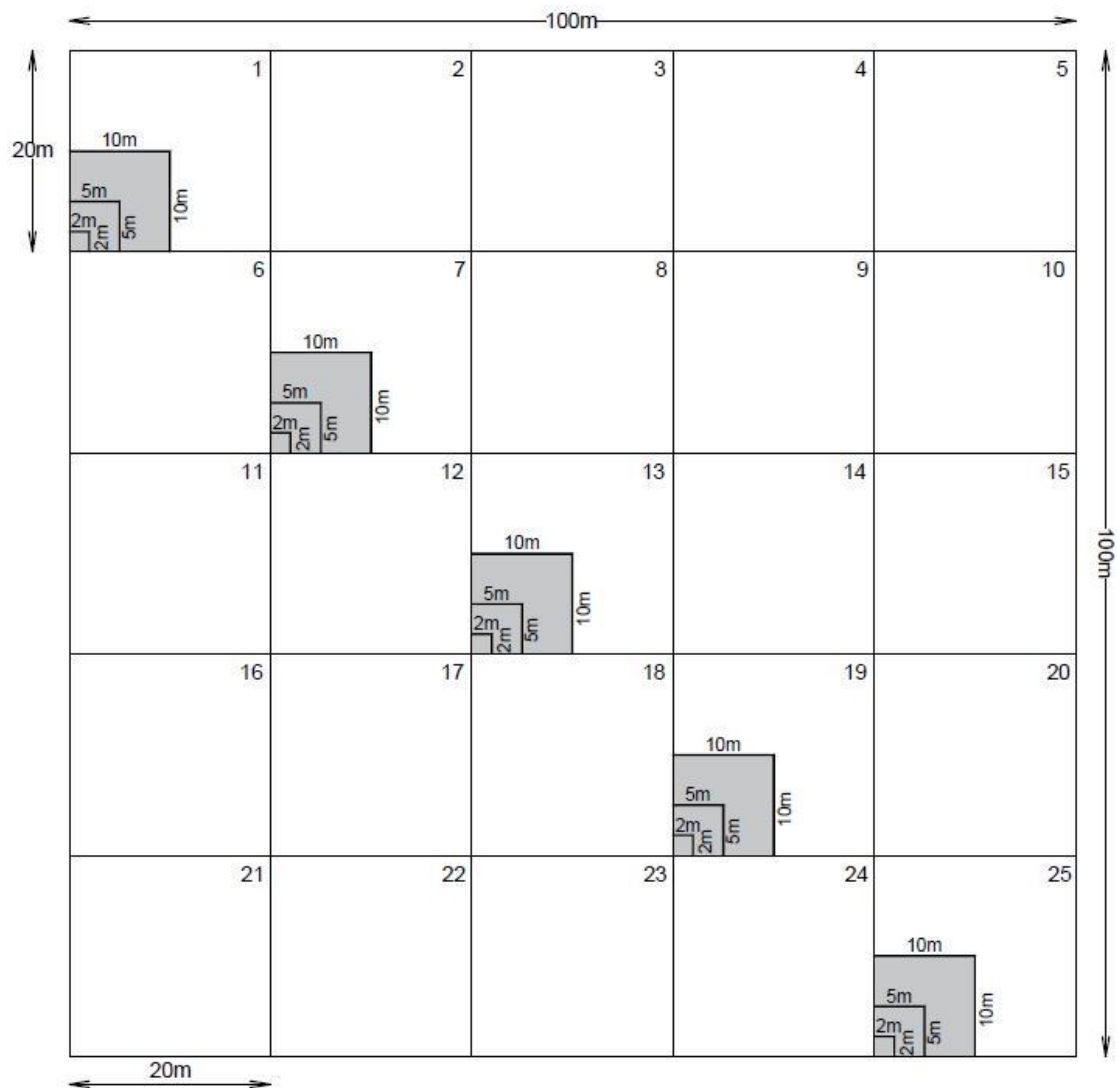
4. PLANT MONITORING

- ARSB collaborate with Universti Putra Malyasia (UPM) or any expert team for conducting plant survey in ARSB HS Petuang concession.
- Forest manager always conduct monitoring of plants / trees and make sure all the protected tree species, rare and endangered tree species, mother trees are not harvested.
- The permanent sample plot (PSP) which is used to determine the principal growth rate and volume estimates to be obtained in the second generation (after 30 years and beyond) is monitored annually.
- The PSP areas are monitor annually and remeasure PSP once every three years.

4.1 PERMANENT SAMPLE PLOT (PSP) PROCEDURE

1. Set up PSP area with 100 m x 100 m in several locations within the ARSB concession. An estimated 10 plots are established to obtain data on tree species, diameter, height, terrain.
2. Sub-plot size 2 m x 2 m – inventory of wildings 15 cm – 1.5 m height.
3. Sub-plot size 5 m x 5 m – inventory of wildings 1.5 m height – 5 cm diameter.
4. Sub-plot size 10 m x 10 m – survey small trees 5 cm diameter – 15 cm diameter.
5. Sub-plot 20 m x 20 m – survey big tress, small trees 30 cm DBH above.
6. Record every measurement in the PSP inventory form.
7. Collect and analyse data to determine the principal growth rate and volume estimates to be obtained in the second generation (after 30 years) and beyond.
8. Monitor and repaint the PSP areas annually.
9. Remeasure PSP once every three years.

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Petak 2m x 2m (Banci anak pokok 15cm tinggi - 1.5 meter tinggi)
 Petak 5m x 5m (Banci anak pokok 1.5 meter tinggi - 5cm diameter)
 Petak 10m x 10m (Banci pokok jaras kecil 5cm diameter - 15cm diameter)
 Petak 20m x 20m (Banci pokok jaras besar, pokok kecil dan pokok besar 30cm perepang keatas)

Figure 2. PSP diagram.

5. WILDLIFE MONITORING

- ARSB regular monitor ARSB HS Petuang concession from encroachment, illegal activities and hunting.
- ARSB engage with local community of Kg. Petuang and TSFD for helping in monitoring ARSB HS Petuang concession from encroachment and illegal hunting.
- ARSB also conduct periodic monitoring of wildlife.
 - Monitor the occurrence of animals through camera trapping.
 - Monitor the occurrence of animals through opportunistic sightings.

5.1 CAMERA TRAP PROCEDURE

1. Create a plan and determine which compartment to be chosen for setting up camera trap to capture animals.
2. Set up camera trap at before and after harvesting areas based on accessibility of road and times.
3. Place Secure Digital (SD) cards and eight double AA batteries into the camera.
4. Adjust the setup of the camera (mode, picture numbers, video length, interval, sensitivity, date and time) before the camera set up in the forest concession.
5. Find suitable location to set up the camera trap in ARSB HS Petuang concession, e.g. area with animal trails.
6. Mount each camera on a tree with the provided rope, approximately 50 cm from the ground.
7. Switch on the camera and ensure the camera is properly mounted on the tree.
8. Record all the GPS location for all cameras along with the dates of placement in the area.
9. Check the camera and collect SD cards every four weeks.
10. Change and replace the battery of camera once the camera was low battery.
11. Send the SD cards to office for storing the captured images.
12. Transfer the captured images from SD card to computer for storage and record.
13. Record the date, time, species of the detected animals from the images in record form and computer.
14. Return to the SD card to forest concession for reuse.

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15. Maintain the camera trap at the same location for one to three months.
16. Change the location of camera trap if no animals are found in that area.

5.2 OPPORTUNISTIC SIGHTING SURVEY PROCEDURE

1. Record animals which are seen in the forest concession in record form (ARSB SF 016 Monthly Opportunistic Sighting Records) [Appendix 2].
 - Record if animal is found / seen in the concession, no record if no animal is found.
2. Snap the photo of the animals with camera phone (if possible) for record and identification.
3. Identify the animal through direct observation and footprints found in the forest concession (Appendix 4 and Appendix 5).
4. Identify the animal through the animal poster placed on the notice board of the base camp.
5. Inform forest manager if saw any unique animals or RTE species.

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Appendix 1. Borang Pelaporan Pencerobohan atau Aktiviti Haram dalam Konsesi ARSB

Borang Pelaporan Pencerobohan atau Aktiviti Haram dalam Konsesi ARSB

Borang 1

ASRAMA RAYA SDN BHD

1. Pekerja hutan perlu melapor kepada Kepala Hutan jika menemui kesan sebarang pencerobohan, kesan impak terhadap hutan simpan atau aktiviti haram yang ditemui di dalam Konsesi Hutan ARSB;
2. Kepala Hutan perlu mengisi borang pelaporan ini setelah menerima aduan daripada pekerja hutan;
3. Borang ini perlu dihantar kepada Pengurus Hutan dalam tempoh 24 jam samada melalui *Whatsapp* atau serahan tangan.
4. Pengurus Hutan/ Pemegang Lesen perlu usulkan borang yang telah disahkan kepada Pejabat Hutan Daerah Trg Barat/JPNT/badan berkuasa tempatan dalam tempoh 48 jam, samada melalui email, *Whatsapp* atau serahan tangan.

A. Butiran Pengadu

Pemberi Maklumat	Saksi (Jika ada)
Nama Pekerja	Nama Pekerja
Jawatan/Unit	Jawatan/Unit
No. K/P	No. K/P
T/Tangan	T/Tangan
Tarikh	Tarikh

B. Laporan Aduan

Jenis Kesalahan ditemui (Sila jelaskan secara ringkas) : <i>*Pencerobohan/ Aktiviti Haram/ Kesan Impak Terhadap Hutan Simpan</i>	
Lokasi dikenalpasti/ GPS koordinat/ Kompartmen	
Tarikh ditemui	
Lampiran yang berkaitan	<i>*Sila lampirkan bersama gambar/ pelan lokasi jika ada</i>

C. Pengesahan Penerimaan Laporan oleh Pengurus Hutan/ Pemegang Lesen

Nama		Ulasan (Jika ada):
Cop & Jawatan		
No. K/P		
T/Tangan		
Tarikh		

D. Pengesahan Penerimaan Laporan Aduan oleh PHDTB/ JPNT/Jabatan Perhilitan/ Pihak Berkuasa Tempatan Yang Berkaitan

Nama		Ulasan & Tindakan Susulan :
Cop & Jawatan		
No. K/P		
T/Tangan		
Tarikh		

- Form 1/SOP 1/Resource Protection/V3 -

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Appendix 2a. Borang Pelaporan Pencerobohan atau Aktiviti Haram dalam Konsesi ARSB (Kg. Payong)

Borang Pelaporan Pencerobohan atau Aktiviti Haram dalam Konsesi ARSB (Kg. Payong) Borang 2

ASRAMA RAYA SDN BHD (Kerjasama Penduduk Komuniti Kg. Payong)

1. Komuniti Kg. Payong boleh melaporkan kepada MPKK Kg Payong jika menemui sebarang pencerobohan masuk ke kawasan hutan, atau sebarang aktiviti haram seperti pemburuan haram/ tebangan haram yang ditemui berdekatan dengan Konsesi Hutan ARSB;
2. Pihak MPKK perlu mengisi borang pelaporan ini setelah menerima aduan daripada komuniti/penduduk kampung;
3. Borang ini perlu dihantar kepada Pengurus ARSB dalam tempoh 24 jam samada melalui *Whatsapp* atau serahan tangan.
4. Pengurus ARSB perlu usulkan borang yang telah disahkan kepada Pejabat Hutan Daerah Trg Barat/JPNT/badan berkuasa tempatan dalam tempoh 48 jam, samada melalui email, *Whatsapp* atau serahan tangan.

A. Butiran Pengadu

Pemberi Maklumat		Saksi (Jika ada)	
Nama		Nama	
Alamat		Alamat	
No. K/P		No. K/P	
T/Tangan		T/Tangan	
Tarikh		Tarikh	

B. Laporan Aduan

Jenis Kesalahan ditemui (Sila jelaskan secara ringkas) : <i>*Pencerobohan/ Sebarang Aktiviti Haram/ Pemburuan Haram/Tebaran Haram</i>	
Lokasi dikenalpasti/ GPS koordinat (jika ada)	
Tarikh ditemui	
Lampiran yang berkaitan	<i>*Sila lampirkan bersama gambar/ pelan lokasi jika ada</i>

C. Pengesahan Penerimaan Laporan oleh MPKK Kg. Payong

Nama		Ulasan (Jika ada):
Cop & Jawatan		
No. K/P		
T/Tangan		
Tarikh		

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Appendix 2b. Borang Pelaporan Pencerobohan atau Aktiviti Haram dalam Konsesi ARSB (Kg. Payong)

Borang Pelaporan Pencerobohan atau Aktiviti Haram dalam Konsesi ARSB (Kg. Payong) Borang 2

D. Pengesahan Penerimaan Laporan Aduan oleh Pengurus ARSB

Nama		Ulasan & Tindakan Susulan :
Cop & Jawatan		
No. K/P		
T/Tangan		
Tarikh		

E. Pengesahan Penerimaan Laporan Aduan oleh PHDTB/ Jabatan Perhutanan Negeri Terengganu/Pihak Berkuasa Tempatan Yang Berkaitan

Nama		Ulasan & Tindakan Susulan :
Cop & Jawatan		
No. K/P		
T/Tangan		
Tarikh		

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Appendix 3. Template form of ARSB SF014 Monitoring - Camera Trapping

ARSB SF014 Monitoring - Camera Trapping

MONITORING - CAMERA TRAPPING

Month / Year		Team leader:	
Staff:			

Camera No.	GPS Location	Compartment	Date Set	Date Collected	Area Description	Animal Image	Remark
AR01							
AR02							
AR03							
AR04							
AR05							
AR06							

ARSB SF 016 Monthly Opportunistic Sighting Records

Month/Year (Bulan/Tahun)		Team leader (Ketua)	
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Appendix 3. Template form of ARSB SF017 Monitoring - Camera Trap Data

Appendix 5. ARSB SF017 Monitoring - Camera Trap Data

Camera no.	Date	Time	Captured animal
		Common name	Species name
AR01			
AR02			
AR03			
AR04			
AR05			
AR06			

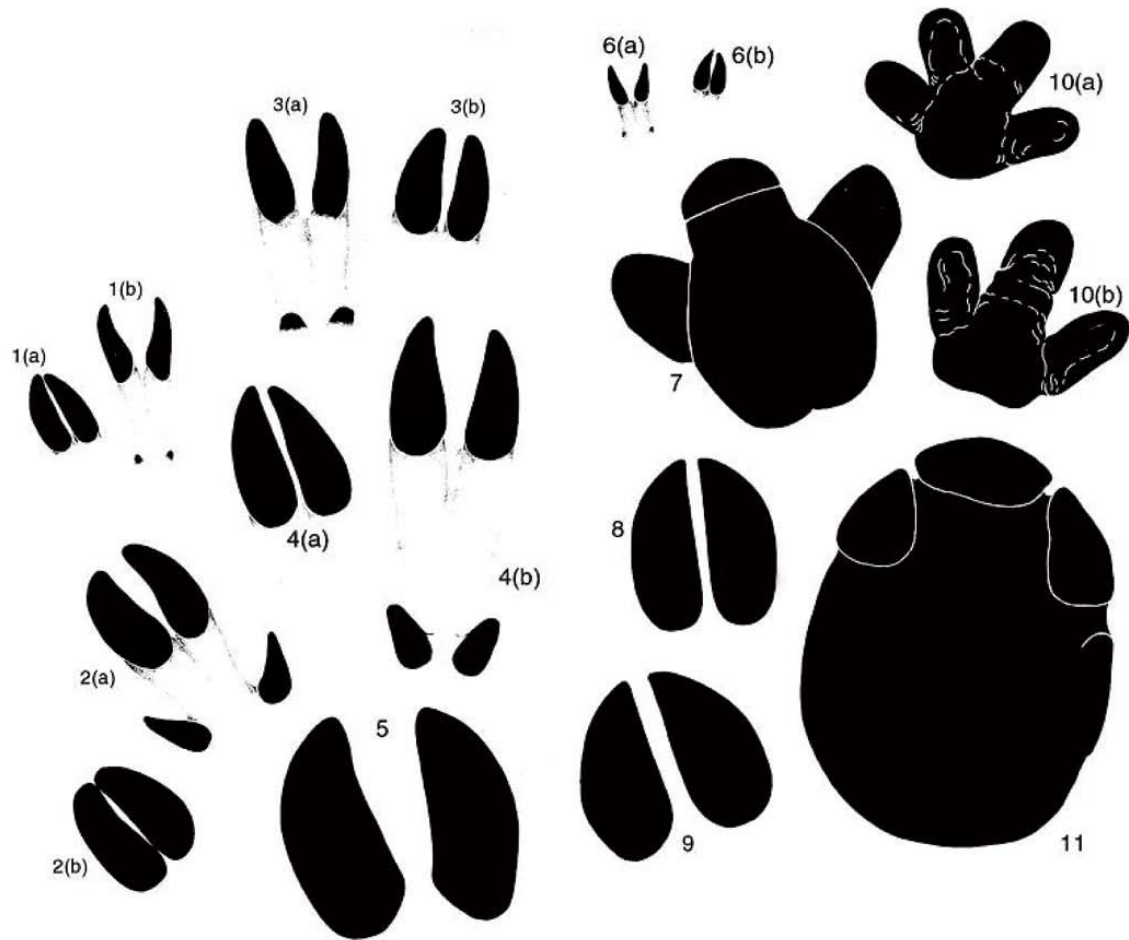
Appendix 6. List of wildlife presented in HS Petuang based on the inventory carried out by PERHILITAN in 2017 (Source: PERHILITAN Terengganu)

No.	Species Name	Saintific Name
1	Banded civet	<i>Hemigalus derbyanus</i>
2	Banded linsang	<i>Prionodon linsang</i>
3	Binturong	<i>Arctictis binturong</i>
4	Brush-tailed porcupine	<i>Atherurus macrourus</i>
5	Clouded leopard	<i>Neofelis nebulosa</i>
6	Common porcupine	<i>Hystrix brachyura</i>
7	Common wild pig	<i>Sus scrofa</i>
8	Crestless fireback	<i>Lophura erythrophalma</i>
9	Dhole	<i>Cuon alpinus</i>
10	Elephant	<i>Elephas maximus</i>
11	Golden cat	<i>Catopuma temminckii</i>
12	Great argus pheasant	<i>Argusianus argus</i>
13	Hornbill spp	<i>Aceros spp.</i>
14	Leopard cat	<i>Prionailurus bengalensis</i>
15	Malay civet	<i>Viverra zangalunga</i>
16	Marbled cat	<i>Pardofelis marmorata</i>
17	Masked palm civet	<i>Paguma larvata</i>
18	Monitor lizard	<i>Varanus salvator</i>
19	Moonrat	<i>Echinosorex gymnura</i>
20	Muntjack	<i>Muntiacus muntjack</i>
21	Pangolin	<i>Manis javanica</i>
22	Panther	<i>Panthera pardus</i>
23	Pig-tailed macaque	<i>Macaca nemestrina</i>
24	Serow	<i>Capricornis sumatraensis</i>
25	Sunbear	<i>Helarctos malayanus</i>
26	Tapir	<i>Tapirus indicus</i>
27	White-thighed langur	<i>Presbytis spp.</i>
28	Yellow-throated marten	<i>Martes flavigula</i>

Appendix 7. List of wildlife presented in HS Petuang based on the inventory carried out by PERHILITAN in 2017 (Source: PERHILITAN Terengganu)

No.	Species Name	Saintific Name
1	Banded civet	<i>Hemigalus derbyanus</i>
2	Banded linsang	<i>Prionodon linsang</i>
3	Binturong	<i>Arctictis binturong</i>
4	Brush-tailed porcupine	<i>Atherurus macrourus</i>
5	Clouded leopard	<i>Neofelis nebulosa</i>
6	Common porcupine	<i>Hystrix brachyura</i>
7	Common wild pig	<i>Sus scrofa</i>
8	Crestless fireback	<i>Lophura erythrophalma</i>
9	Dhole	<i>Cuon alpinus</i>
10	Elephant	<i>Elephas maximus</i>
11	Golden cat	<i>Catopuma temminckii</i>
12	Great argus pheasant	<i>Argusianus argus</i>
13	Hornbill spp	<i>Aceros spp.</i>
14	Leopard cat	<i>Prionailurus bengalensis</i>
15	Malay civet	<i>Viverra zangalunga</i>
16	Marbled cat	<i>Pardofelis marmorata</i>
17	Masked palm civet	<i>Paguma larvata</i>
18	Monitor lizard	<i>Varanus salvator</i>
19	Moonrat	<i>Echinosorex gymnura</i>
20	Muntjack	<i>Muntiacus muntjack</i>
21	Pangolin	<i>Manis javanica</i>
22	Panther	<i>Panthera pardus</i>
23	Pig-tailed macaque	<i>Macaca nemestrina</i>
24	Serow	<i>Capricornis sumatraensis</i>
25	Sunbear	<i>Helarctos malayanus</i>
26	Tapir	<i>Tapirus indicus</i>
27	White-thighed langur	<i>Presbytis spp.</i>
28	Yellow-throated marten	<i>Martes flavigula</i>

Appendix 8. Pictorial references to footprints of hoofed animal (WWF, 2009)



Pictorial reference to tracks of pawed animals (Not to scale)

List of animal names based on the footprints pictures of Appendix 6 (WWF, 2009)

No.	Name of animal (English / scientific / Malay)
1(a) & (b)	Common barking deer / <i>Muntiacus muntjak</i> / Kijang
2 (a) & (b)	Common wild pig / <i>Sus scrofa</i> / Babi hutan
3 (a) & (b)	Serow / <i>Capricornis sumatraensis</i> / Kambing gurun
4 (a) & (b)	Sambar deer / <i>Cervus unicolor</i> / Rusa
5	Water buffalo / <i>Bubalus bubalis</i> / Kerbau
6 (a) & (b)	Lesser mouse deer / <i>Tingulus javanicus</i> / Kancil
7 (a) & (b)	Sumatran rhinoceros / <i>Dicerorhinus sumatrensis</i> / Badak sumbu
8	Banteng / <i>Bos javanicus</i> / Banteng
9	Gaur / <i>Bos gaurus</i> / Seladang
10 (a) & (b)	Tapir / <i>Tapirus indicus</i> / Tenuk atau Cipan
11 (a) & (b)	Elephant / <i>Elephas maximus</i> / Gajah

Appendix 9. Pictorial references to footprints of pawed animal (WWF, 2009)



List of animal names based on the footprints pictures of Appendix 7 (WWF, 2009)

No.	Name of animal (English / scientific / Malay)
1 (a) & (b)	Yellow-throated marten / <i>Martes flavigula</i> / Pulasan
2 (a) & (b)	Malayan porcupine / <i>Hystrix brachyura</i> / Landak raya
3	Eurasian otter / <i>Lutra lutra</i> / Memerang
4	Smooth-coated otter / <i>Lutra perspicillata</i> / Memerang
5 (a) & (b)	Burmese ferret badger / <i>Melogale personata</i>
6 (a) & (b)	Hare / <i>Lepus</i> sp. / Arnab
7 (a) & (b)	Malayan pangolin / <i>Manis javanica</i> / Tenggiling
8	Small-clawed otter / <i>Aonyx cinerea</i> / Memerang
9	Long-tailed macaque / <i>Macaca fascicularis</i> / Kera
10 (a) & (b)	Large bamboo rat / <i>Rhizomys sumatrensis</i> / Dekan Brush-tailed porcupine / <i>Atherurus macrourus</i> / Landak
11 (a) & (b)	batu
12 (a) & (b)	Bay bamboo rat / <i>Cannomys badius</i> / Dekan
13	Rat / <i>Rattus</i> sp. / Tikus
14 (a) & (b)	Large Indian civet / <i>Viverra zibetha</i> / Musang Jebat
15	Masked palm civet / <i>Paguma larvata</i> / Musang
16	Hog badger / <i>Arctonyx collaris</i>
17	Javan mongoose / <i>Herpestes javanicus</i> / Tikus mondok
18	Moonrat / <i>Echinosorex gymnurus</i> / Tikus bulan
19	Otter civet / <i>Cynogale benetti</i> / Musang Common palm civet / <i>Paradoxurus hermaphroditus</i> /
20	Musang
21	Small Indian civet / <i>Viverricula indica</i> / Musang
22	Binturong / <i>Arctictis binturong</i> / Binturong
23	Asiatic wild dog / <i>Cuon alpinus</i> / Anjing hutan
24	Three-striped ground squirrel / <i>Lariscus insignis</i> / Tupai
25	Malayan weasel / <i>Mustela nudipes</i> / Jelu
26	Fishing cat / <i>Prionailurus viverrinus</i> / Kucing hutan
27	Tiger / <i>Panthera tigris</i> / Harimau
28	Asiatic black bear / <i>Ursus thibetanus</i> / Beruang