# Mapping the Distribution of People, Elephants, and Human-Elephant Conflict in Temengor Forest Complex, Peninsular Malaysia

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**Abstract:** Settlements of indigenous people in tropical rainforests are generally small and difficult for outsiders to locate. In Malaysia, such unrecognised settlements are often within forest reserves and protected areas which can pose a challenge for planning wildlife conservation. Here, we examine the location of Orang Asli habitation in Temengor Forest Complex, which has been identified as a priority site for the conservation of elephants in Peninsular Malaysia. Our specific objectives were to (i) determine the original extent of indigenous lands; (ii) map the location of existing human settlements; and (iii) to determine the extent of current human-elephant conflict. We reviewed the history of settlement in the site; we geo-referenced settlements in existing maps; and, we ground-truthed a sample of these locations. We found that the whole of the site is located in part of the original indigenous lands; we mapped a total of 16 occupied settlements inside the Temengor forest reserve, including three settlements in the interior of the forest reserve and 13 on the periphery; we found that 97.5% of sites visited has elephants and 43% experienced human-elephant conflict. We discuss several ethical implications of community mapping but recommend carrying out further mapping of villages throughout all sites designated for elephant conservation and propose that land claims be identified via a participatory approach.

**Keywords:** Asian Elephant, community mapping, customary rights, Google Maps, Google Earth, Jahai, Orang Asli, Temiar

## INTRODUCTION

As of 2017, there are still human communities in remote parts of the forested tropics that remain uncontacted by the outside world (Nath 2017). The government of Brazil has successfully used aerial surveys to identify dozens of uncontacted groups in the vast Amazonian forests (Reel 2007). While the forests of Malaysia are much smaller and more accessible, there is some speculation that there could still be some isolated groups living in these forests as well (Holmes 2013). There is no evidence of any uncontacted group in Malaysia but several forest settlements have very little interaction with the outside world and are only accessible by footpath (Sluys 1999, Lye 2004, Lai 2015). The government seldom gives official recognition to these remote forest settlements (Lim 2011).

The Orang Asli claim customary rights over much of the forests of Peninsular Malaysia. The lack of recognition of these land rights by the government has caused the Orang Asli to suffer numerous problems. Most of these issues have been documented by a national enquiry convened by Malaysia's national human rights commission which found "a high level of frustration, anger and desperation among indigenous communities because of the non-recognition of their rights to land" (SUHAKAM 2013, Subramaniam 2013). Those communities living in forested settlements are particularly vulnerable if the authorities permit the forest to be logged without taking community interests into account (Watson 1996, Rist et al. 2012).

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Furthermore, government agencies lack clear strategies for dealing with remote forest settlements. In particular, the existence of these settlements poses a challenge for the state agencies that control logging and mining (Subramaniam 2013). In addition, conservation of forests and wildlife can be undermined without due consideration of the presence of people in protected areas (Schwartzman et al. 2000, Aziz et al. 2013). Indeed, in some cases, the negation of the role of local people in safeguarding forest resources has been identified as the most important driver of deforestation (Waiswa et al. 2015).

The lack of recognition of forest communities poses significant challenges in the Malaysian government's attempts at planning and implementing programmes to conserve the nation's rich biodiversity. These challenges are particularly acute in the conservation of large mammals such as tigers and elephants that require a large area of forest and can potentially come into conflict with people.

One example of a national wildlife conservation plan is Malaysia's National Elephant Conservation Action Plan, known as 'NECAP', which covers a ten-year timeframe (2013-2022). The objective of NECAP is to allow elephants and humans to co-exist in the same landscapes, giving priority to elephant conservation in three sites in Peninsular Malaysia (Figure 1). NECAP recognises that co-existence will require resolving issues related to Orang Asli living within these sites, including determining the extent of any land claims (DWNP 2013: s. 3.5.1, p. 57), the location of settlements and the degree to which the human activities and land uses are compatible with elephant conservation.

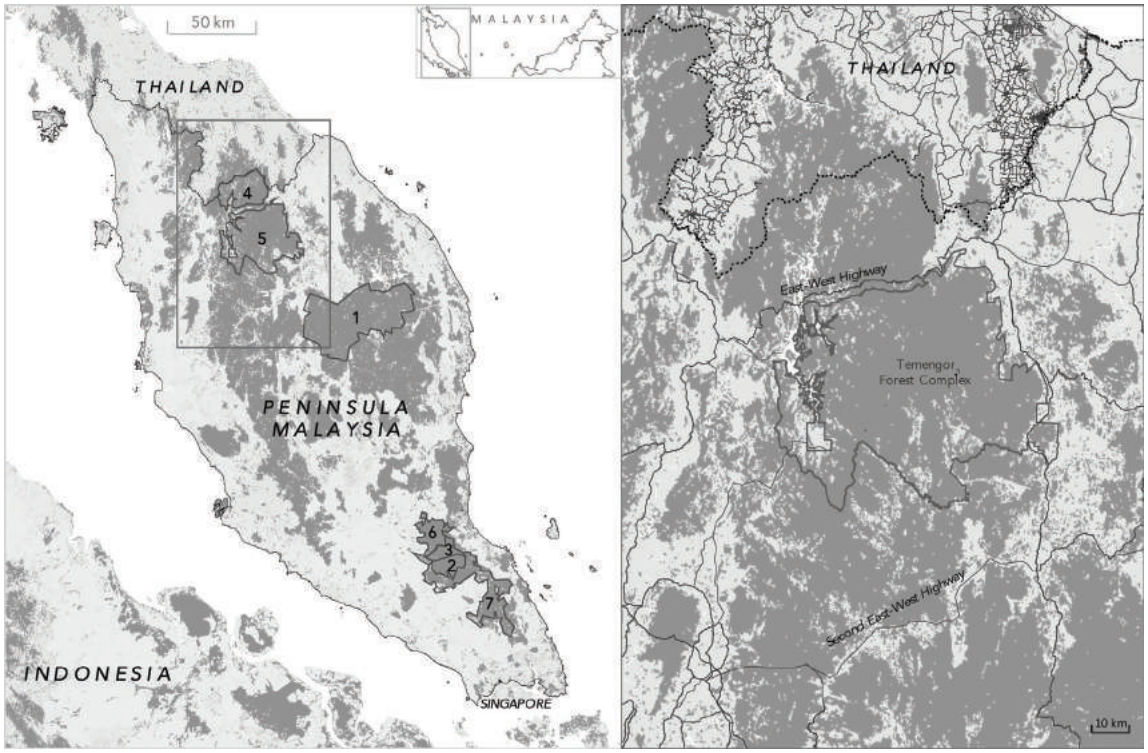


**Figure 1.** Priority Sites for Elephant Conservation in Peninsular Malaysia (with inset showing road network surrounding the Temengor Forest Complex). Dark grey: forest cover based on "Closed to open (>15%) broadleaved evergreen or semi-deciduous forest (>5m)" from ESA and UCLouvain (2009), excluding plantations from Potapov et al. (2017); light grey: all other landcover; white: waterbodies.

1. Taman Negara National Park,
2. Endau Rompin Johor National Park (Endau-Rompin complex comprises sites 2, 3, 6 & 7)
3. Rompin/Endau Wildlife Reserve (Pahang),
4. Royal Belum State Park (Perak),
5. Temengor Forest Complex (Perak & Kelantan),
6. Endau-Rompin Forest Complex (permanent reserved forests in Pahang), and
7. Endau-Rompin Forest Complex (permanent reserved forests in Johor)

*Orang Asli Settlement Patterns*

The first groups of modern humans arrived in the forests of the Malay Peninsula around 60,000 years ago (Hill et al. 2006, Baer 2016). Since then, there have been several waves of settlement resulting in a patchwork of different indigenous groups occupying different parts of the Peninsula. Skeat and Blagden (1906) mapped nine main language groups and 22 outlying "dialects". Recent maps have included varying classifications ranging from 19 (Jimin 1968) to 22 groups (Simons and Fennig 2017). Most of these maps are simplifications and generalisations but a map by Benjamin (1983) shows the inter-woven nature of ethnic groups in the Peninsula, with the Orang Asli minority groups occupying most of the forests of the interior and the Malay majority group moving up the valleys.

Orang Asli have settlements spread throughout the forests of the Peninsula. Basically all parts of the Peninsula was part of the traditional territory of some group of Orang Asli although several of these groups are now extinct (Benjamin 2012). Even areas shown as blank by maps such as Jimin (1968) and Benjamin (1983) have since been shown to be occupied (Lim 2017). Orang Asli settlements are not confined to aboriginal reserves or to explicitly titled land (Nicholas 2000, Aziz et al. 2013). Some Orang Asli settlements are within areas declared as forest reserves, state parks, and wildlife reserves.

Several problems can arise when Orang Asli land is declared to be a protected area. For example, crop raiding by elephants has become a significant issue for some of the communities living in the Belum-Temengor area that is identified by NECAP a priority elephant conservation site (Yee et al. 2016). There are several studies on the Orang Asli of Belum-Temengor (Lim and Jimin 1995, Sluys 2000, Lim et al. 2002, Burenhult 2005, Azrina et al. 2011 and Aziz et al. 2013). The issue of the rights of these indigenous people with respect to the land itself is addressed as one of several case studies in an NGO report (SAM and JKOASM 2016). However a clear geographical review of the history of settlement in Belum-Temengor is presently lacking. Such a review would provide context that would be helpful in framing the present land claims and give the context for the conflict with the elephant conservation planning.

*Elephant Conservation in Peninsular Malaysia*

The Asian elephant is one of three extant species of elephant and the only remaining species of the genus Elephas. The genus has its roots in Africa during the Pliocene (5.3 to 2.6 million years before present) and has been found in Peninsular Malaysia since at least the Pleistocene (Haynes 1991; Lim 2013). Elephants are a generalist species and occupied most of the Peninsula (Saaban et al. 2011). However, the advent of agriculture in the last 10,000 years and industrial plantations in the last 100 years has increased the level of conflict between humans and elephants.

Elephants are presently considered to be a "major" component of human-wildlife conflict in Peninsular Malaysia. Between 1998 and 2010, the Department of Wildlife and National Parks (DWNP) reported that it received 10,750 complaints related to wild elephants (Saaban et al. 2011). Most of these cases (72.8%) involved damage to crops and some (0.1%) involved human casualties.

The Malaysian government has responded by spending millions of ringgit on building electric fences to protect crops from elephant raids and by translocating elephants away from conflict areas (Saaban et al. 2011, Ahmad and Magintan 2016, Ponnusamy et al. 2016). Translocation has meant that over a 40 year period there has been a 65% reduction of elephant range within human-dominated landscapes (Tan 2016). To prevent a continued elephant decline, NECAP was developed and is being implemented by the Malaysian Elephant Alliance ('MYGAJAH'), a collaboration between the wildlife department, other government agencies, scientists and civil society organisations. One of the MYGAJAH partners is Management and Ecology of Malaysian Elephants (MEME), a research project that is run in collaboration between the University of Nottingham Malaysia Campus (UNMC) and DWNP (Hii et al. 2016).

Between 2013 and 2015 MEME carried out a series of questionnaires throughout Peninsular Malaysia to determine where elephants are still found and to examine the degree of conflict that they cause (Tan 2016). Tan's survey used a method developed by the Elephant Conservation Group ('ECG') (Campos-Arceiz and Fernando, 2016) for the study of human-elephant conflict in nine Asian elephant range countries. It involved partitioning Peninsular Malaysia into 5-km by 5-km grid cells and interviewing people within each grid on whether elephants were found there and the extent of human-elephant conflict (see Figure 2).

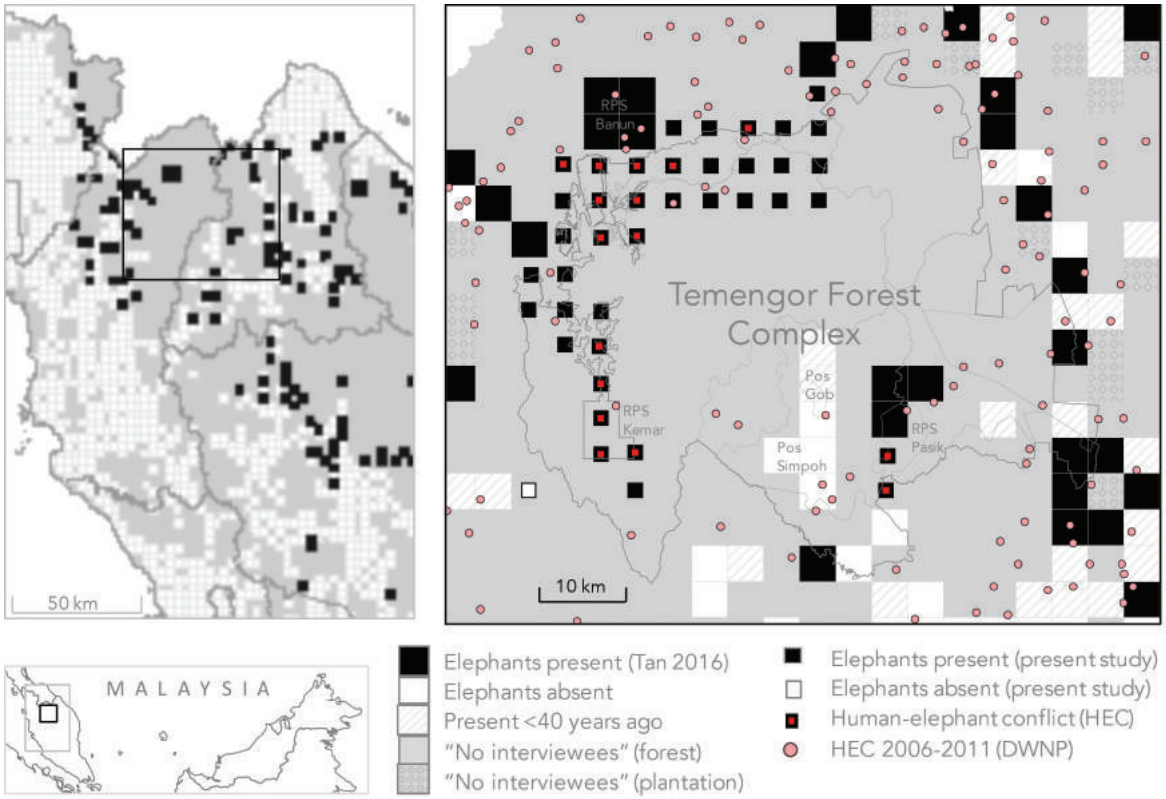


**Figure 2.** Elephant presence in Peninsular Malaysia (from Tan 2016) with inset showing human-elephant conflict in the Temengor Forest Complex (present study).

Tan's (2016) survey included respondents from about 16 grids in the Temengor Forest Complex as well as numerous respondents from the non-forest areas on the periphery of the complex (Figure 2, inset). The interviewees from the grids in Temengor Forest Complex included members of Orang Asli communities in Rancangan Pengumpulan Semula (RPS) Banun in Perak as well as RPS Pasik in Kelantan. Tan also visited several other villages outside RPS Pasik, these included Pos Simpoh and Pos Gob. For this study Tan only visited settlements that were accessible by motorcar and not grids that were were dominated by plantations, water-bodies, and forests. She marked these areas as "no interviewees" and did not include them in the study.

In order to contribute to the implementation of NECAP in Belum-Temengor in a manner that recognises the rights of local communities, the present paper supplements the work of Tan (2016) by examining human-elephant relations in the less accessible parts of the Temengor Forest Complex. Our objectives included (i) to review the history of indigenous settlement; (ii) to map the current extent of indigenous settlements; and (ii) to determine the extent of human-elephant conflict.

## Methods

*1. Study area*

Our study area is the Temengor Forest Complex, the southern portion of the Belum-Temengor complex, one of NECAP's three priority sites for elephant conservation. At 7500 km², Temengor is the largest forest patch on the Peninsula's main Titiwangsa mountain range. The forest stretches from the state of Perak in the west to Kelantan in the east and is bounded by the East-West Highway to the north and the Second East-West Highway to the south (Figure 3).

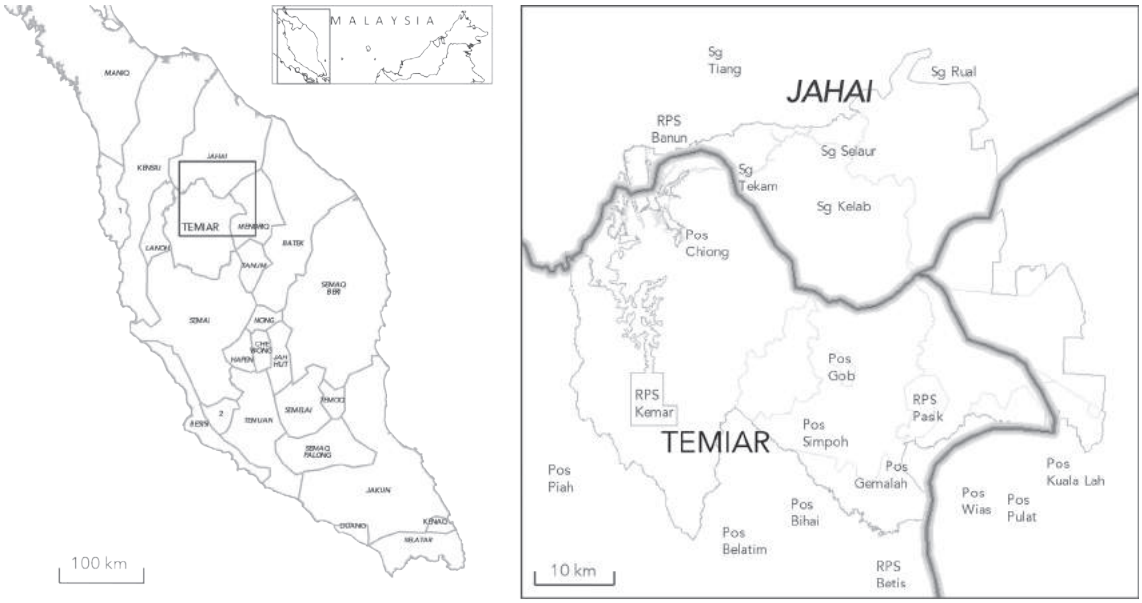


**Figure 3.** The approximate distribution of Orang Asli groups prior to the arrival of the Malays (adapted from Benjamin 1983) with an inset showing the location of Orang Asli regroupment schemes and government-supported outposts in and around the Temengor Forest Complex 1–'Low-Country Semang'; and 2–'Sakai of Ulu Langat' are both now extinct.

*2. Village locations from literature*

We reviewed the literature on Orang Asli distribution in Peninsular Malaysia. Focusing on existing maps showing the location of settlements in Temengor (Davison 1995, Azrina et al. 2011, Aziz et al. 2013, Kamal et al. 2013, Siti et al. 2015). We also identified settlements in Temengor Forest Reserve from topographical maps (JUPEM 2012).

We used the Google Earth Pro (Version 7.1) software to geo-reference copies of these maps and marked the coordinates of each putative settlement. We took a single point coordinate for each settlement and did not attempt to assess the extent of the boundaries of the village. To take into account the fact that settlements cover more than just a single point, we included all settlements centred within one kilometre of the forest reserve.

We checked the coordinates of putative settlements from the published maps using satellite imagery provided via Google Earth. Specifically, we used the following images: CNES/Airbus 8/22/2013; DigitalGlobe 5/13/2014; and CNES/Airbus 5/26/2016 (these are mostly panchromatic images with very high resolution). We noted whether we could see any settlement within a 1-km radius of each point. When we could not see any obvious buildings we used the historical imagery option to identify any forest clearings indicative of swidden farming.

*3. Village locations from memory*

P.P. [2] and R.A. worked with T.L. to identify settlement locations on Google Earth based on memory. P.P. and R.A. are familiar with the area as they belong to the Temiar ethnic group and originate from and reside in Kampung Semelor, situated just north of Temengor Forest Reserve (Fig. 2). P.P. and R.A. also used their personal smartphones to identify settlements using the maps and imagery on the Google Maps app – also available on the website <https:// www.google.com/maps/>.

*4. Site visits*

For field verification we decided to focus on the south of Temengor Forest Reserve since most of the existing literature focused on the north. We carried out site visits from 5-19 October 2016 and 16-20 December 2016, visiting a total of 11 points in Sg. Singor and Sg. Temengor (point Nos. 1-4, 6, 19-21, 23-25 in Table 1).

At each location we attempted to carry out interviews following the method used by Tan (2016) and aimed to interview at least two respondents for each 5-km by 5-km grid cell. We found that the ECG survey methodology employed by Tan (2016) required several modifications when applied to forested landscapes with low human populations. Instead of using a haphazard selection method, we deliberately selected senior male respondents. While the ECG methodology required respondents to be at least 30 years old, we targeted senior respondents over 50 years old, including those designated as village leaders and village elders who were the most confident in answering questions. We targeted male respondents as they are more likely to agree to be interviewed (A. Tan pers. comm., 2016).

Permission was obtained from the Department of Orang Asli Development (JAKOA), the Department of Wildlife and National Parks (DWNP), the Forestry Department Peninsular Malaysia and the Perak Integrated Timber Complex Sdn. Bhd. logging company. Verbal informed consent was sought from the village elders and from each respondent prior to commencing the interviews. The study protocol was approved by the Research Ethics Committee of University of Nottingham Malaysia Campus.

We wrote down the Orang Asli place names following the phonemic orthography recommended by Benjamin (1986). The glyphs mostly follow the International Phonetic Alphabet (IPA), with the following exceptions: we use j instead of IPA *j* or *ʤ*, *y* instead of *j*, and *ʔ* instead of *ʔ*. We write phonemically long vowels geminate (VV) instead of with a colon (V:).

[2]Initials refer to authors of the current paper.

**Table 1.** Settlements in Temengor Forest Reserve

| *No.* | *Name*[1] | *Pop.*[2] | *Ethnicity* | *Notes*[3] |
|---|---|---|---|---|
| 1. | Sg. Halong | - | n/a | Expedition camp 1995 |
| 2. | Kg. Pulau Tujuh | 98 | Temiar/Jahai | Within RPS Air Banun |
| 3. | Sg. Enam | - | n/a | Expedition camp 2012 |
| 4. | Kg. Sg. Tekam | 86 | Jahai/Temiar | [*tə'kaᵇm*] (Burenhult 2002) |
| 5. | Kg. Kuala Mangga | - | n/a | Former army camp |
| 6. | Kg. Selaor | 149 | Jahai | *Səlaʾo* – Salaor/Salo/Selaur |
| 7. | Kg. Sungai Kelap | 110 | ” | [kə'lapə'lBurenhult 2002) |
| 8. | Kg. Sg. Chuweh Lama | * | Jahai/Temiar | *Pop. included in no. 9 |
| 9. | Kg. Sg. Chuweh Baru | 97 | ” ” | Includes no. 8 |
| 10. | Kg. Charok Bus[4] | 93 | Jahai/Temiar | Carəʾ Bus (Baru) |
| 11. | Kg. Charok Bus Lama | - | n/a | Six buildings on topo |
| 12. | Kg. Sg. Tebang Baru | 131 | Temiar/Jahai | Includes no. 13 |
| 13. | Kg. Sg. Tebang Lama | * | ” ” | *Population w. no. 12 |
| 14. | Pos Chiong | 229 | Temiar/Jahai | [*ci'jɨᵍŋ*] (Burenhult 2002) |
| 15. | n/a | - | n/a | Bridge on Sg. Sara |
| 16. | Kg. Sg. Terhong | - | ” | Farmed by residents of no. 14 |
| 17. | Kg. Panggas[5] | - | ” | |
| 18. | Kg. Jeh[6][5] | - | ” | |
| 19. | Kg. Chabang Tiga | * | Temiar | *Nine huts. “P. Chabang Tiga” |
| 20. | Kg. Sg. Tersau (*Təsau*) | * | ” | *Eleven huts. “Sg. Tesau” (topo) |
| 21. | Kg. Sg. Kenyer (*Kɛɲɛr*) | * | ” | *Seven huts |
| 22. | Kg. Pulau Hitam[5] | - | n/a | |
| 23. | Kg. Lerlar (*Lɛrlar*) | 255 | Temiar | Within RPS Kemar |
| 24. | Pos Lengweng[7] | - | n/a | *ʔɔŋ Lɛ̃ŋwɛ̃ʔ*(topo: “Sg. Lanweng”) |
| 25. | Kg. Changkat Tenel[8] | * | Temiar | “Kg. Lelah” on topo |
| 26 | Kg. Agik[9] (*ʔagiʾ*) | * | ” | “Kg. Sumba” (JUPEM 2011) |

*Notes:* (1)(2) Name and population from JAKOA (2016) database; administratively nos. 1-16 are under RPS Banun and nos. 17-26 are under RPS Kemar; “Kg.” = kampung (kampong); “Sg.” = sungai (river); “Charok” = caruk (stream); “Chabang” = cabang (fork); pulau = island); “Changkat” = cangkat (hillock); lama = old; baru = new; pos = post; kuala = river mouth. (3) References to “topo” refer to JUPEM (2012).(4) A small traditional settlement by the same name is around 400-m north of here (5°26.812’N, 101°25.603’E). (5) place name given by topo map and probably now abandoned. (6) this site is outside the Temengor river basin. (7) *Ləgəb Burʉʾ*. (8) *Taŋkɔl Tɛnʾɛl*, population under no. 23; three huts with only three individuals present when we visited. (9) Population (of about three families) is included in 219 people of Kg. Lediau (a village that is part of RPS Kemar but we do not consider to be in Temengor Forest Reserve).

## RESULTS

*1. Original Extent of Indigenous Lands in Temengor Forest Complex*

Temengor includes part of the territory of three Orang Asli groups: the Jahai, the Mendriq and the Temiar (Fig. 1). The Jahai and Mendriq were traditionally hunter-gatherers and are part of the Semang or "Negrito" cultural group (Evans 1937; Sluys 1999). The Temiar have traditionally practised swidden farming of grain and root crops and are considered part of the Senoi cultural group (Benjamin 2014). All three groups continue to have a close relationship with the forest but have become increasingly settled due to developments following the Second World War.

The Orang Asli, played an important role in the guerrilla war that the Malayan Communist Party fought in the Peninsula over three phases from 1941 until 1989. At first the Orang Asli aided the guerrillas (Wombell 2011) but the British forces managed to convince the Orang Asli to collaborate with them (via the 'Senoi Praaq' police unit) to build a chain of 12 jungle forts and a number of temporary outposts throughout the Peninsula. These fortifications were the first permanent structures to be built in the jungle highlands of the Peninsula and the government encouraged the Orang Asli to settle down at these sites. These moves led to the isolation of the guerrillas and by 1960 the guerrillas had either surrendered or retreated across the border to Thailand.

Unfortunately the retreat was only temporary and in 1968 the guerrillas launched a new offensive from their bases in southern Thailand. The response of the government (now the independent federation of Malaysia) was a combination of military action and an enhanced programme of rural aid and "development" which included the construction of the East-West Highway and a hydroelectric dam on the Temengor river.

To move them away from the guerrillas and to facilitate the provision of government services the government has, since the 1970s, relocated many of the Orang Asli villages to regroupment sites known as Rancangan Pengumpulan Semula ('RPS') usually located at the sites of the jungle forts (Nicholas 2000: 113-118). Some of the villages were moved several times. For example, 13 Jahai villages in northern Perak were moved from near the Thai border downstream to a site named Pulau Tujuh, which was jointly settled with people from several Temiar villages (point no. 2 on Fig. 4) (Nicholas 1995). In 1978, the lake spanning 152 km² was created by the Temengor Dam and the people had to move to a new site known as RPS Banun (Davison et al. 1995).

Once again, the twin strategy of military force and development was to be successful and in 1989, the government and the guerrillas signed a peace agreement. The guerrillas no longer a threat, the Orang Asli began to leave the regroupment sites, some returned to their original territories and several established new villages in sites accessible from the East West Highway.

The federal and state governments did not recognise the right of the Orang Asli to return to their original territories and tried to discourage the Orang Asli from leaving the RPS areas. In Perak, the state executive council decided that 15.84 km² at RPS Banun be gazetted as an aboriginal reserve under the provisions of the Aboriginal Peoples Act 1954 but that the wider forests be reserved for timber production under the provisions of the National Forestry Act 1984[3]. The law courts have held that the Orang Asli have the right to the forest produce within their RPS areas (Abdul Malek 1991) but their rights in the forest reserves are seldom recognised by the government (Lim 2011).

[3]For example, on 10 October 1991, the Perak state government constituted 1477 km² of the land in-between but excluding the Banun and Kemar RPS sites as the "Temengor Forest Reserve" (Gazette notification no. 1378-91)

The government policy of excluding the Orang Asli from forest reserve and restricting them the RPS areas had limited success. In Perak the majority of the Jahai and Temiar had left RPS Banun by 1993 (Lim et al. 2002). The sites the Orang Asli settled in included forest reserves and areas outside forest reserves that the government considers to be "stateland". Orang Asli also spread out from RPS Kemar, in the south of Temengor, as well as from RPS Pasik, in the Kelantan portion of the Temengor Forest Complex.

Different government agencies have different policies towards dealing with Orang Asli outside the RPS areas. Federal agencies from the ministries of rural development, education and health provide extensive aid including building homes, schools, and clinics for the Orang Asli, even in settlements located inside the forest reserves.

Other agencies such as the forestry departments and the state land offices do not recognise the legality of settlements inside forest reserves. The state governments portray indigenous activities as detrimental to the forest, using the argument that "shifting cultivation" is destructive and wasteful. However, social scientists suggest that this pejorative term for swiddening deliberately mischaracterises the rotational nature of the agroforestry system in order to set it apart from "permanent agriculture" of the kind more favoured by the state (Dove 1983, Peluso 1995, Majid Cooke 1999, Nicholas 2003, Vandergeest and Peluso 2006).

Over the years the state governments have approved projects that have proved far more destructive, including industrial logging, oil palm and rubber plantations. The Orang Asli have taken legal action against some of these projects and several court rulings have upheld the Orang Asli traditional land rights (Lim 2011). Recently there have been cases of Temiar communities challenging logging in both the Perak and Kelantan parts of the Temengor priority site. These challenges have occasionally involved the Temiar building blockades to obstruct logging roads which have led to arrests when the authorities have dismantled the blockades (Lim and Lee 2017, Murad 2017). Several of these cases are still before the courts.

*2. Settlements in Temengor Forest Reserve*

We identified 26 points of putative camps and settlements in and within 1-km of Temengor Forest Reserve (Fig. 4). Of these points, 17 (65%) were presently occupied by Orang Asli settlements. We were able to match 14 of these 17 sites with 10 entries from the JAKOA (2016) database, totalling 1248 people (Table 1).

In addition to these 14 points, P.P. and R.A. identified five more points using the satellite imagery (e.g. Fig. 5). Site visits and interviews with residents indicated that eight of the published points and all of the five points identified by P.P. and R.A. – a total of 13 points – were still occupied (e.g. Fig. 6). Table 2 identifies the sources that refer to each point.

*3.Human-Elephant Conflict*

Out of 161 grids overlapping with the Temengor Forest Complex, 31 (19%) had reports of previous conflict. We found that elephants were reported present in 39 out of 40 cells with respondents (Figure 2, inset). Of these 17 grid locations (43%) reported presence of human-elephant conflict (mainly crop-raiding) including nine locations where conflict had not been previously reported.

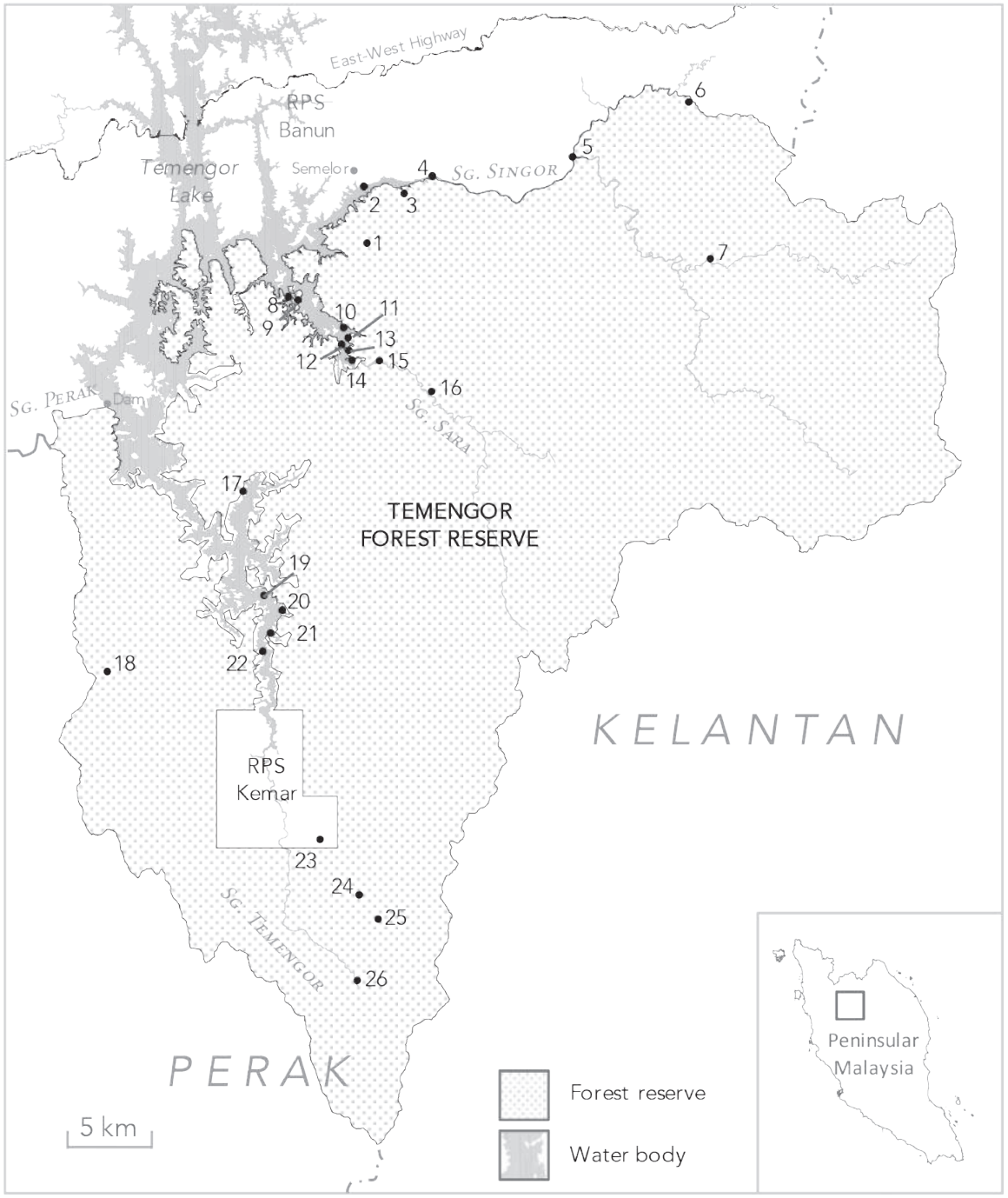


**Figure 4.** Putative settlements in Temengor Forest Reserve (numbered points):
-Sg. Singor: 1–Halong, 2–Pulau Tujuh, 3–Enam, 4–Tekam, 5–Mangga, 6–Selaor, 7–Kelap; Sg. Sara: 8–Chuweh Lama, 9–Chuweh Baru, 10–Charok Bus Baru, 11–Charok Bus Lama, 12–Tebang Baru, 13–Tebang Lama, 14–Chiong, 15–n/a, 16–Terhong; Sg. Temengor: 17–Panggas, 18–Jeh, 19–Chabang Tiga, 20–Tersau, 21–Kenyer, 22–Pulau Hitam, 23–Lerlar, 24–Lengweng, 25–Changkat Tenel and 26–Agik.


**Figure 5.** Satellite image of Kg. Kelap (point no. 7 in our study), showing six buildings in a clearing next to a river bend. Screenshot from Google Earth, image (c) 2017 CNES/Airbus.

**Figure 6**. Kg. Changkat Tenel (point no. 25 in our study), showing a traditional Temiar dwelling place in a forest clearing. Photo by T.W. Lim, 2016.

## DISCUSSION

*Mapping indigenous territories & settlements*

The fact that the whole of Temengor is part of the traditional territories of the Orang Asli poses a challenge for NECAP. Native land claims affect all of the NECAP priority sites and dealing with these claims are one of the key challenges for wildlife conservation generally. Clarifying the location of villages is a first step to mapping the extent of the claims together with the villagers. However, before embarking on this exercise it will be important to consider the implications.

So far, no state nor federal government agency has published any maps of the Orang Asli land claims. Instead, the federal and several state governments have agreed to a policy whereby each Orang Asli household would be granted individual title to between two and six acres (0.8 - 2.4 ha) of plantation land, an amount of land largely insufficient for swidden cultivation (Subramaniam 2015). The exercise of mapping is often seen as an act of confronting the state's control in what Nicholas (2000) describes as a "contest for resources". In the light of this contest, Peluso (1995) describes mapping as an "intrinsically political act", she labels maps produced by NGOs and communities as "counter" maps that challenge the "hegemony" of the state (Peluso 1995). Bryan and Wood (2015) characterise maps as a weapon in the "war" for native land rights. Nietschman (1994) characterises indigenous people as "Fourth World nations" fighting against the "internal colonialism" of state governments: "More indigenous territory has been claimed by maps than by guns. This assertion has its corollary: more indigenous territory can be reclaimed and defended by maps than by guns".

Even if the government were to agree to community mapping, it can be hard for maps to capture the complexities and dynamics of indigenous rights. Peluso (1995: 401) highlights how mapping of landuses can have the effect of "freezing" them, taking away their natural flexibility, variability and fuzziness. There are also problems that can arise from overly territorialising rights that in reality are overlapping or vary according to individual trees (Ibid.: 402). Gemmell (2014) also cautions that Google's digital maps lack the depth of expression of traditional indigenous cartographic conventions that are often based on narratives that incorporate gesture, song and dance.

Community mapping also raises several ethical issues. Taking an "externalist" approach, the use of satellites to monitor activities of rural communities bears the hallmarks of a "surveillance society" and risks encroaching on the right of these people to privacy (Crampton 1995). Bujang (2005) also notes the danger of community maps revealing too much information regarding exploitable resources.

Indeed, in some instances the actual location of a settlement can be something that the community may not wish to reveal. Identifying settlements makes them "legible" to the state (Scott 1995) and thus exposes them to administrative intervention which can include forced resettlement. Maps can also be exploited by commercial interests including people involved in hunting, tourism, forest products, and cultural artefacts. Maps of settlements also make it easier for proponents of various mainstream religions to proselytise the Orang Asli.

Despite these challenges associated with community mapping, Peluso (1995) concludes that few communities would choose the alternative: not being on the map and having local claims obscured.

*Map of Settlements in Temengor Forest Reserve*

Despite the National Forestry Act 1984 not recognising Orang Asli rights inside forest reserves, including the right to reside, there are still a significant number of Orang Asli villages in and around Temengor Forest Reserve. Many of these settlements are just on the reserve's border and might be regarded as being outside the forest. However, at least three settlements with a total population of at least 110 are more than 5-km inside the reserve and are not accessible neither by motorbike nor by motorboat.

In addition to the settlements in our study, we note that there are around 10 additional settlements in RPS Kemar that we did not map because they are outside the 1-km buffer that defines our study area and they are not presently included within the NECAP priority site. However, these settlements are almost enclaved by the forest reserve and the residents probably also consider their territory to extend into the forest reserve (SAM and JKOASM 2016).

Furthermore, there are probably several additional settlements that we did not capture in our survey. Meyer (2004) mentions a "Kg. Bidayus" which may refer to "Kg. Kelap" or it may be a separate location. Our respondent from Kg. Lerlar mentioned that there was a settlement of four or five families in a location known as Barlɛs to the southwest of our point no. 24. There are also several locations on the lake that look like they have been cleared recently and might contain settlements. We recommend that future studies look at these locations as well as all the minor settlements in the RPS Kemar area.

*Accuracy of Published Data*

None of the existing maps provided adequate detail in terms of settlements inside the reserve. The JAKOA (2016) database was a good source of data but its usefulness was compromised by the fact that it often lumped several settlements into one entry and did not note the proportion of the population living in the main village compared with the proportion living in the minor settlements.

The topographical maps (JUPEM 2012) were constrained by the fact that they were relying on old sources dating back to 1986. Temiar swiddening means that the precise location of a settlement moves every few years as part of a rotation that can take more than 100 years (Cole 1959). By the time a map goes to print, the data can already be out of date. For example, we assume that a recent move is the source of the error that lead JUPEM (2012) to place Kg. Charok Bus at point no. 11 (Fig. 4) as there is no longer any settlement at that point. This is an issue that will probably arise again in future but it can be somewhat overcome if community maps focus on the location of rivers and watersheds (which are fixed) rather than on the location of particular settlements (that are dynamic).

Another issue with the topographical maps is with regards to labels. Several of the place names on the maps are not recognised or accepted by the local people. One reason for this is the inadequacy of the national spelling system. The Jahai and Temiar languages are Austroasiatic languages that have a very wide range of vowels and *Aslian* words are not adequately captured by the spelling system used for the national language, Malay, which is an Austronesian language (Benjamin 1986).

One example of spelling difficulties is the word "Temengor" itself. The region, forest reserve, lake, and dam are all named after the river which in turn comes from the Temiar word for a species of fruit tree, *tumŋɔɔʔ* (Benjamin 2014, SAM and JKOASM 2016). The topographic maps render this both as "Temengor" and as "Temenggor"; other published spellings include "Temengoh" (Ridley 1910), "Temangor" (Durai 1939), and "Temanggor" (FAO 2013). However, a more accurate spelling would actually be "Temengok" (SAM and JKOASM 2016).

Another issue related to spelling is the fact that many of the village names pre-date the national spelling rules adopted in 1972. For example, villages such as Chiong and Chuweh are spelled using the letters <ch> rather than <c> for the voiceless palatal plosive. The use of the old spelling is common with most place names in Malaysia as changing the spelling of toponyms can lead to confusion. Nevertheless, the governments of some Malaysian states have directed that spelling of place names follows the 1972 rules (e.g. "Melaka" instead of "Malacca"; Koh 2017).

In Table 1 we did not change any of the spellings of the names of the villages. For point no. 25 our respondent gave the Temiar name as *Taŋkɔl Tɛnʔɛl* and we transcribe this as "Changkat Tenel" – opting for spelling that is consistent with that of the other village names.

Moreover, despite the advent of computer-based GIS, there is still scope for human error and some published maps have limited value due to mislabelled points and errors in plotting. These errors meant that we were unable to use some of these maps in our analysis (we did not use the map found in Zainon and Daniel 2014, nor the one in Siti et al. 2015).

*Community Mapping*

Peluso (1995) states that "investment in specialized computers and software and knowledge will make the costs of mapping prohibitive for most local people". We find that now, the widespread ownership of smartphones and mobile broadband internet means this is no longer the case. People throughout Peninsular Malaysia are beginning to use this technology to map their homes as well as to assert their claims to land and resources.

Mapping is very important for staking a legal claim to land. Indeed, Malaysian courts have already recognised the legitimacy of community maps (Majid Cook 2003, Lasimbang 2004, Bujang 2005). On their own initiative, the Orang Asli communities in Temengor are now in the process of preparing detailed maps of their land claims. In the meantime, MYGAJAH partners should consider mapping the location of all settlements within the NECAP priority sites. These maps will form the basis for discussions on which areas should be allocated for elephant conservation and which areas require assistance on conflict mitigation (such as building electric fences to protect crops).

The map produced by the present study does expose the settlements to the risk of increased attention by the state and other external interests. We acknowledge and accept that this risk is not really addressed by our efforts at ensuring our respondents consented to being interviewed and did not express any reservations to our revealing the location of their settlements. Nevertheless we feel that we have demonstrated that the accessibility of high-resolution satellite imagery means that the locations of the settlements that we map here are already in the public domain. We also feel that the benefits of highlighting the location of the settlements – via appropriate zonation of and prescriptions for elephant management areas outweigh any potential negative effects.

We made no attempt at mapping any claims to resources, boundaries or property rights. This is something for future studies to examine via a participatory mapping exercise that has the free, prior and informed consent of the residents of these settlements.

*Human-Elephant Conflict*

We were not surprised that elephants were reported from throughout the Temengor forest complex. However, our findings do demonstrate that the ECG survey methodology can be applied in remote and inaccessible parts of the Peninsula, this suggests that there is much scope to build on Tan's (2016) survey of human-dominated landscapes.

We were surprised that the respondents from Piah reported that there were no elephants there. The locality is just over the ridge from Kemar where there are a lot of elephants. There is the possibility that there are actually elephants at Piah and that the negative finding is not accurate due to the respondent not being aware of the elephant or some other reason. It is also possible that Piah is too far from salt licks or simply not as attractive as Kemar for some other reason.

We found it encouraging that conflict was not reported in every location. The pattern of conflict distribution requires more analysis but our preliminary observation is that the smaller, traditional settlements had lower levels of conflict than the larger villagers, possibly due to the plantation agriculture being particularly susceptible to elephant damage.

## CONCLUSION

We have demonstrated that (1) the whole of the Temengor Forest Complex is part of the original territory of the Orang Asli, (2) there are several Orang Asli settlements inside Temengor Forest Reserve, (3) conflict with elephants takes place in a significant proportion of these settlements. There is now a need to evaluate how to address the presence of human settlements in the heart of the priority sites for elephant conservation. This will require a more detailed assessment of the Orang Asli land claims and a review of the boundaries of the priority sites, taking all land uses into account. Addressing the presence of human settlements and taking them into account when defining a conservation policy would be needed to ensure the effectiveness of protected areas established under NECAP (Bruner&al. 2001).

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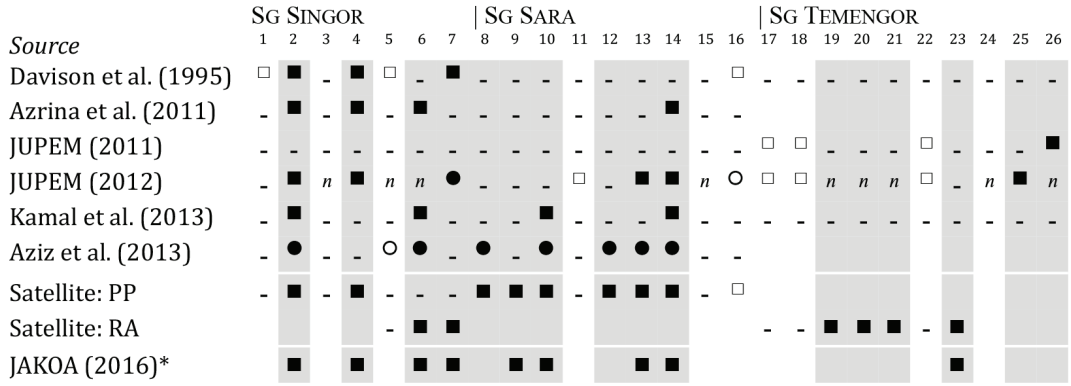
**Table 2.** Source for points in Temengor Forest Reserve




*Notes*: *Demographic data only (no spatial data).
*Key*: Shaded columns indicate extant settlements, unshaded columns indicate that there is no extant settlement at that point.
*Symbols for settlements*: (■): named extant; (●): unnamed extant; (□): named not extant; (○): unnamed not extant; *Other symbols*: (*n*): named river or island; ( - ): not labeled or identified as a settlement; ( ): outside boundaries of map.
*Settlement Names*: 1–Halong, 2–Pulau Tujuh, 3–Enam, 4–Tekam, 5–Mangga, 6–Selaor, 7–Kelap, 8–Chuweh Lama, 9–Chuweh Baru, 10–Charok Bus Baru, 11–Charok Bus Lama, 12–Tebang Baru, 13–Tebang Lama, 14–Chiong, 15–n/a, 16–Terhong, 17–Panggas, 18–Jeh, 19–Chabang Tiga, 20–Tesau, 21–Kenyer, 22–Pulau Hitam, 23–Lerlar, 24–Lengweng, 25–Changkat Tenel, 26–Agik.