

## 1. Forest Restoration & Restoration Monitoring

Forest Restoration efforts in 2019 were two pronged. Firstly, KOPEL continued its forest restoration efforts through the active involvement of volunteers and ecotourists. The voluntourism and ecotourism activities still forms the backbone of KOPEL's conservation programs including the forest restoration program. The tourism program provides year-round funding streams, which likewise supports the employment of a full-time conservation team. The Conservation Team includes a conservation manager, as well as the tree propagation and nursery team, Supu Cave ranger team, and other field monitoring and reporting staff. Secondly KOPEL continued ongoing efforts partnering with the Sabah Forestry Department, via the RMK11 Restoration Project. The RMK11 project involves tree planting, maintenance of tree planting, and silviculture tending (vine liberation). Although this project came to an end in 2019, this project employs more than 74 people from the local community of Batu Puteh on a seasonal basis.

Tree planting through ecotourism activities in 2019 planted a total of **7,842 trees**. A total of 18 species of tree were planted with the bulk of the trees being Bangkal (*Nauclea sp* =2,012), Salungapid (*Mollotus muticus* = 1,210)= 1,445) and Mangkapon (*Colona serratifolia* = 1,319). Three (3) key areas were planting in 2019, as follows:

1. **Block Kaboi Stumping**, is a riparian site in Pin-Supu Forest Reserve. A total of 1,070 trees were planted in both small and large gaps within the forest at this site, namely Bongkol (*Nauclea sp.* 610 trees) and Salungapid (*Mollotus muticus*), with a mix of 3 other species (*Colona sp.*, *Pterospermum sp.* and *Durio sp.* )
2. **Riparian corridor Ladang Kinabatangan**, is a riparian site providing a narrow but vital riparian corridor for wildlife on the south side of the Kinabatangan River - adjacent to Pin-Supu Forest Reserve. In 2019, a total of 4,755 trees were planted on this site, covering the remaining gaps on this site. A total of 15 species were planted on this site in 2019, the majority coming from Mangkapon (*Colona sp.* = 1,287), Bangkal (*Nauclea sp.* = 1,128), Salungapid (*Mollotus muticus* = 957), and Bayur (*Pterospermum sp.* = 817).
3. **Block G Laab (Swamp Besar)** is a permanently waterlogged swamp forest, in Pin-Supu Forest Reserve. In 2019 a total of 867 tree were planted in experimental plots to evaluate different planting techniques in this unique form of swamp forest. A total of 28 plots of size 20x20 m were established and enumerated with the support of volunteers in 2019. Four planting methods were tested in this experiment. Planting via (a) stem cuttings (otherwise known as "pole planting"). Planting with seedlings (b) at ground level and (c) on artificial mounds, and (d) using marcots from nearby *Ficus sp.* The tree species planted in these experimental plots were *Mytrogyna sp.* *Nauclea sp.*, *Alstonia sp.*, *Terminalia sp.*, *Ficus sp.* (marcots).
4. **Block H Laab (Pangkalan Gajah)**, is a riparian site of mixed secondary floodplain forest within Pin-Supu Forest Reserve, directly adjacent to and southwest of Block G Laab (Swamp) referred to in previous paragraph. Similar to Block G, planting in the adjacent Block H was also experimental. The experiment on this site was designed to trial the planting of climax species within a mixed secondary forest stand. In 2019 a total of 1,150 trees were planted in this site. The planting in this site was designed to enrich the species mix and to help restore this floodplain forest to pre-logging conditions. For this effect typical climax species for Riverine Dipterocarp Forest were chosen including Seraya (*Shorea sp.*), Pengiran kesat (*Anisoptera sp.*), and Kapur (*Dryobalanops sp.*). For more information on tree planting on this site refer to page 6

The tourism restoration efforts also involved a number of related restoration activities such as seed collecting, nursery propagation, site preparation for tree planting, tree planting (mentioned above), and follow-up maintenance of planted trees.

No.	Local name	Species 2	Kaboi Stumping	Ladang K	Laab		Total
					Swamp Besar	Pangkalan Gajah	
2	Mangkapon	Colona serratifolia	32	1287			1319
9	Bongkol	Nauclea sp.	610	1128	274		2012
7	Salongapid	Mallotus muticus	368	957	120		1445
13	Bayur	Pterospermum sp.	50	817			867
11	Binuang	Octomeles sumatrana		320			320
8	Sepat	Mitragyna speciosa		141	125		266
4	Durian	Durio sp.	10	36		232	278
15	Payung2	Terminalia copelandii		32	127		159
14	Kelumpang	Sterculia sp.		14		264	278
12	Nyatoh	Palaquium sp.		13			13
5	Belian	Eusideroxylon zwager		4			4
1	Pulai	Alstonia sp.		3	129		132
6	Ficus (Marcots)	Ficus benjamina		1	92		93
3	Keruing	Dryobalanops sp.		1			1
10	Laran	Neolamarckia cadamba		1			1
18	Seraya	Shorea sp.				228	228
16	Pengiran kesat	Anisoptera sp.				227	227
17	Kapur paji	Dryobalanops sp.				199	199
<b>Total</b>			<b>1070</b>	<b>4755</b>	<b>867</b>	<b>1150</b>	<b>7842</b>

Figure 1: Tree species Planted at each Planting site



Figure 2: Map Tree Planting Sites & Permanent Sample Plots PSFR 2019

## Monitoring of Permanent Sample Plots (PSP) in 2019:

KOPEL has three (3) permanent sample plots in meander belt forest. Plots numbered KP01, KP03 are in the riparian corridor adjacent to Pin Supu Forest Reserve (PSFR) – on the south side of the Kinabatangan River (ref Map 3, page 26).

Plot **KP01** is the riparian corridor on the north side of the River in Pin-Supu Forest Reserve downstream of the small Kaboi River. The site KP01 is known locally as Kaboi Stumping Ground because in the early 1980s it was a large log scaling and loading depot (a.k.a. “stumping ground”). Tree planting on the Kaboi Stumping Ground started in 2006 with most of the planting occurring between 2007-2008. Three (3) tree species were planted in the plot KP01 in 2008. Enumeration of the PSP KPO1 in 2019 showed there are now nine (9) tree species, not including shrubs, vines and grasses, within the PSP. The average height of 1086 trees within this PSP was 14.8m with an average DBH of 10.5cm.

Plots **KPO2 & KP03** are located in the riparian corridor on the southern Kinabatangan Riverbank adjacent to PSFR - known locally as the Riparian Corridor Ladang Kinabatangan. This site was planted between 2014-2015. Enumeration of the 352 trees in PSP KPO2 in 2019 shows the average height of tree on this site is now 9.3m with DBH 11.6cm. Of the 485 trees enumerated in KP03, the average height is 8.4m with average DBH at 9.1cm. Both study plots have experienced an increase in species through natural regeneration from 3 species planted to 9 species in KP02, and from 4 species planted to 8 species in KP03. Permanent Sample Plot (PSP) map and data is appended to this report.

Camera traps have only been set-up for short duration within these PSPs due to their proximity to human populations and the fear of losing the cameras to theft. Even so, tourist, guide and rangers have all observed a large variety of wildlife in KP01 including orangutan, proboscis monkey, bearded pigs, long-tail macaques, civet cats, Borneo pygmy elephants and a wide variety of hornbill species and other birds. Wildlife sightings in KP02-03 are also frequent, albeit less abundant, with sightings of long-tailed macaques, civet cats, leopard cat, hooded pitta, and a wide variety of hornbill species. Work will be expanded in 2020 to establish a more permanent wildlife monitoring presence in these permanent sample plots.

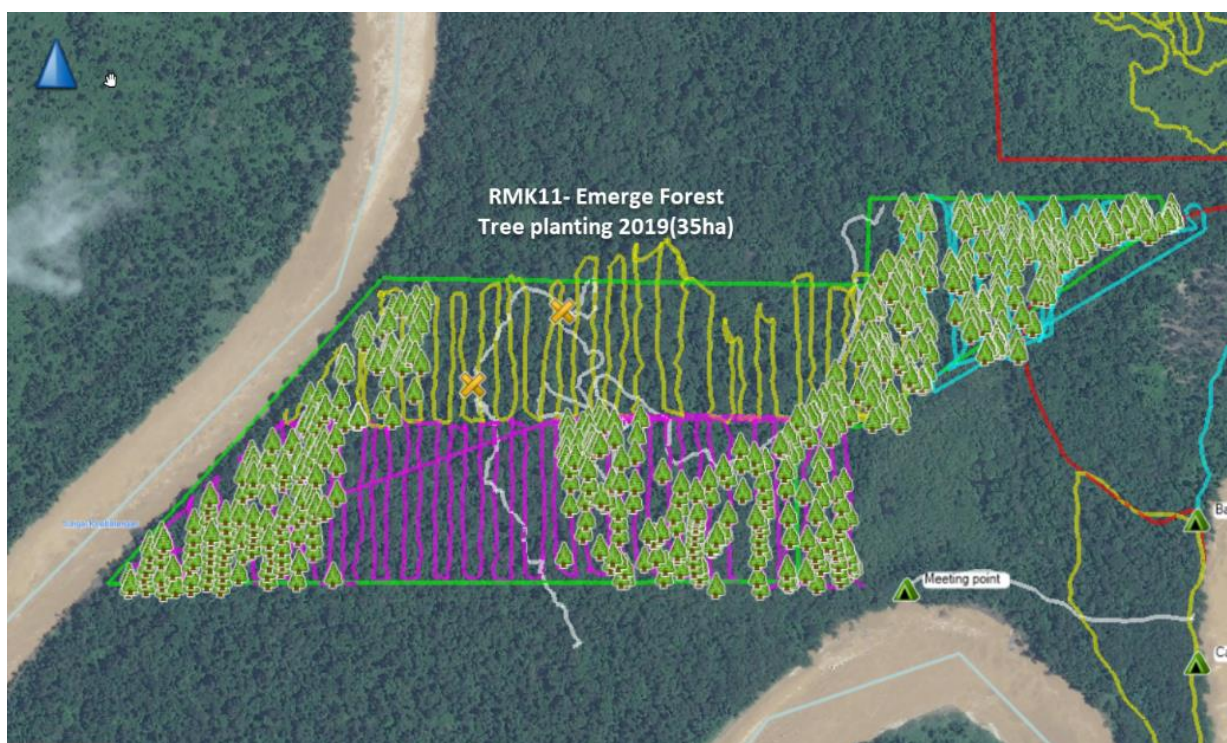


Figure 3: Map RMK11 Tree planting Project (35ha) 2019



### RMK11 Forest Restoration Project PSFR:

The RMK11 Project is focused primarily on the Pin Supu Forest Reserve (PSFR) and includes tree planting, silviculture treatment and maintenance work on trees previously planted.

**Tree Planting:** Tree planting efforts have targeted the most severely degraded sites outlined in the PSFR Management Plan. The most severely degraded sites within PSFR are currently all within seasonally flooded and permanently waterlogged sites (refer to Figure 1 next page). KOPEL has taken a precautionary approach to tree planting work on these sites due to the high potential of failure due to flooding and subsequent potential to waste RMK11 funds.

Tree planting by KOPEL in these flooded and waterlogged sites was decided to be experimental at first, following the method of “pole planting” based-on the success of this methodology, by KOPEL, in similar waterlogged sites in LKWS Lot 7. The tree species chosen for the pole planting technique are *Nauclea spp.* (Bangkal/Rubiaceae) and *Mytrogyna speciosa* (Sepat/Rubiaceae) based on previous experience and their tolerance to flooded and waterlogged environments. The Laab site was chosen for this experimental tree planting because of its relative proximity to Batu Puteh compared to other sites for its accessibility - being set-back only 300m from access points on the Kinabatangan River.

**Tree Maintenance:** The removal of grasses, weeds and climbers from around the newly planted trees was carried out twice in 2019. This maintenance work was carried out on the total 10.5ha of tree planting sites. This maintenance was designed to remove the choking grasses and vines that smother the newly planted trees. It is understood that without this maintenance work, these sites would experience a much higher mortality. Maintenance work is carried out by staff of KOPEL Bhd from the surrounding community of Batu Puteh. The method includes grass cutting, grass folding (to further impede grass regrowth) and vine cutting.



Figure 4: Location Map RMK11 Tree Maintenance(10.5ha) 2019

**Silviculture Treatment:** Within Pin Supu Forest Reserve silviculture treatment involved vine cutting to liberate trees threatened by thick and choking vine cover – also known as “vine liberation treatment”. The removal of the vine cover is designed to support and speed up the regeneration of tree species within the forest, especially in target sites where trees are threatened and damaged by thick vine cover. The vine liberation treatment is designed to enhance the regeneration of climax species and enhance the diversity and structure of the forest (See Figure 6, next page).

Silviculture treatment under the RMK11 project in 2019 was carried out on 255ha of forest in both Pin Supu Forest Reserve Block A & Block B (See Figure 5). The largest of the silviculture sites was upstream from the KOPEL base, in the area known as Kawasan Batu Supu. A total of 544ha was treated in the Supu site. The remainder of the Silviculture sites were downstream from the KOPEL base. A total of 11ha was restored in PSFR Block A.

**Silviculture response:** KOPEL is in the process of establishing a long-term-study to quantify the benefits of silviculture liberation treatment on forest health and wildlife habitat within Pin-Supu Forest Reserve. Based on the feedback from guides, forest rangers and tourists, there has been an increase in sightings of wildlife in areas treated by vine liberation. Even so, the long-term improvement to forest structure and tree species diversity has yet to be established. It is expected that improvement to forest structure will only be visible via detailed sampling through a long-term monitoring program.

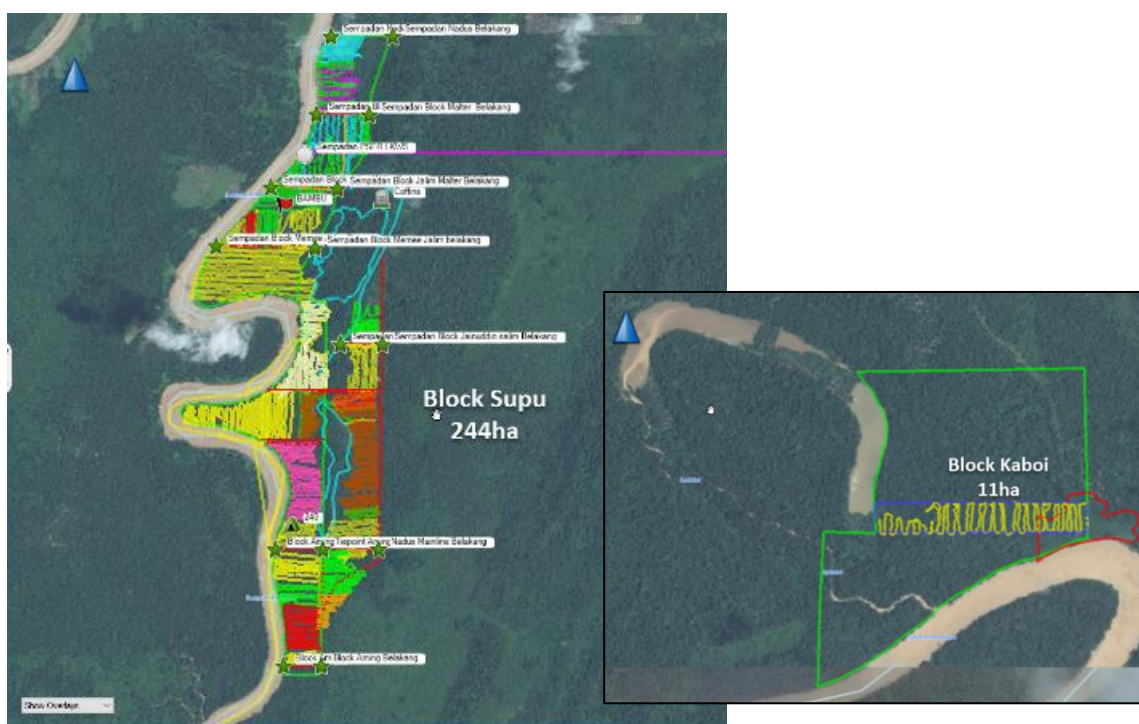


Figure 7: Location Map of RMK11 Silviculture Vine Liberation Treatment 2019

**Restoration Monitoring Outcomes & Feedback into Management**

1. Current data shows positive outcomes for restoration work on all riverine and riparian sites, which are mostly dry and well drained. In all other areas which are seasonally flooded or permanently waterlogged outcomes are mixed and some site extremely poor outcomes.
2. Further experimentation is advised in these waterlogged and seasonally flooded sites. The current experimental plots are designed to provide further data and it is hoped that work can be expanded and trials enhanced with additional equipment for monitoring hydrology and soil chemistry alongside additional trials on alternative or innovative restoration techniques.

**Closing Remarks:**

In summary ongoing monitoring work has been effective and continues to have consistent outcomes, no other major changes are suggested apart from what has already been outlined in this document. It is important that this work continues into the long-term hence ensuring reliable and consistent income into this program is paramount to its success. Income generation mechanisms are hoped to be expanded to benefit expanded monitoring activities in the future.

KOPEL Bhd continues to work closely with numerous of partners both in the preparation and analysis of data collected for the monitoring in 2019. KOPEL Bhd acknowledges and is extremely grateful for the efforts of students, volunteers, KOPEL staff, and the staff of Sabah Forestry Department and Sabah Agriculture Department. It is hoped that future partnerships can be established with Sabah Wildlife Department and other research institutions (such as UMS and Danau Girang Field Centre) to further build local capacity within KOPEL Bhd to strengthen monitoring and protection activities.

It is also hoped that the monitoring work can be expanded and improved to support better management of the forests and ecosystems around the Community of Batu Puteh and in the process further the knowledge and skills transfer to the community, the education of students, and economic benefits to the community, alongside improved conservation of the HCVF values into the future.