SABAH FORESTRY DEPARTMENT

[Prepared by Kalabakan Forestry Office]

ANALYSIS REPORT ON THE EFFECTIVENESS OF HCV MONITORING IN NGR FMU

2018

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Executive Summary

High Conservation Value (HCV) assessment for Northern Gunung Rara Sustainable Forest Management project area was carried out through field assessment in March 2015 and also attaining secondary data from management team and previous HCV report by Wong et al 2010. The main objective of this assessment is to enhance relevant information on the HCV elements within the NGR project area. A multidisciplinary team carried out the assessment with experienced assessors from various fields. Generally, all HCV elements are found to be present were elaborated for NGR project area. Appropriate management and monitoring actions have been recommended and discussed with the management team for further actions to be undertaken. Based on the High Conservation Values in Northern Gn Rara Forest Management Unit (July 2016), the HCV's identified present in NGR Project area is as follows:

1. HCV 1: Biodiversity Values
    a. HCV 1.1: Protected Area
    b. HCV 1.2: Threatened and Endangered Species
    c. HCV 1.3: Endemic Species
    d. HCV 1.4: Critical Temporal Use
2. HCV 2: Landscape Level Forest
3. HCV 3: Ecosystems
4. HCV 4: Services to Nature
    a. HCV 4.2: Forest Critical to Erosion Control
    b. HCV 4.3: Forest Providing Barriers to Destructive Fire
5. HCV 6: Cultural Identity of Local Community

All HCV identified were monitored according to the recommendation of the High Conservation Values in Northern Gn Rara Forest Management Unit (July 2016) report done by Forest Research Center. Periodic monitoring activities were established for all identified HCV's i.e. patrolling and surveillance activities, wildlife monitoring (5 methods established), and establishments of PSP Plots for HCV 1. On a landscape level (HCV 2), NGR project area forms a critical link that connects the three larger undisturbed natural forest of protected areas, namely Danum, Imbak Canyon and Maliau Basin forest reserves to support greater landscape connectivity of lowland areas Retaining the whole FMU under conservation and natural forest management functional zones is the best effort in maintaining the forest ecosystem function as forest corridor for plant dispersal and also acts as a transient wildlife migratory path between the different forest reserves it borders. Most of southern border of NGR project area is bordering oil palm estate. Furthermore, secondary vegetation dominates most of the peripheral area of the reserves that mostly susceptible to fire in comparison to pristine forest. A 50 m band of moderate to high forest structure inside the project area that border local communities land and oil palm estate are categorised as HCV 4.3. Nine teriti or heirs from Kg Kuamut carry out the edible nest collection at VJR Batu Timbang and they have obtained the collection permits from Sabah Wildlife Department. The continuous survival of the swiftlet that produce edible nests is highly dependent of the quality of food that are found outside of the limestone caves. The protection and preservation of mixed dipterocarp forest and limestone vegetation that is indicated as HCV 6 is crucial in order to support the cultural value of some Kg Kuamut villager. Continouous consultation with the stakeholder were established and strengthened through frequent meetings.

Analysis of the effectiveness of monitoring program was done and elaboration of the analysis was explained through this report. Improvements were seen in the effectiveness of conducting more frequent patrolling and surveillance in HCV 1 monitoring program i.e increase in patrolling frequency, extensive wildlife monitoring in all methods, and also maintaining all established PSP Plots. Frequent monitoring program covering the entire Project site for ensuring the link between the three larger undisturbed natural forests of protected areas, namely Danum, Imbak Canyon and Maliau Basin were done (HCV2). Re-enumeration of all PSP Plots and establishing new PSP plot covers the activities done for HCV 3. Water sampling were done in 4 locations to monitor HCV 4.2 Erosion Control, while frequent patrolling along the Forest Barrier of the 50 m band of moderate to high forest structure inside the project area that border local communities land and oil palm estate covers HCV 4.3. The Project Team also strengthened the relationship with the Birds' Nest Collectors of Bt Timbang Cave through continuous consultation and conflict resolution, which covers HCV6.

1.0 Objectives:

1. To evaluate the effectiveness by which HCV management and protection measures to maintain and/ or enhance the pertinent conservation attributes
2. As a guidance for Forest Manager to modify/ adjust/ enhance HCV management prescription to cater for any weaknesses
3. To comply with FSC indicator 9.4.3 and to close Minor CAR in the last surveillance audit
4. To achieve the strategic management objective as stated in the Forest Management Plan.

References:

- Annual Report 2013
- Annual Report 2014
- Annual Report 2015
- Annual Report 2016
- Annual Report 2017
- Annual Report 2018
- Wildlife monitoring report 2014
- Wildlife monitoring report 2015
- Wildlife monitoring report 2016
- Wildlife monitoring report 2017
- Wildlife monitoring report 2018
- Quarterly wildlife monitoring 2014-2018
- List of Enforcement Activities/ Arrests/ Prosecution Cases 2013 – 2018
- High Conservation Values in Northern Gunung Rara Forest Management Unit: Assessment Report and Management Recommendations (July 2016)
- Annual Environmental Monitoring Program Report 2017-2018
- Quarterly Report 2017-2018

2.0 HCV Management and Monitoring Plan:

HCV	ID	GENERAL HCV MANAGEMENT OBJECTIVE	SPECIFIC HCV MANAGEMENT OBJECTIVE	MANAGEMENT TARGETS	MANAGEMENT STRATEGIES		OPERATIONAL / STRATEGIC MONITORING	DOCUMENT TO BE REVIEWED
					AREAS	PRESCRIPTIONS		
1.1	69,432 ha Consisting of Mt Magdelena FR, Gn. Rara Wildlife Corridor FR, Batu Timbang FR, Imbok FR (Class VI) and one as production forest (Gn. Rara FR).	The whole project site remained protected from serious environmental or ecological threat.	Encroachment into the Project site is controlled and reduced. ***Indicators:** 1. Number of encroaches arrested per year 2. Number of Aerial survey frequency (hours) conducted per year 3. Distance of boundary re-brushing per year	Illegal entry into NGR in a reducing trend.	Whole area	• No conversion of forests is permitted. • No entry without permission. • No poaching. • Conduct periodic patrolling and surveillance in accessible HCV areas. • Demarcation of HCV boundaries on the ground for all designated HCVs within the TPAs is not required since 100 % overlaps occured among other HCV elements. • No open burning within the NGR SFM as well as right nearby/ boundary of NGR SFM • Signboards to prohibit any illegal activities to be erected and visibly maintained at the strategic location as well as all identified HCV area. • Awareness sessions to be conducted with neighbouring logging and plantation owners regarding the protection status of	• Periodic monitoring and control should be carried out to prevent encroachment in the FMU. • Monitoring to be conducted as documented target in AWP as follow: i. Aerial surveillance: 2 times per year. ii. Gate control to be conducted 16 hours (6.00 am - 10.00 pm) • Inspection of boundaries to be conducted 2 times a month. • Enforcement and monitoring through Forest Checking Station Batu Timbang and Imbok. • Signboards to prohibit any illegal activities erected and maintained at the strategic locations as well as all identified HCV area.	• Aerial survey report • Gate control report • Stakeholder Consultation meeting minutes. • List of stakeholders • AWP, Compliance Report and Quarterly Report • Communities and stakeholders grievance report • Satellite imagery monitoring report.

HCV	ID	GENERAL HCV MANAGEMENT OBJECTIVE	SPECIFIC HCV MANAGEMENT OBJECTIVE	MANAGEMENT TARGETS	MANAGEMENT STRATEGIES		OPERATIONAL / STRATEGIC MONITORING	DOCUMENT TO BE REVIEWED
					AREAS	PRESCRIPTIONS		
						NGR SFM, applicable laws, forest fire, biodiversity and habitats within. • Cooperation with World Wildlife Fund (WWF), Sabah Wildlife Department (SWD), Monitoring, Control, Environment and Enforcement (MCEE) Tawau, DAMAI Team, Yayasan Sabah (YS), Sabah Forestry Department (SFD) in preventing encroachment and poaching		
					Boundary NGR SFM (particularly neighbouring logging and estate) I. Empayar Kejora Sdn. Bhd II. Serijaya Industries Sdn Bhd III. Maliau Basin Conservation Area IV. Imbak Canyon Conservation Area V. Danum Valley	• No entry without permission. • No illegal felling • No poaching • No illegal cultivation's • No illegal occupations • No open burning within the NGR SFM as well as right nearby/ boundary of NGR SFM • Signboards to prohibit any illegal activities to be erected and visibly maintained at the strategic location as well as all identified HCV area. • Awareness sessions to		• Aerial survey report • Gate control report • Stakeholder Consultation meeting minutes. • List of stakeholders • AWP, Compliance Report and Quarterly Report • Communities and stakeholders grievance report • Satellite imagery monitoring report.

HCV	ID	GENERAL HCV MANAGEMENT OBJECTIVE	SPECIFIC HCV MANAGEMENT OBJECTIVE	MANAGEMENT TARGETS	MANAGEMENT STRATEGIES		OPERATIONAL / STRATEGIC MONITORING	DOCUMENT TO BE REVIEWED
					AREAS	PRESCRIPTIONS		
					Conservation Area	be conducted with neighbouring logging and plantation owners regarding the protection status of NGR SFM, applicable laws, forest fire, biodiversity and habitats within.		
1.2	[Listed] Flora 28 species from 4 families of plants are rare, endangered or threatened plant species	Biodiversity in NGR is maintained or enhanced	Flora diversity in NGR is maintained *Indicators: 1. Number of RTE flora species (Refer: i. Plot similarities in species assemblages ii. Mortality and recruitment rates iii. Growth iv. Species change v. Above ground biomass	No deterioration detected in diversity and/or abundance of identified flora in NGR.	• Whole area • 12 permanent sample plots: 12 x 0.13 ha	• Conduct periodic patrolling and surveillance in designated HCV areas. • No encroachment. • No illegal felling and collecting trees species (except for authorized survey) • Establish a long term biodiversity monitoring system for critical forest ecosystem, flora. • Marked on the ground and on the maps of high conservation value plant species discover in PSP Plots and nature trails in NGR Project area. • Field staff is required to attend training courses on plants to further enhance their botanical knowledge on species that are	• Periodic monitoring and control. • Monitoring to be conducted as documented target in AWP as follow: i. PSP Plot maintenance: once a year. - Ensuring the tie point is still in position. - Ensuring the plant indicating endemic tree species is still in position - Re-paint all marked tree within the radius plot area of 20 m - Re-paint each number on the tree. ii. Periodic monitoring by conducting re-enumeration of all trees in the permanent sample plots and to be conducted once every three year to get	• AWP, Compliance Report and Quarterly Report • PSP Plot Report. • Wildlife monitoring report. • Satellite imagery monitoring report. • Annual monitoring report on wild animals utilise the integrated mosaic planted forest of Empayar Kejora Sdn Bhd

HCV	ID	GENERAL HCV MANAGEMENT OBJECTIVE	SPECIFIC HCV MANAGEMENT OBJECTIVE	MANAGEMENT TARGETS	MANAGEMENT STRATEGIES		OPERATIONAL / STRATEGIC MONITORING	DOCUMENT TO BE REVIEWED
					AREAS	PRESCRIPTIONS		
						currently listed in the threatened, endemic and forestry prohibited list to ensure they do not harvest or damage and also for monitoring purposes. • Signboards of PSPs (No., Coordinate No, etc.), HCV 1.2 and list of RTEs species within the PSPs to be erected at the strategic locations.	indication of changes in tree structure and species assemblages. • Analysis report of PSP re-enumeration to be conducted once every three year.	
1.2	[Listed] Fauna 17 species of fauna	Biodiversity in NGR is maintained or enhanced	Fauna diversity in NGR is maintained *Indicators: 1. Number of RTE Species (Refer: IUCN Redlist), Wildlife Conservation Enactment 1997), CITES	No deterioration detected in diversity and/or abundance of identified fauna in NGR.	Whole area Adjacent forest reserve	• Conduct periodic patrolling and surveillance in designated HCV areas. • No encroachment. • No poaching. • Establish a long term biodiversity monitoring system for critical forest ecosystem, fauna. • Field staff is required to attend training courses on wildlife to further enhance their wildlife knowledge on species that are currently listed in the threatened, endemic and forestry prohibited list to ensure they do not harvest or damage and also for monitoring	• Quarterly progress reports in reporting of the progress of activities as prescribed in the approved Annual Work Plan (AWP), encompassing reporting of monitoring results of know HCV attributes. • Annual wildlife monitoring report from Empayar Kejora Sdn Bhd shall be submitted to Sabah Forestry Department once in a year.	

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					AREAS	PRESCRIPTIONS		
						purposes. • Identifying migratory pathway of wildlife within the project area and adjacent to the project area.		
1.3	[Listed] Flora 162 species endemics to Borneo- 16 of these endemic to Sabah.	Biodiversity in NGR is maintained or enhanced	Flora diversity in NGR is maintained *Indicators: 1. Number of Endemic flora species (Refer: i. Plot similarities in species assemblages ii. Mortality and recruitment rates iii. Growth iv. Species change v. Above ground biomass	No deterioration detected in diversity and/or abundance of identified flora in NGR.	Similar to HCV 1.2 (Flora)	Similar to HCV 1.2 (Flora)	Similar to HCV 1.2 (Flora)	• AWP, Compliance Report and Quarterly Report • PSP Plot Report. • Wildlife monitoring report. • Annual monitoring report on wild animals utilise the integrated mosaic planted forest of Empayar Kejora Sdn Bhd
1.3	[Listed] Fauna 5 species of mammals, 4 species of birds, 4 species of frogs, 1 species of reptile and 12 species of insects	Biodiversity in NGR is maintained or enhanced	Fauna diversity in NGR is maintained *Indicators: 1. Number of RTE Species (Refer: IUCN Redlist), Wildlife	No deterioration detected in diversity and/or abundance of identified fauna in NGR.	Similar to HCV 1.2 (Fauna)	Similar to HCV 1.2 (Fauna)	Similar to HCV 1.2 (Fauna)	

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					AREAS	PRESCRIPTIONS		
	are endemic		Conservation Enactment 1997), Cites					
1.4	The limestone Karst in Batu Timbang VJR - nesting site for swiftlet, bats and other troglofauna.	Biodiversity of Batu Timbang VJR cave is maintained or enhanced	The limestone Karst in Batu Timbang VJR is maintained *Indicators: 1. Total weight of bird's nest harvested 2. Number of SFD revenue (RM) from COI endorsement 3. Number of Bird's Nest Stakeholder Consultation	Illegal harvesting of bird's nest in a reducing trend.	VJR Batu Timbang	• No entry without permission except: i. Approved by Persatuan Warisan Gua Batu Timbang Kuamut. ii. Approved by Mahkamah Anak Negeri iii. Approved by Sabah Wildlife Department • No poaching. • No illegal tree felling • No illegal cultivation • No littering and vandalism act • No fishing • No open burning • Conduct periodic aerial survey to curb illegal activities such as encroachment and poaching.	• Monitoring to be conducted as documented target in AWP as follow: • Bird's nest Stakeholder Consultation: Once a year	• AWP, Compliance Report and Quarterly Report • Bird's Nest Stakeholder Consultation meeting minutes. • Certificate of Identity (COI) records. • Aerial survey report.
2	NGR connects Danum, Imbak Canyon and Maliau Basin	The whole project site remained protected from serious environmental or ecological threat.	Encroachment into the Project site is controlled and reduced. ***Indicators:** 1. Number of encroaches arrested per year / forest fire	Illegal entry into NGR in a reducing trend.	Whole area Adjacent forest reserve	Similar to HCV 1.1, 1.2 & 1.3	Similar to HCV 1.1, 1.2 & 1.3	• Aerial survey report • Gate control report • Stakeholder Consultation meeting minutes. • List of stakeholders • AWP, Compliance Report and

HCV	ID	GENERAL HCV MANAGEMENT OBJECTIVE	SPECIFIC HCV MANAGEMENT OBJECTIVE	MANAGEMENT TARGETS	MANAGEMENT STRATEGIES		OPERATIONAL / STRATEGIC MONITORING	DOCUMENT TO BE REVIEWED
					AREAS	PRESCRIPTIONS		
			incidents. 2. Number of RTE & Endemic flora species (Refer: i. Plot similarities in species assemblages ii. Mortality and recruitment rates iii. Growth iv. Species change v. Above ground biomass 3. Number of RTE & Endemic Fauna Species (Refer: IUCN Redlist), CITES & Wildlife Conservation Enactment 1997					Quarterly Report • Communities and stakeholders grievance report • Satellite imagery monitoring report. • PSP Plot Report analysis from FRC. • Wildlife monitoring report. • Annual monitoring report on wild animals utilise the integrated mosaic planted forest of Empayar Kejora Sdn Bhd
3	Extreme lowland classified as mixed dipterocarp with mixture of kerangas forest and limestone vegetation.	Ecosystem and rich biodiversity in NGR SFM which is rich in significant diversity of ecosystem are maintained and enhanced.	Reduce the number of illegal activities and fire occur within the NGR SFM ***Indicators:** 1. Number of encroaches arrested per year / forest fire	Illegal entry into NGR in a reducing trend. No deterioration detected in diversity and/or abundance of identified flora and fauna in NGR.	Whole area	Similar to HCV 1.1, 1.2, 1.3	Similar to HCV 1.1, 1.2, 1.3	• Aerial survey report • Gate control report • Stakeholder Consultation meeting minutes. • List of stakeholders • AWP, Compliance Report and Quarterly Report • Communities and

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					AREAS	PRESCRIPTIONS		
			incidents 4. Number of RTE & Endemic flora species (Refer: i. Plot similarities in species assemblages ii. Mortality and recruitment rates iii. Growth iv. Species change v. Above ground biomass 2. Number of RTE & Endemic Fauna Species (Refer: IUCN Redlist), CITES & Wildlife Conservation Enactment 1997					stakeholders grievance report • Satellite imagery monitoring report. • PSP Plot Report. • Wildlife monitoring report.
4.2	All areas with slopes >25° and 30 m riparian buffer strips	Areas with slopes >25° and river or streams banks are maintain to prevent soil erosion	Maintain the Areas with slopes >25° and riparian reserves to prevent soil erosion. ***Indicators:** 1. Total number of Water quality parameter	Zero encroachment, fire, illegal felling, illegal cultivation, and illegal occupation activities which are might contribute water pollution's.	• 30m buffer zone	• Conduct periodic patrolling and surveillance in designated HCV areas. • No entry without permission. • No poaching. • No illegal felling • No illegal fishing • No open burning • No chemical	• Periodic monitoring and control to prevent encroachment in HCV areas. • Quarterly progress report in reporting of the progress of activities as prescribed in the approved AWP encompassing reporting of monitoring results of	• Water quality report. • AWP, Compliance Report and Quarterly Report • Environmental quarterly report. • Annual Environmental Monitoring report

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					AREAS	PRESCRIPTIONS		
			(Temperature, pH value, DO, Conductivity, TDS)			treatment/application • Warning signage to be erected and visibly maintained at the strategic location. • Maintain the natural vegetation along the riparian buffer zone. • Conduct water sampling along Sg. Lanap, Sg Kasuyan, Sg Kuamut and Sg. Imbok	known HCV attributes. • Water sampling to be conducted twice yearly.	
4.3	Buffer strips of 50 m inside the southern boundaries of NGR project area that bordering oil palm estate are categorised as HCV 4.3.	Barriers to destructive fire are maintained and enhance.	Maintain the buffer zone along neighbouring boundaries of oil palm plantations ***Indicators:** Number of forest fire incidents	Zero encroachment, fire, poaching, illegal felling, illegal cultivation, and illegal occupation activities which are might contribute to fire.	50m buffer zone	• No encroachment. • No entry without permission • No poaching. • No open burning. • Maintain the natural vegetation along the buffer zone. • The Forest Fire Management Plan has to be updated periodically.	• Aerial surveillance: 2 times per year. • Ground patrolling. • Collecting FDRS data: Every day. • Ensure that all fire prevention procedures (monitoring, fire drills, public awareness campaign etc.) to be practised on a regular basis (at least once a year), especially during the drought season. • Main stakeholder consultation with neighbouring stakeholders and contractors to be conducted once a year for forest fire awareness.	• Aerial surveillance report • Ground patrolling report • FDRS report • Fire drill training records • AWP, Compliance Report and Quarterly Report • Communities and stakeholders grievance report • Satellite imagery monitoring report. • Stakeholder Consultation meeting minutes.

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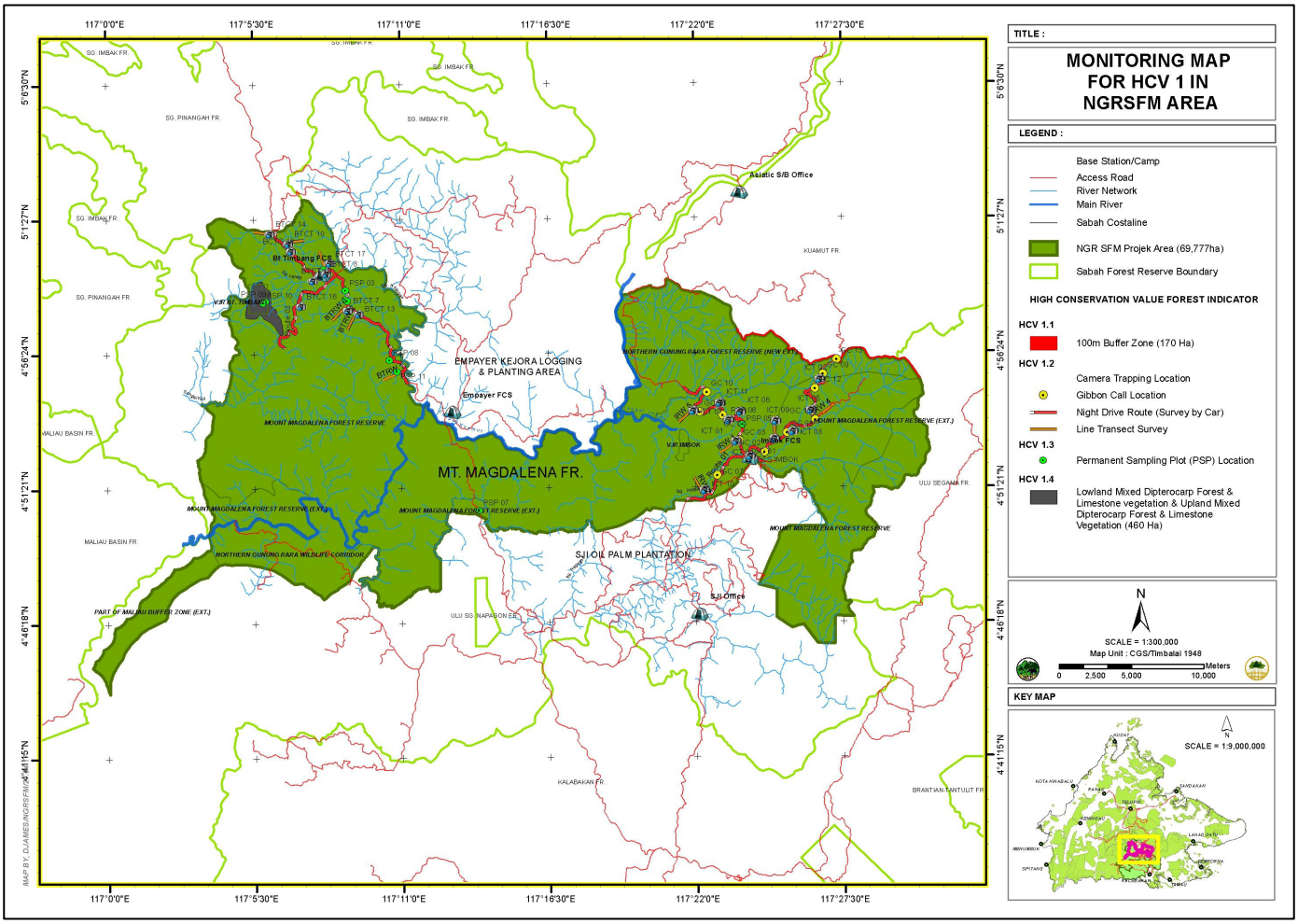
6	The mixed dipterocarp forest and limestone vegetation of CJR Batu Timbang are categorized as HCV 6 to depict the cultural value importance for the nine teriti of Kg Kuamut.	Cultural value in the NGR SFM are maintained and enhanced	Maintain the area of cultural value *Indicators: Similar to HCV 1.4	Zero encroachment within the significant HCV 6 area.	VJR Batu Timbang	Similar to HCV 1.4	Similar to HCV 1.4	• AWP, Compliance Report and Quarterly Report • Bird's Nest Stakeholder Consultation meeting minutes. • Certificate of Identity (COI) records. • Aerial survey report.

3.0 Effectiveness of monitoring program and enhancements by each HCV Attributes:

Based on the summary and monitoring activities table above, the effectiveness of the monitoring activities can be elaborated as follows:

3.1 HCV 1 BIODIVERSITY VALUES



Map 1 of HCV 1: Biodiversity Value

3.1.1 HCV 1.1 Protected Areas

The protected areas activities in the NGR SFM project are divided into several activities, such as the following:

i. Patrolling and enforcement, arrest, prosecution

Based on the Annual Report 2013 – 2018, there were no arrests made from 2013 – 2016, but there were (5) arrest made in 2017 and increased again to (10) arrest in 2018.

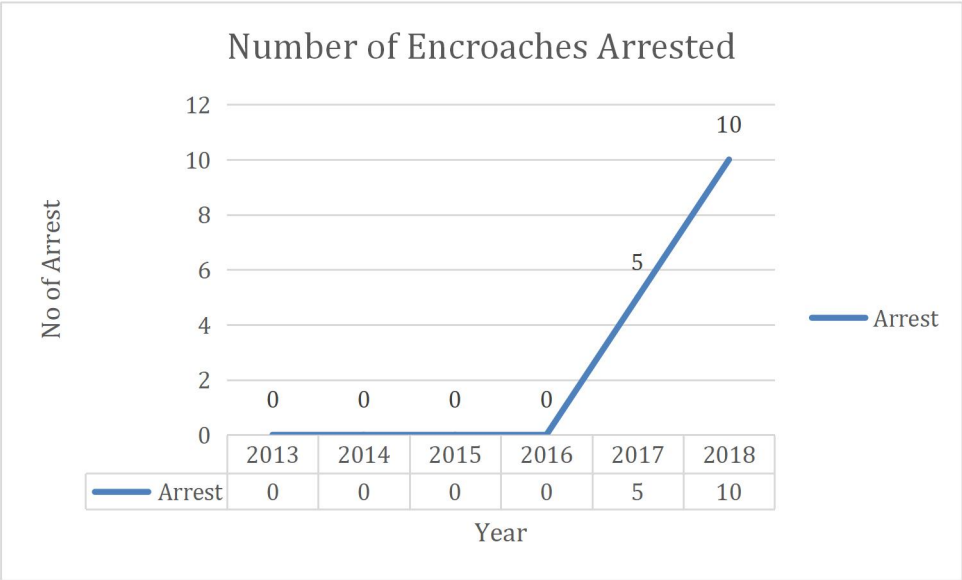


Figure 1: Number of Encroaches Arrested

Based on data from 2013 – 2018 (See Figure 1), the number of encroaches arrested was increased, so patrolling and enforcement activities had been intensified.

ii. Aerial Surveillance

Based on Figure 2, the data from year 2014 – 2018 shows data of the frequency of the aerial surveys done. As shown in the graph, the aerial surveillance had not been consistent in yearly hours as it was sometimes difficult to arrange the schedule with the Sabah Air. The frequency as per graph below:

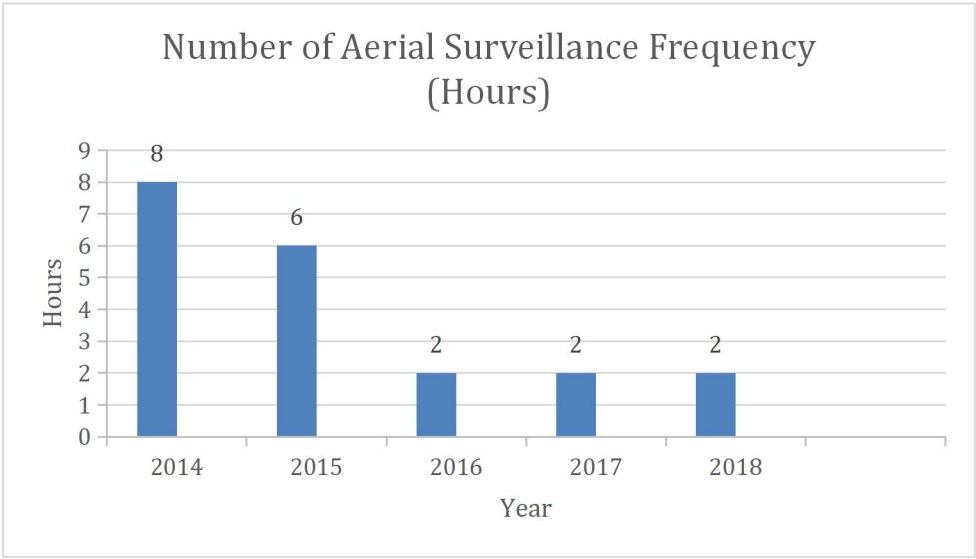


Figure 2: Number of Aerial Surveillance Frequency (Hours)

Figure 3: Aerial Surveillance

iii. Inspection of boundaries and re-brushing of NGR SFM Project

As stated in the AWP 2014 – 2018 and also Compliance Report 2014 – 2018, the inspection and re-brushing of main boundaries was conducted 10,000 meter per year. This corresponds to the responsibility of the team Management to protect the project area and installing of proper signages to ensure that all the stakeholders are aware of entering the area. There are few signages had been placed as follows :

- Project signboards on all entries
- Warning signboards on all entries.
- Safety signage.
- Riparian signage
- HCV signage.
- PSP signage.
- Enforcement signage.
- Prohibited activities signage

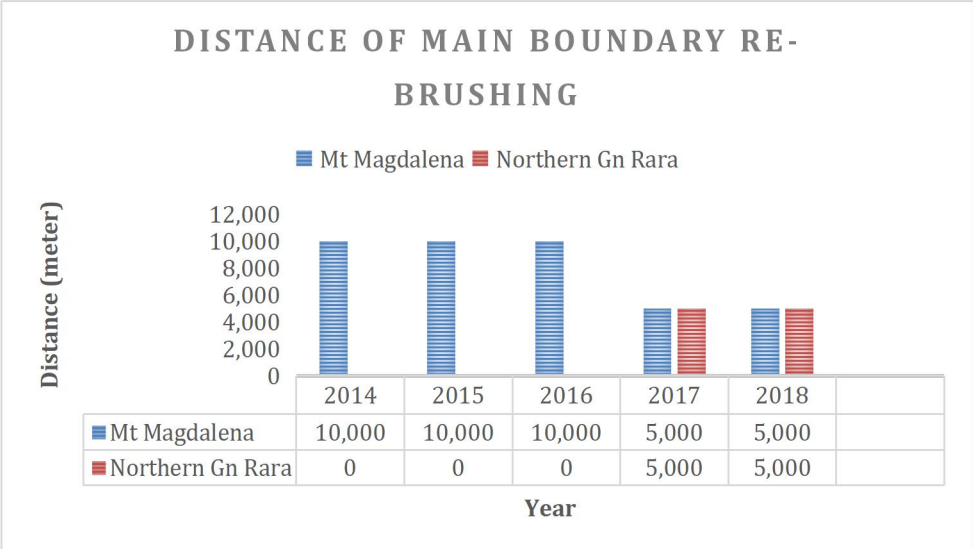


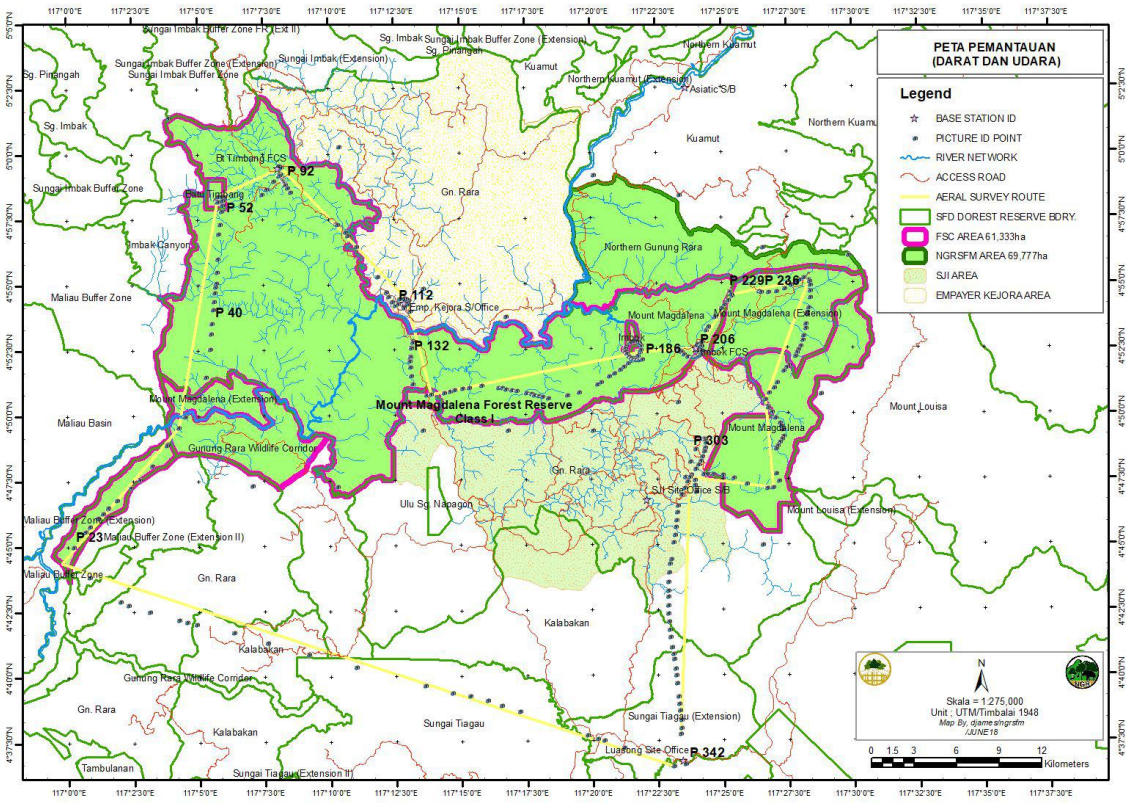
Figure 4: Distance of Main Boundary Re-Brushing

Based on Figure 4, the boundary re-brushing activities were well maintained every year. Since 2014 until 2018, the distance of boundary re-brushing were achieved with a total distance of 40,000 metre at Mount Magdalena FR Class 1 and 10,000 metre at Northern Gn. Rara FR Class 1.

Figure 5: Inspection of Boundary

iv. <u>Establishment of Forest Checking Station</u>

The Project team has established enforcement gates and Forest Checking Stations, in regards to the team's responsibility to safeguard the HCVs as a whole. The two established Forest Checking Stations are FCS Batu Timbang and FCS Imbok. FCS Bt Timbang was established due to the frequent number of complaints received on poachers entering from the northwestern route of the project area, while FCS Imbok covers the eastern side of the project area.



Map 2: Map showing the aerial survey route covering the whole project area, ground patrolling route and road accessibility, and locations of the Forest Checking Stations

Figure 6: FCS Batu Timbang

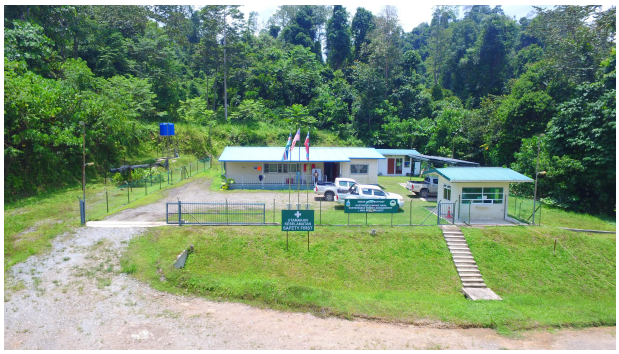


Figure 7: FCS Imbok

3.1.2 HCV 1.2 Threatened and Endangered Species

FLORA DIVERSITY

PSP Plot Analysis

The PSP Plots analysis will be prepared by FRC Sepilok. Eleven (11) 0.125 ha permanent sample plots (PSPs) were established end of 2014 and early 2015 (the report refer as 1st census 2015), and further re-census in 19th till 24th March 2018. An addition of one PSP Plot that is plot no. 12 were established in the year 2017. However, the re-enumeration for plot no.12 has not been conducted as it will be re-enumerate in the year 2020.

The overall objectives of the monitoring activities are to investigate changes of trees ≥ 10 cm dbh according to the prescribe indicators:

i. plot similarities in species assemblages
ii. mortality and recruitment rates
iii. growth
iv. species change
v. above ground biomass

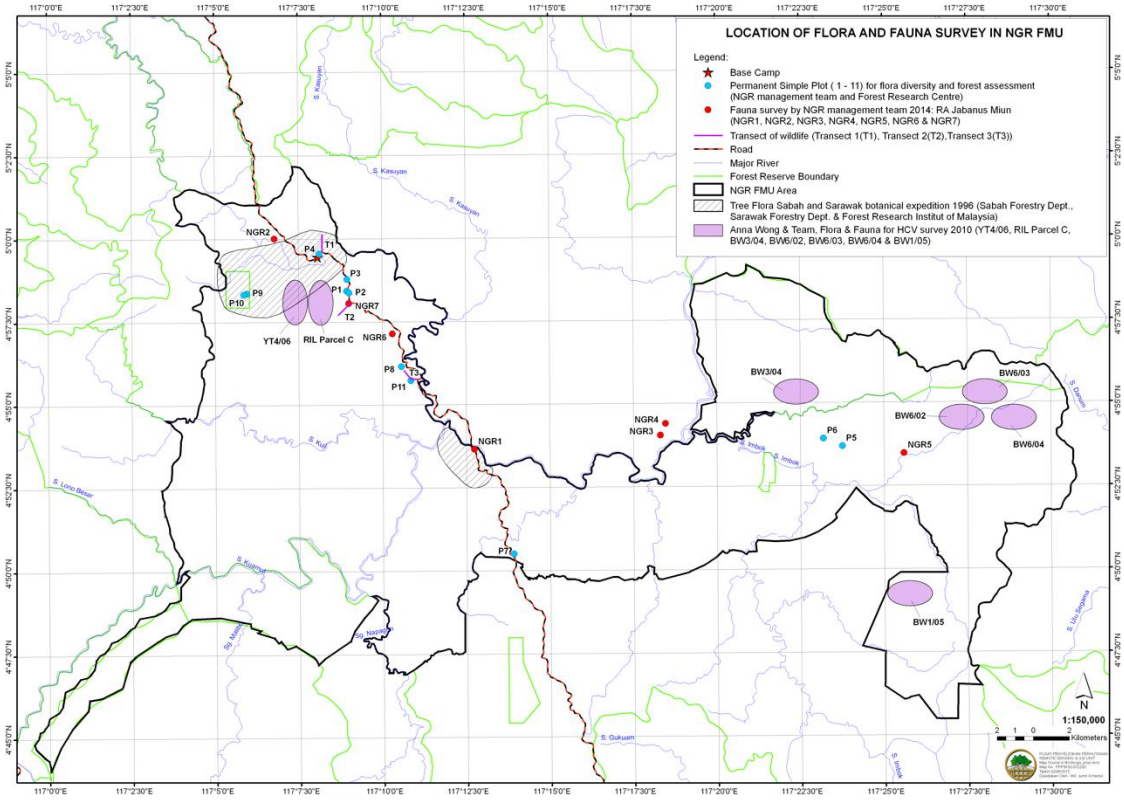
Re-measurement of recorded trees

The location of eleven PSPs is shown in Table 1 and Map 3. All previously labelled-trees ≥10 cm diameter at breast height (dbh) within 20 m radius circular plot and newly recruited trees were labelled, measured and identify to species level.

Table 1: Summary of location, date of census and altitude of the eleven PSPs at Northern Gunung Rara Sustainable Forest Management Project Area in Sabah, Malaysia.

Plot No.	Location	Ist Census	2nd Census	Latitude	Longitude	Altitude (m)
1	Mt Magdelena	24-Oct-14	19-Mar-18	N 04^0 58' 26.0"	E 117^0 08' 56.6"	197
2	Mt Magdelena	24-Oct-14	19-Mar-18	N 04^0 58' 22.6"	E 117^0 09' 0.7"	190
3	Mt Magdelena	13-Nov-15	20-Mar-18	N 04^0 58' 47.3"	E 117^0 08' 57.2"	190
4	Mt Magdelena	13-Nov-15	20-Mar-18	N 04^0 59' 33.4"	E 117^0 08' 07.8"	223
5	Mt Magdelena	19-Nov-15	22-Mar-18	N 04^0 53' 41.7"	E 117^0 23' 45.7"	307
6	Mt Magdelena	19-Nov-15	22-Mar-18	N 04^0 53' 55.7"	E 117^0 23' 11.7"	283
7	Mt Magdelena	20-Nov-15	22-Mar-18	N 04^0 50' 30.5"	E 117^0 13' 54.8"	188
8	Mt Magdelena	22-Jan-15	23-Mar-18	N 04^0 56' 09.3"	E 117^0 10' 34.6"	350
9	Batu Timbang	12-Mar-15	23-Mar-18	N 04^0 58' 21.9"	E 117^0 05' 57.4"	455

10	Batu Timbang	12-Mar-15	24-Mar-18	N 04^0 58' 19.6"	E 117^0 05' 51.8"	532
11	Mt Magdelena	13-Mar-15	24-Mar-18	N 04^0 55' 43.9"	E 117^0 10' 51.4"	267

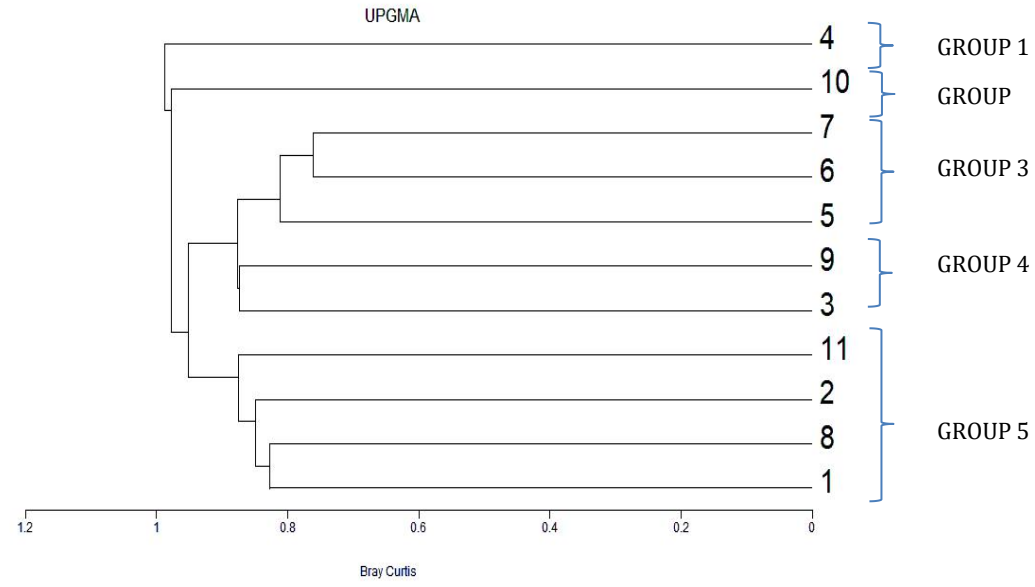


Map 3: The distribution of the eleven PSPs at Northern Gunung Rara Sustainable Forest Management Project Area in Sabah, Malaysia.

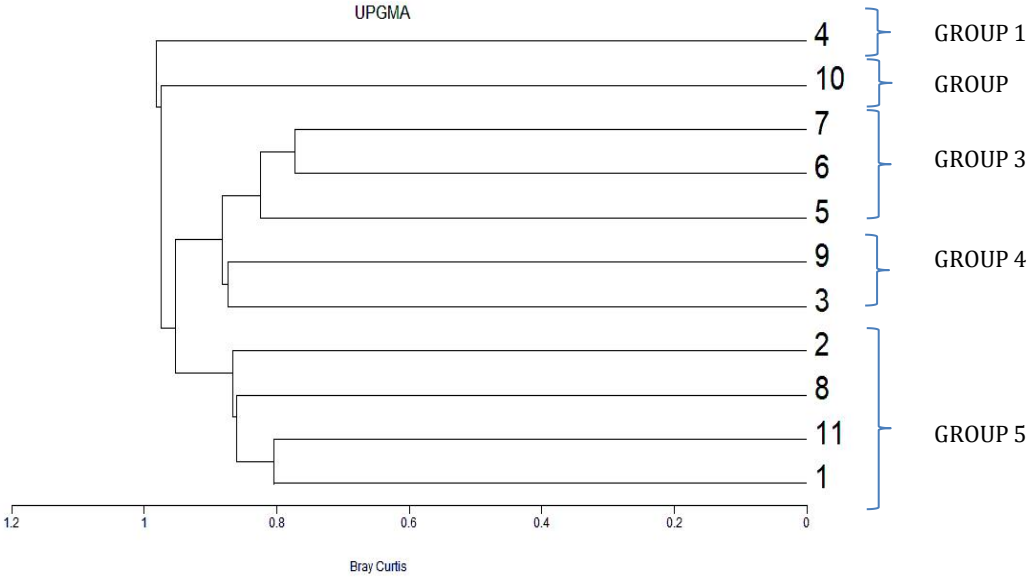
RESULTS

i. Plot similarities in relation to species assemblage

The cluster analysis based on species abundance indicated that all PSPs enumerated in 2015 and 2018 can be grouped into five forest types or species assemblages (Figure 8). The grouping can be differentiated in relation to level of past disturbances and edaphic factors. Group 1 and 3 are forest that were dominated by secondary tree species where the former natural climax forest could have been totally cleared in the past. Group 2 is mainly trees that are found associated with limestone substrate. The other groups are mainly advance regenerating lowland mixed dipterocarp forest. In the three-year interval (2015-2018), the species assemblages grouping has shown no deviation from the initial observation in 2015 (Figure 8).



Census 2015



Census 2018

Figure 8. The dendrogram derived from Bray-Curtis ordination analysis (1957) for trees recorded in eleven PSPs at Northern Gunung Rara Sustainable Forest Management Project Area in Sabah, Malaysia: A) year 2015 and B) year 2018. (Note: 0 = completely similar & 1 = completely dissimilar).

ii. Mortality, recruitment and turnover

A comparison of tree mortality and recruitment for all sample plots is presented in Table 2. Seven out of eleven plots had greater numbers of recruits than deaths over the interval 2015–2018. Two plots had slightly more mortality than recruitments, and one has similar count of mortality and recruitments. One plot has no observation of mortality and recruitment of trees. In total, tree recruitment is three times more than mortality. The highest number of tree deaths were recorded in Plot 3 and 7, whereas the greatest number of recruits were observed in Plot 1, 4 and 5.

Plot No	Tree 2014	Tree 2017	No of Dead	No of Recruit	Mortality Rate (% per year)	Recruitment Rate (% per year)	Turnover Rate (% per year)
1	75	84	3	12	1.19	4.41	2.80
2	69	70	1	2	0.43	0.84	0.64
3	52	56	5	9	2.96	5.08	4.02
4	65	83	0	18		7.01	3.51
5	60	72	2	14	1.01	6.26	3.63
6	34	40	0	6	0.00	4.74	2.37
7	50	48	4	2	2.46	1.26	1.86
8	62	62	7	7	3.71	3.71	3.71
9	57	55	2	0	1.17	0.00	0.58
10	47	47	0	0	0.00	0.00	0.00
11	53	59	1	7	0.63	4.08	2.35
Grand Total	624	676	25	77	1.23	3.40	2.32

Table 2 Dynamic of trees ≥ 10 cm dbh in all 11 permanent sample plots (PSPs) between 2015–18 in Northern Gunung Rara Sustainable Forest Management project area, Sabah, Malaysia

iii. Growth

A comparison of tree growth on all sample plots is presented in Table 3. On average, all trees ≥ 10 cm dbh for all plots have demonstrated positive growth within the interval 2015-2018. Trees in Plot 4 demonstrated the highest growth rate and Plot 9 as the lowest.

Plot No.	N	Mean of AGR	Min of AGR	Max of AGR	Mean of RGR	Min of RGR	Max of RGR
1	71	0.31 ± 0.06	-0.38	2.55	1.31 ± 0.25	-1.90	9.79
2	67	0.38 ± 0.09	-0.59	4.10	2.11 ± 0.54	-2.70	23.30
3	45	0.44 ± 0.17	-5.06	2.74	2.27 ± 0.47	-4.81	13.68
4	64	0.93 ± 0.09	-0.27	3.93	4.90 ± 0.41	-1.03	17.30
5	57	0.60 ± 0.13	-0.75	4.90	3.99 ± 0.88	-4.98	37.70
6	34	0.74 ± 0.13	-0.36	2.78	2.93 ± 0.49	-2.11	9.67
7	46	0.55 ± 0.10	-1.44	3.20	2.71 ± 0.46	-3.68	16.84
8	55	0.54 ± 0.09	-0.85	3.19	3.28 ± 0.62	-4.48	24.51
9	54	0.23 ± 0.11	-2.24	3.95	0.91 ± 0.22	-3.35	5.90
10	47	0.49 ± 0.10	-0.03	3.59	2.28 ± 0.43	-0.21	17.10
11	50	0.51 ± 0.11	-0.33	4.29	2.63 ± 0.56	-1.82	18.64

Grand Total	590	0.51	± 0.03	-5.06	4.90	2.66	± 0.16	-4.98	37.70

Table 3 Growth of trees ≥ 10 cm dbh in all 11 permanent sample plots (PSPs) between 2015–18 in Northern Gunung Rara Sustainable Forest Management project area, Sabah, Malaysia. (Annual Growth Rate, AGR; Relative Growth Rate, RGR)

iv. Species compositional changes

The number of species that were recruited is almost three times more than those recorded as dead in 2018, i.e. 52 species recorded as newly recruits and 19 species as dead (Table 4). This demonstrated that diverse tree species were recruited in all forest ecosystem throughout the three-year period. The composition of recruited trees also varies between successional group of trees from mixed climax and pioneer species, and also mixed structural canopy, such as main canopy, middle storey and understorey species. Based on plant traits, of the 52 species recruited, about 42% of the list are large stature climax species and 21% as pioneer. As for dead individuals, of the 19 species, both pioneer and climax contributed about 37% of total mortality, respectively.

Plot No	Recruits	Dead
1	*Alangium javanicum*	*Nephelium maingayi*
	Ardisia macrophylla	*Shorea angustifolia*
	Artocarpus kemando	*Xanthophyllum vitellinum*
	Artocarpus lanceifolius	
	Gluta wallichii	
	Lithocarpus beccarianus	
	Lithocarpus canfleyanus	
	Macaranga gigantea	
	Shorea ferruginea	
	Shorea parvifolia	
	Vatica albiramis	
2	*Hopea beccariana*	*Lophopetalum subovatum*
	Vatica chartacea	
3	*Baccaurea tetrandra*	*Macaranga hypoleuca*
	Cephalomappa malloticarpa	*Macaranga indistincta*
	Dendrocnide eliptica	*Shorea ferruginea*
	Knema latifolia	
	Macaranga hypoleuca	
	Mallotus molissimus	
	Palaquium calophyllum	
	Shorea macrophylla	
4	*Litsea garcia*	
	Ludekia borneensis	
	Macaranga cf. grandibracteota	
	Macaranga pearsonii	
	Nauclea subdita	
	Neonauclea artocarpoides	
	Norrisia major	
	Terminalia citrina	
5	*Aglaia rufinervis*	*Macaranga pearsonii*
	Baccaurea macrocarpa	
	Brownlowia peltata	
	Dendrocnide elliptica	
	Garcinia gaudichaudi	
	Ludekia borneensis	
	Mallotus korthalsii	
	Paranephelium joannes	
	Parashorea tomentella	
	Polyalthia rumphii	
	Shorea johorensis	
	Syzygium tawahense	
6	*Callicarpa pentandra*	

	Dendrocnide elliptica *Parashorea tomentella* *Symplocos fasciculata*	
7	*Hopea ferruginea* *Sindora irpicina*	*Baccaurea bracteata* *Bridelia sp.* *Callicarpa plumosa* *Litsea acceden*
8	*Aporosa acuminatissima* *Artocarpus lanceifolius* *Chisocheton medusae* *Dacryodes rostrata* *Pentace laxiflora*	
9	-	*Diospyros sp.* *Dryobalanops lanceolata*
10	-	-
11	*Dacryodes laxa* *Dacryodes rugosa* *Shorea macroptera* *Shorea parvifolia* *Shorea pilosa* *Swintonia acuta* *Vatica albiramis*	*Macaranga hypoleuca*

Table 4 List of species recruited and dead of trees ≥ 10 cm dbh within the elven PSPs between 2015–18 in Northern Gunung Rara Sustainable Forest Management project area, Sabah, Malaysia

v. Above ground biomass changes

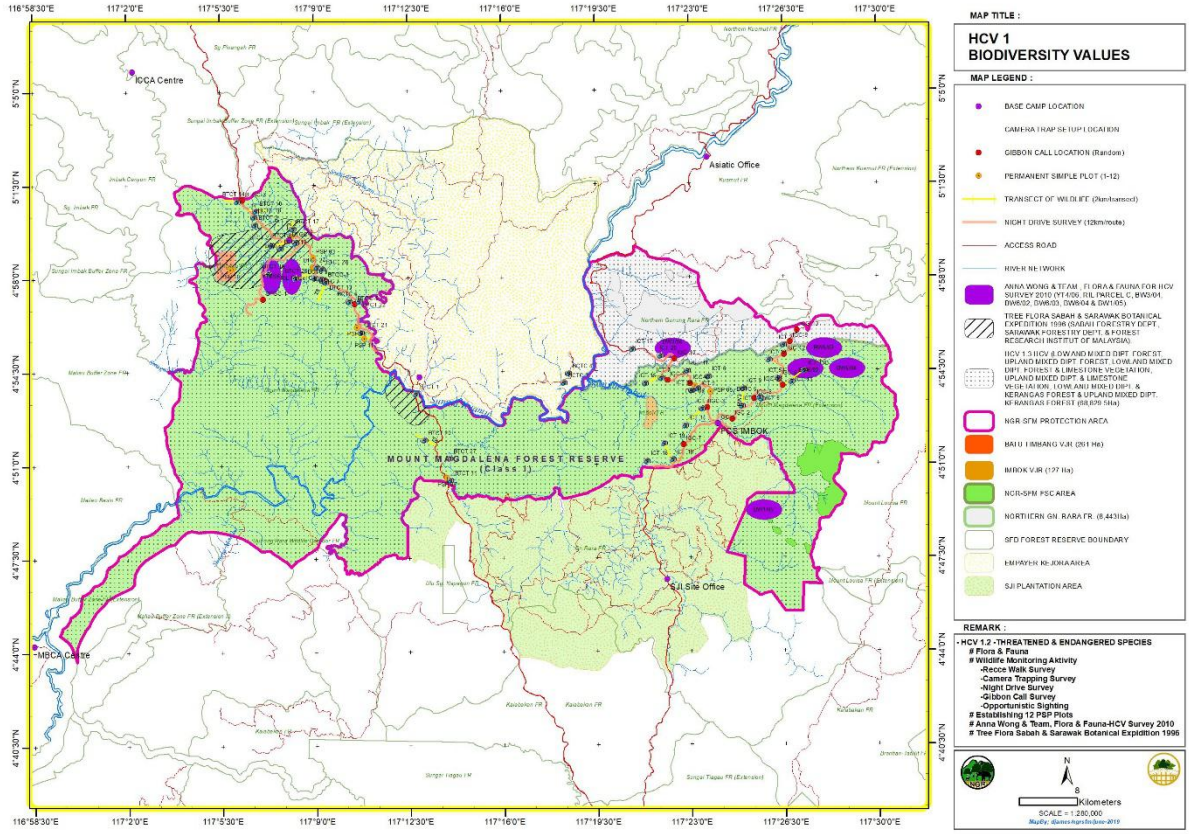
Throughout the period 2015–2018, the overall total AGB indicates an increase of 8 % from the initial observation value (Table 5). About nine PSPs demonstrated an increase of AGB with range from 6-33% from their initial values, and two PSPs indicated a decrease of 2-13%.

Plot No	AGB 2015		AGB 2018		Rate of change %
	N	Total (Mg/ha)	N	Total (Mg/ha)	
1	75	542	84	578	7
2	69	782	70	892	14
3	52	585	56	509	-13
4	65	272	83	362	33
5	60	488	71	478	-2
6	34	171	40	223	31
7	50	283	48	317	12
8	62	185	62	196	6
9	57	792	55	865	9
10	47	315	47	367	16
11	53	356	59	387	9
Grand Total	624	4769	675	5174	8

Table 5 Comparison of two census years (2014 and 201)7 on above ground biomass (AGB) per hectare of lived standing trees with ≥ 10 cm dbh within the 11 PSP in Timimbang Botition Sustainable Forest Management project area, Sabah, Malaysia.

FAUNA DIVERSITY

The NGR SFM Team established (5) methods of wildlife monitoring, that is; (a)Recce Walk Survey; (b)Camera Trapping; (c)Night Drive Survey; (d)Opportunistic Sightings; & (e)Gibbon Call. Of these (5) wildlife monitoring methodology, we analysed (5) of the methods. Below is a table of NGRSFM Wildlife RTE Indicator:



Map 4: Map of RTE Species (Flora&Fauna)

No	Common name	WCE (SWD). 1997	CITES	Status IUCN Redlist	Comments	HCV PRIORITY SPECIES	IUCN Red List
1	Asian Giant Tortoise	III		Status: **Endangered** ver 2.3 Pop. trend: decreasing			**EN**
2	Bornean Banteng (Tambadau)	I	I	Status: **Endangered** ver 3.1 Pop. trend: decreasing	Endemic in Borneo	√	**EN**
3	Bornean gibbon	II	I	Status: **Endangered** ver 3.1 Pop. trend: decreasing	Endemic in Borneo	√	**EN**
4	Bornean Orangutan	I	I	Status: **Critically Endangered** ver 3.1 Pop. trend: decreasing	Endemic in Borneo	√	**CR**
5	Bornean pygmy Elephant	II (I since June 2013)	I	Status: **Endangered** ver 3.1 Pop. trend: decreasing	Endemic in Borneo	√	**EN**
6	Bornean Bay Cat	II	I	Status: **Endangered** ver 3.1 Pop. trend: decreasing	Endemic in Borneo	√	**EN**
7	Helmeted Hornbill			Status: **Critically Endangered** ver 3.1 Pop. trend: decreasing			**CR**
8	Otter Civet	II		Status: **Endangered** ver 3.1 Pop. trend: decreasing		√	**EN**

9	Sunda Pangolin	II (I since 13th Feb 2018)	II	Status: **Critically Endangered** ver 3.1 Pop. trend: decreasing		√	**CR**

Table 6 #List Of Species RTE recorded from year 2013-2018 (Ref IUCN)

Based on the data collected from all the wildlife monitoring methods, the status of NGR RTE by percentage are as follows:

Table 7: NGR RTE Percentage

Status IUCN Redlist	No. of Widlife Species	Remarks	Percentage (%)
Critically Endangered	3	Threatened	27.8%
Endangered	7		
Vulnerable	12		
Near Threatened	12	Near Threatened	15.2%
Least Concern	43	Least Concern	54.4%
Endemic Borneo	18	Endemic	22.2%
HCV Priority	15	HCV	18.5%
Data Deficient	2	Data Deficient	2.5%
Total	**79**		**100%**

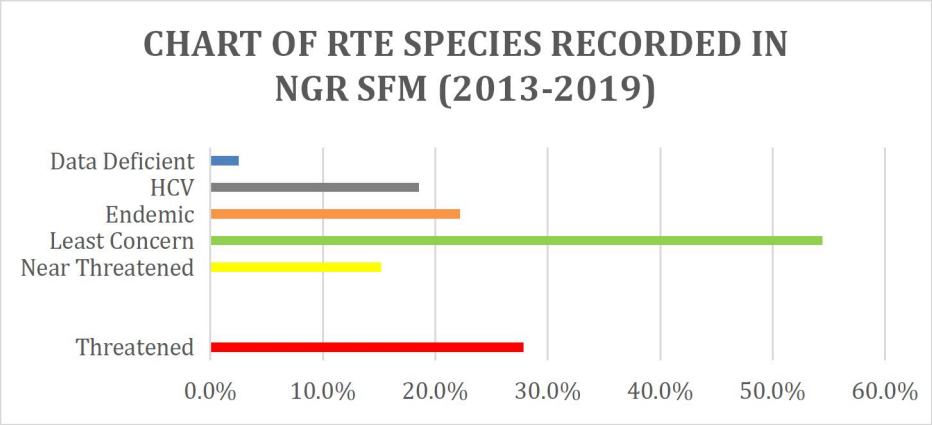


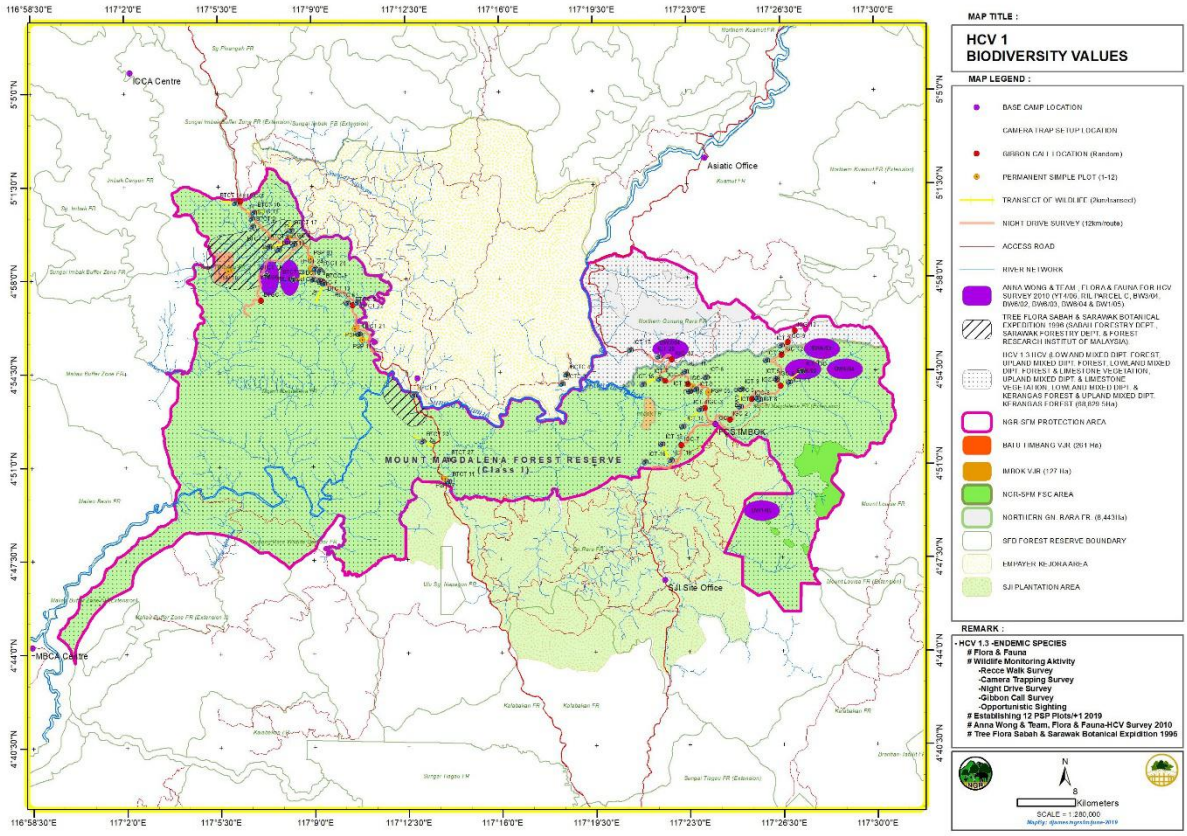
Figure 9: Chart pf RTE Species Recorded in NGR SFM (2013-2019)

Based on monitoring records form the year 2013-2018, nine (9) RTE species of fauna were identified through the wildlife monitoring analysis. There were 7 RTE mammals species, 1 RTE reptile species and 1 RTE bird species identified within the project area.

3.1.3 HCV 1.3 Endemism

FLORA DIVERSITY
Similar to HCV 1.2.

FAUNA DIVERSITY



Map 5: Map of Endemic Species (Flora&Fauna)

There are eighteen known endemic species of wildlife found in the Project Area. Based on the analysis result of the wildlife monitoring, there were 12 endemic mammals species and 6 endemic bird species identified within the project area. Most of the identified species were recorded through camera traps.

Table 8: #List Of Endemic Species Recorded From the Year 2013-2018 (Ref. IUCN)

No	Common name	WCE (SWD). 1997	CITES	Status IUCN Redlist	Comments	HCV PRIORITY SPECIES	IUCN Red List
1	Blue-Headed Pitta			Status: **Vulnerable** ver 3.1 Pop. trend: decreasing	Endemic in Borneo		VU
2	Bornean Banded Pitta			Status: **Least Concern** ver 3.1 Pop. trend: decreasing	Endemic in Borneo		LC
3	Bornean Banteng (Tambadau)	I	I	Status: **Endangered** ver 3.1 Pop. trend: decreasing	Endemic in Borneo	√	EN
4	Bornean Crested Fireback			Status: **Near Threatened** ver 3.1 Pop. trend: decreasing	Endemic in Borneo		NT
5	Bornean gibbon	II	I	Status: **Endangered** ver 3.1 Pop. trend: decreasing	Endemic in Borneo	√	EN
6	Bornean Ground Cuckoo			Status: **Near Threatened** ver 3.1 Pop. trend: decreasing	Endemic in Borneo		NT
7	Bornean Mountain Ground Squirrel	II		Status: **Least Concern** ver 3.1 Pop. trend: decreasing	Endemic in Borneo		LC
8	Bornean Necklaced Partridge			Status: **Vulnerable** ver 3.1 Pop. trend: decreasing	Endemic in Borneo		VU
9	Bornean Orangutan	I	I	Status: **Critically Endangered** ver 3.1 Pop. trend: decreasing	Endemic in Borneo	√	CR

10	Bornean pygmy Elephant	II (I since June 2013)	I	Status: **Endangered** ver 3.1 Pop. trend: decreasing	Endemic in Borneo	√	**EN**
11	Bornean Striped Palm Civet	II		Status: **Least Concern** ver 3.1 Pop. trend: decreasing	Endemic in Borneo		**LC**
12	Bornean Sun bear	I	I	Status: **Vulnerable** ver 3.1 Pop. trend: decreasing	Endemic in Borneo	√	**VU**
13	Bornean-yellow muntjac	III		Status: **Near Threatened** ver 3.1 Pop. trend: decreasing	Endemic in Borneo		**NT**
14	Bornean Bay Cat	II	I	Status: **Endangered** ver 3.1 Pop. trend: decreasing	Endemic in Borneo	√	**EN**
15	Sabah Grey Langur	II		Status: **Least Concern** ver 3.1 Pop. trend: decreasing	Endemic in Borneo		**LC**
16	Thomas's Flying Squirrel	II		Status: **Least Concern** ver 3.1 Pop. trend: decreasing	Endemic in Borneo		**LC**
17	White-crowned Shama			Status: **Data Deficient** ver 3.1 Pop. trend: unknown	Endemic in Borneo		
18	Sabah Grey Langur	II		Status: **Endangered** ver 3.1 Pop. trend: decreasing	Endemic in Borneo		**EN**

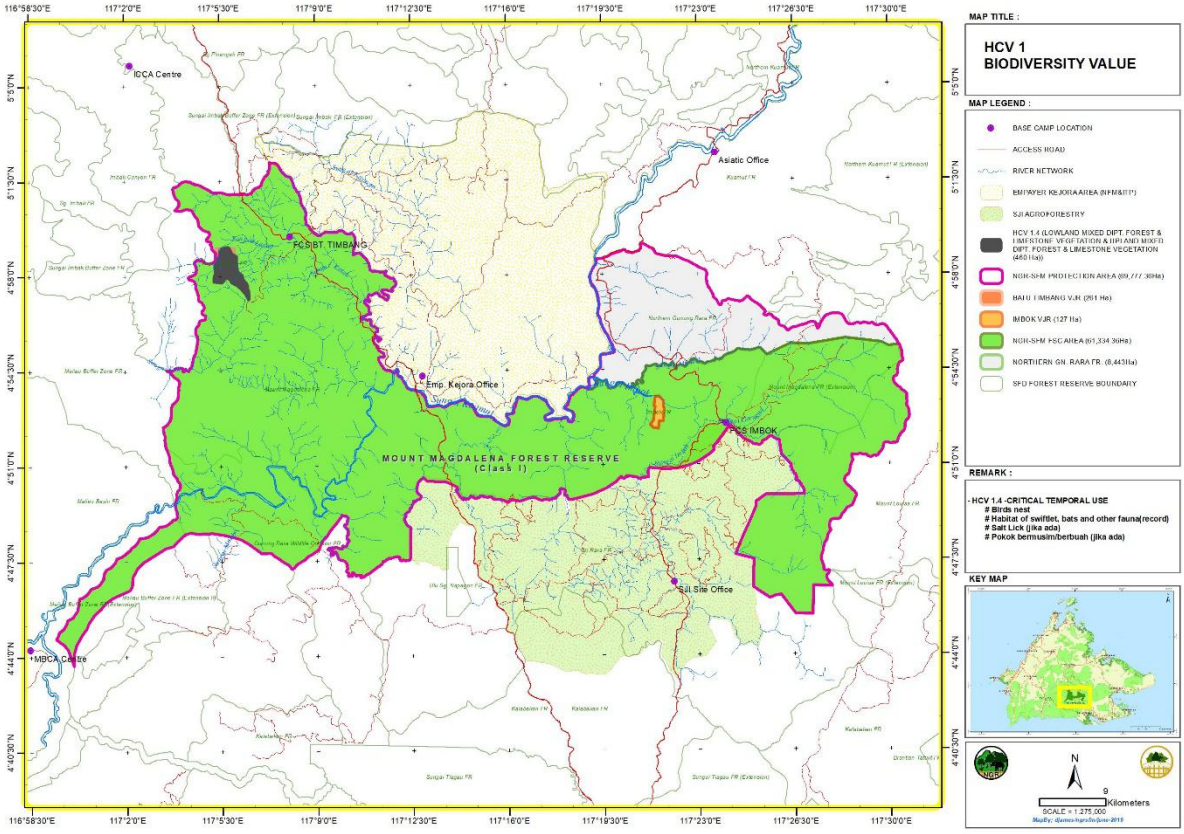
Figure 10: Tembadau/ Banteng – Camera Trap

Figure 11: a herd of Borneon Pygmy Elephants taken during opportunistic sightings

Figure 12: Sun Bear – Camera Trap

Figure 13: Bornean-yellow muntjac – Camera Trap

3.1.4 HCV 1.4 Critical Temporal Use



Map 6: HCV 1.4 Critical Temporal Use – VJR Batu Timbang

The limestone karst in Batu Timbang FR is an important nesting site for swiftlet, bats and other troglofauna. Team management is required to monitor this critical nesting site especially on illegal harvesting of bird's nest during the management period of the project area.

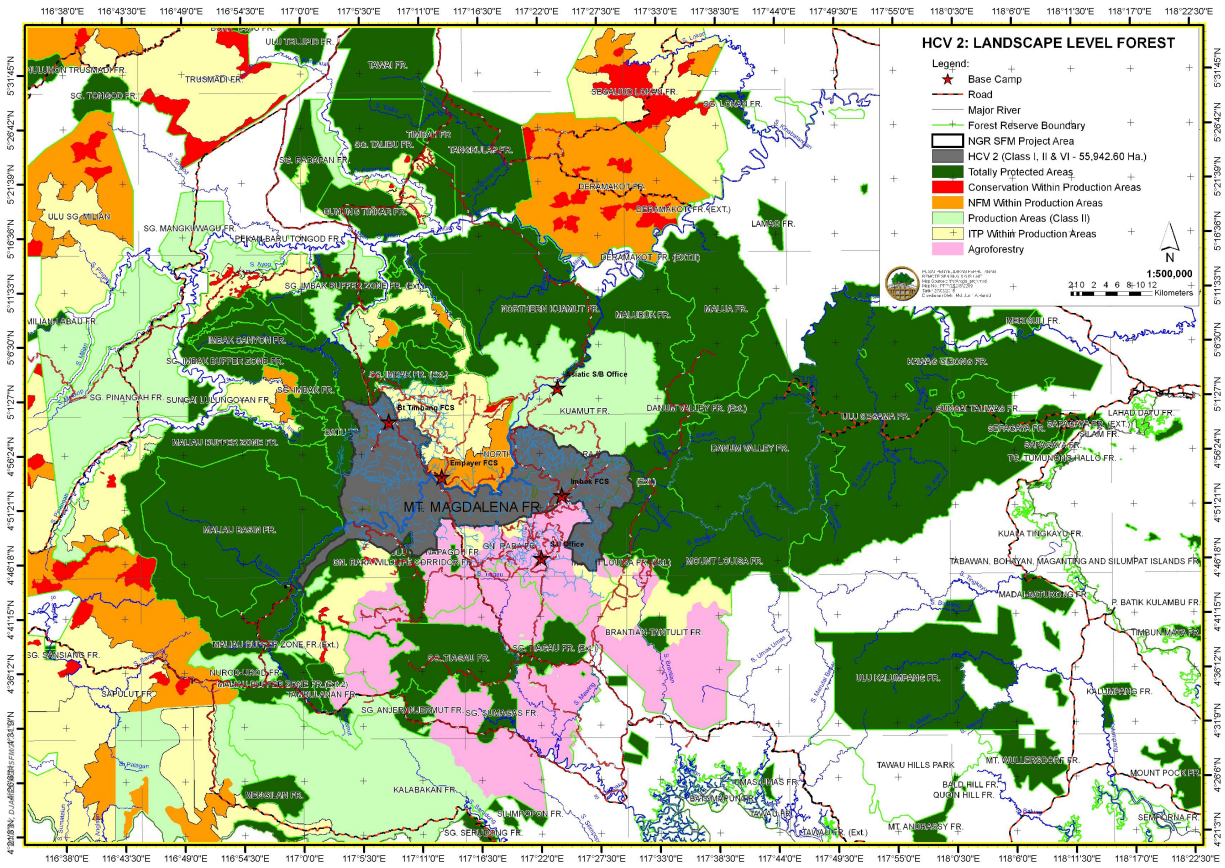
Therefore, it is significant for establishement of the enforcement gate, i.e FCS Bt Timbang to monitor the entering of the bird's nest collector to Bt. Timbang cave. The FCS is manned 16 hours seven days a week by rotation of staffs. The bird's nest scalling data such as the table 1 below:

Table 9 The Harvesting of Bird's Nest Scalling in FCS Bt. Timbang

Year	Cave in Bt. Timbang (kg)		
	Tendalaw	Intan	Mabpar
2015	85	40	0
2016	0	0	0
2017	20	7	0
2018	0	0	0

Based on the bird's nest scalling data, about 152 kg were taken out from the Bt. Timbang cave to date. From the data above, in year 2015 – 2018 harvesting of bird's nest was conducted at three caves in BT. Timbang (Tendalaw cave, Intan cave, and Mabpar cave). In 2016 and 2018, the teriti had not reported any bird's nest harvesting to FCS Bt. Timbang. Apart from that, the team has conducted meetings and consultations with the Bird's Nest Collector to give cooperation. We have raised this issue during the consultation process, in attendance of the Sabah Wildlife Department representative from Kinabatangan Office.

3.2 HCV 2 LANDSCAPE-LEVEL FOREST



Map 7: Map of HCV 2 - Landscape Level Forest

Periodic patrolling and surveillance was done as elaborated in HCV 1 activities done (page 14) in this report. Biodiversity monitoring were also done with the establishment of 12 PSP plots and five wildlife monitoring methods (1. Camera Trapping; 2. Recce walk; 3. Night drive survey; 4. Gibbon call; and 5. Opportunistic sightings). The results of the monitoring were elaborated in page 18 – 23 of this report under HCV 1.2 and HCV 1.3.

Map 7 shows the current status of all Forest Reserve surrounding the Project area. All activities pertaining to the fulfillment of monitoring for HCV were all done in tandem with all the other HCV's. In conjunction with the project area as the main connector of wildlife migratory pathway to other forest reserve, the FMU management cooperate with the adjacent stakeholder that is Empayar Kejora Sdn Bhd in wildlife monitoring data sharing. Based on the data derived from camera trap deployed in 2018-2019 form Empayar Kejora Sdn Bhd are shown as Figure 14.

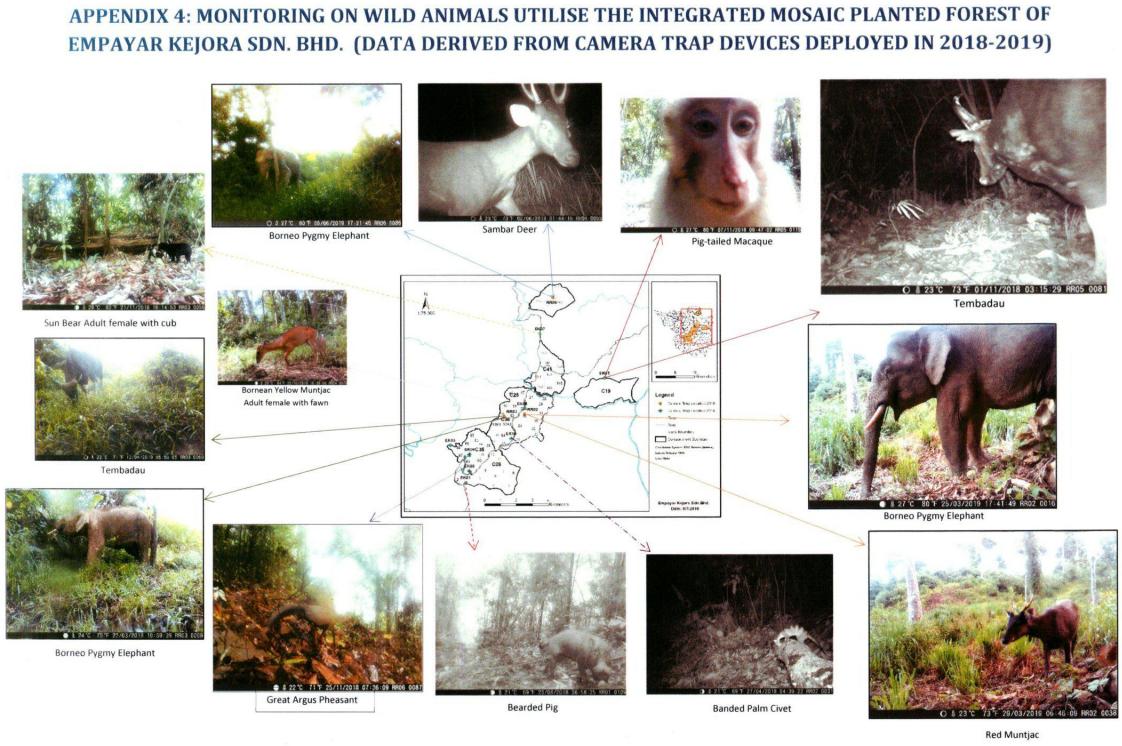
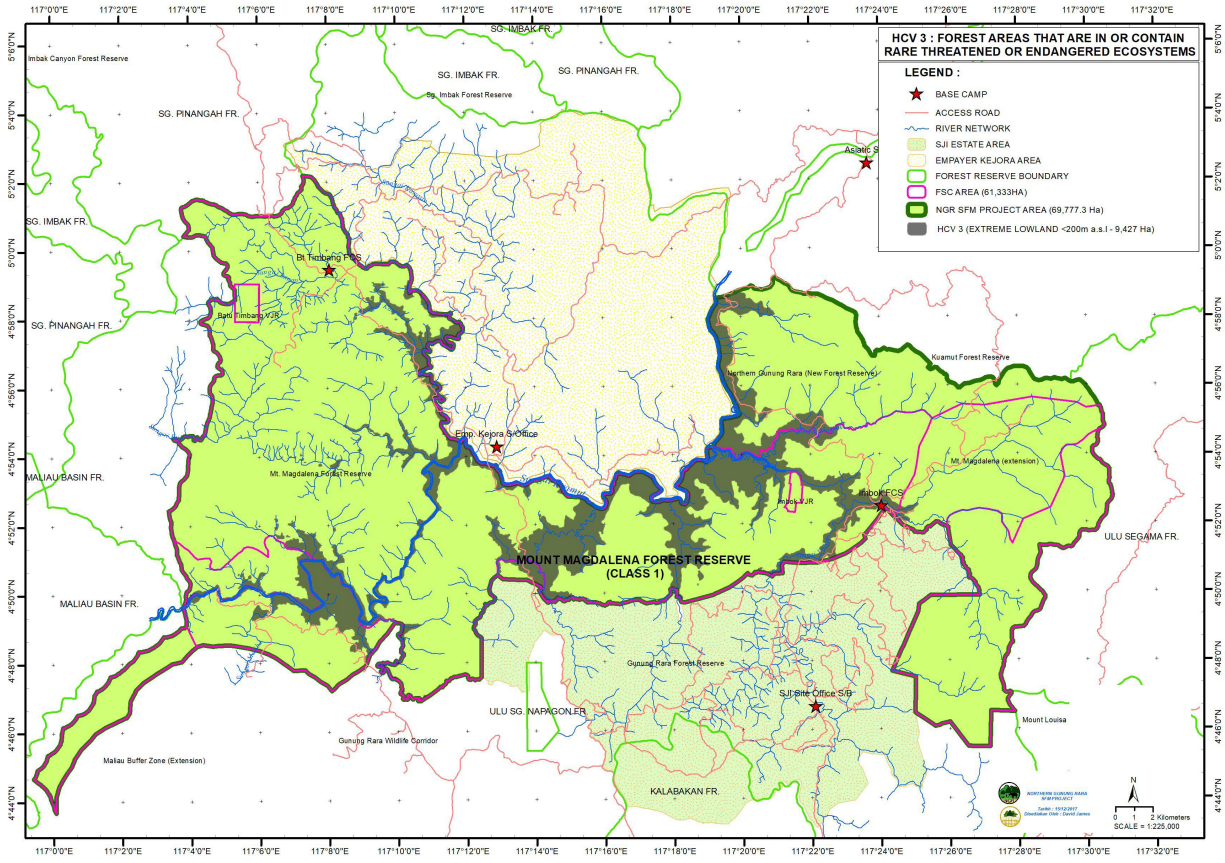


Figure 14: Monitoring on Wild Animals Utilise the Intergrated Mosaic Planting Forest of Empayar Kejora Sdn Bhd

3.3 HCV 3 ECOSYSTEM

Similar to HCV 1.1, HCV 1.2 and HCV 1.3



Map 8: HCV 3 - Forest Areas that are in or Contain Rare Threatening or Endangered Species

3.4 HCV 4 SERVICES OF NATURE

3.4.1 HCV 4.2 Erosion Control

1. To date, there is no major erosion issues regarding of areas with slopes >25° and 30 m riparian buffer within the Project Area. The only potential erosion area of slope >25° is located at Bt Timbang area near the main roadside which is heading to FCS Bt Timbang. Continuous monitoring and installation of warning signage's were conducted not only at the potential erosion area but also the 30 m riparian buffer within the project area.

2. Three PSP Plots were establish within the slopes >25° area. To date, no erosion issues occurs at the PSP Plots area.

3. The report on the Assessment of water quality in Northern Gunung Rara SFM Area is shown as below:

REPORT ON THE ASSESSMENT OF WATER QUALITY IN NORTHERN GUNUNG RARA (NGR) FOREST RESERVE 2018

by

Noor Azmizah Binti Andaman, Reuben Nilus & Jabanus Miun

INTRODUCTION

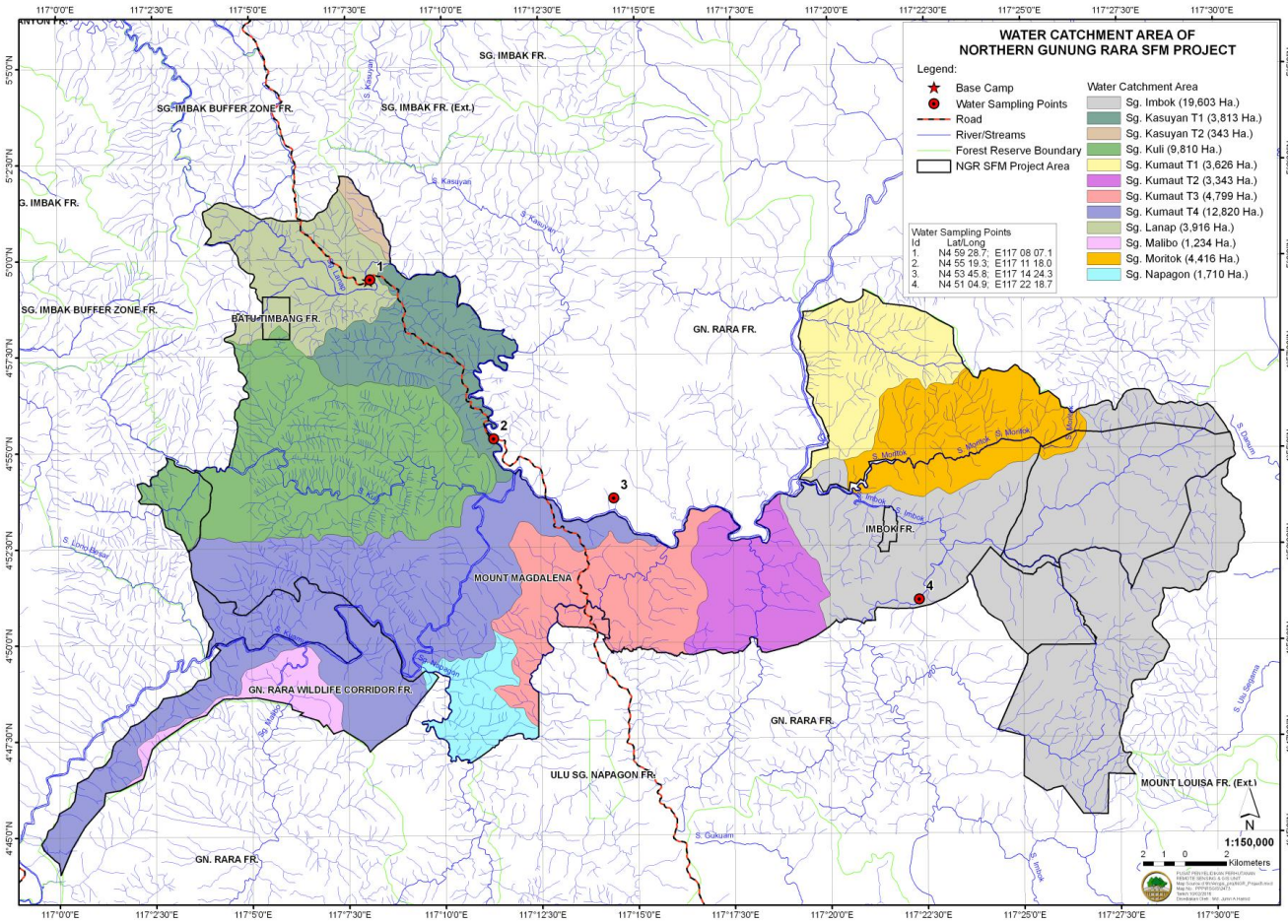
An environmental baseline sampling was carried out by Hydrology Unit of Forest Research Centre to characterize the water quality of 4 rivers, which drained thru the Northern Gunung Rara (NGR) Sustainable Forest Management project area. These rivers are Sg.Lanap, Sg. Kasuyan, Sg. Kuamut and Sg. Imbok. This assessment is part of the study component required for the Forest Management Plan for NGR project area.

LOCATION OF STUDY AREA

A total of 4 sampling points represent the project watershed and its sub-catchment areas which predominantly drain through the project site (Map 9). These sampling points are labelled W1 to W4 (Table 10). The chemical analyses and water quality classes for all parameters tested for the sampling points in the project area are listed in Table 7.

Table 10. The location of water quality sampling points in NGR FR (see Map, Figure 1).

Sampling Point	Location	GPS location		Date of Sampling		Surrounding Condition
		Latitude	Longitude			
W1	Sg. Lanap	04°59'28. 7"	117°08'07.1"	March 2018	November 2018	Secondary forest
W2	Sg. Kasuyan	04°55'19.3"	117°11'18.0"			Secondary forest
W3	Sg. Kuamut	04°53'45.8"	117°14'24.3"			Secondary forest
W4	Sg. Imbok	04°51'04.9"	117°22'18.7"			Secondary forest



Map 9: Locations of Water Sampling Plots in NGR SFM Project Area

RESULTS

Water Quality

The chemical analyses and water quality classes for all parameters tested for four sampling points in the project area are listed in Table 11.

Table 11. The results of chemical analyses and water quality classes for all parameter tested for sampling location W1-W4 in NGR project area . Note: Dissolved Oxygen (DO in mg/l), Conductivity (µS/cm), Total Dissolved Solid (TDS in mg/l), and Temperature (°C)

Sampling Location	Location	Temperature (°C)		pH Value		Dissolved Oxygen, DO (mg/l)		Conductivity (µS/cm)		Total Dissolved Solid (mg/l)	
		March 2018	November 2018	March 2018	November 2018	March 2018	November 2018	March 2018	November 2018	March 2018	November 2018
W_1	Sg. Lanap	26.86	27.46	7.58	7.02	0.58	1.8	62	152	31	76
W_2	Sg. Kasuyan	25.99	27.05	7.44	6.88	1.08	1.95	102	147	51	73
W_3	Sg. Kuamut	27.97	27.15	7.03	6.24	2.62	2.05	87	95	43	47
W_4	Sg. Imbok	26.99	26.97	7.46	7.12	2.67	5.4	141	238	70	119
Minimum		25.99	26.97	7.03	6.24	0.58	1.8	62	95	31	47
Maximum		27.97	27.46	7.58	7.12	2.67	5.4	141	238	70	119
Mean		26.95	27.16	7.38	6.82	1.74	2.80	98.00	158.00	48.75	78.75
NWQSM*		**Normal**		**Class I**	**Class I**	**Class III to Class V**	**Class I to Class V**	**Class I**		**Class I**	

* National Water Quality Standards for Malaysia

Synthesis of assessment

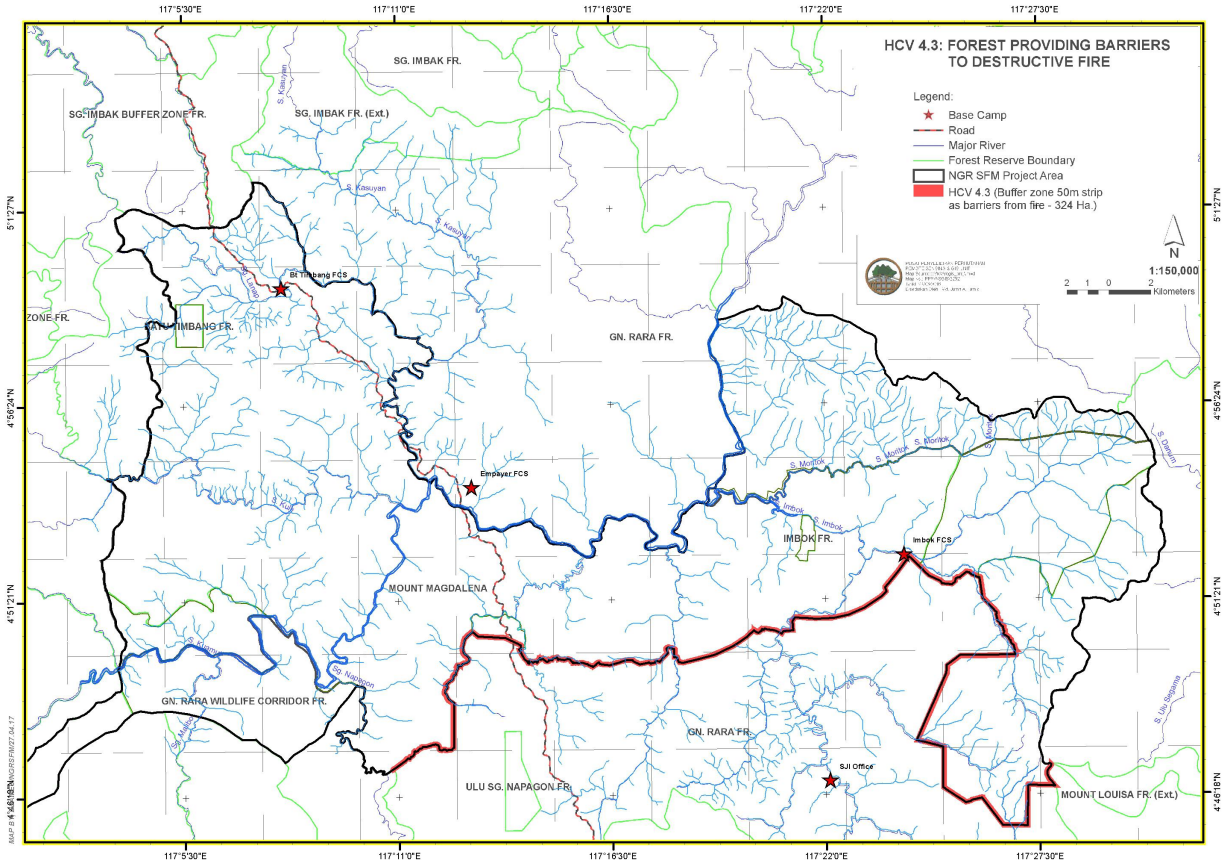
According to the National Water Quality Standard (NWQS) the water quality of the rivers based on the physicochemical parameters (except for dissolved oxygen in certain sampling point) fall into Class 1. The pH for all rivers generally complied with the standards set for water under Class I of the NWQSM. The acceptable limit for river water pH is 6 to 9, thus the pH for all sampling points are in an acceptable limit.

For DO it is essential for the aquatic life within the river water. A low DO level would threaten the aquatic community whereas only DO level below 2 mg/l is considered harmful for aquatic life. The DO for the sampling point on the month of July 2018 was very low that is under 1 mg/l, further investigation is needed to clarify this issue. The temperatures for all sampling points vary as the sampling was done from early morning until in the afternoon and it is still in normal value of NWQSM.

The concentration of TDS (mg/L) and conductivity were low indicating that there is no leaching of organic or inorganic substances from the ground. Both parameter shows Class I of NWQSM.

It is recommended that the management team to always carry out periodic inspection and monitoring at all the sampling points to prevent deterioration of the water quality. The management team should install signage at all the sampling point to prevent visitors or passer by traversing the road from dumping waste into the watercourse. Nevertheless, the river water would require conventional treatment such as boiling before it can be used for domestic consumption.

3.4.2 HCV 4.3 Barriers to Destructive Fire



Map 10: HCV 4.3 - Forest Providing Barriers to Destructive Fire

Most of southern border of NGR FMU is bordering oil palm estate. Furthermore, secondary vegetation dominates most of the peripheral area of the reserves. A 50 m band of moderate to high forest structure inside the project area that border local communities land and oil palm estate are categorised as HCV 4.3.

This corresponds to the responsibility of the team Management to protect the project area is to ensure that all the stakeholders are aware of entering the area. The team management have conducted several measures such as:

- Forest Fire Management Plan (FFMP) was made available September 2016 and was revised on June 2018. The FFMP has been submitted to SFD HQ for review and the FMU Management is still waiting for approval.
- Main Stakeholder Consultation was made all year round to discuss about forest fire awareness to stakeholders and contractors.
- Fire drill training was conducted on the 13th of September 2018.
- Patrolling was conducted all year round to curb illegal activities such as encroachment to steep areas and riparian.
- Collecting the data from Forest Fire Danger Rating System (FFDRS) to analysis the fire hotspot. It is compulsory for every Forestry Offices to submit FFDRS report every day to HQ. The data collected from our weather station everyday from our office in Brantian, directly to the SFM Office, SFD HQ.

Table 12: Fire Incidents

Year	Number of Incidents	Forest Reserve
2014	1	Abandoned Sawmills of Kebamega Sdn Bhd (**Mt Magdalena FR Class 1**)
2015	0	-
2016	1	Abandoned Sawmills of Smart Oracle Sdn Bhd (**Gunung Rara Wildlife Corridor FR**)
2017	0	-
2018	0	-

3.5 HCV 6 CULTURAL IDENTITY OF LOCAL COMMUNITIES

Bird's nest collection in the limestone caves of VJR Batu Timbang is one of the main sources of income of the nine teriti. These caves are located at 4° 58' N, 117° 05' E on a 300 m height hill of the reserve and important nesting area of the edible bird'd nest of Aerodramus fuciphaga (White Nest Swiftlet) and Aerodramus maximus (Black Nest Swiftlet). Due the presence of these species the reserve is gazette as Virgin Jungle Reserve to protect their habitat.
The only access to the caves is by river and by foot. From the mouth of Kuamut on the Kinabatangan river (Kg. Kuamut) to the mouth of the Kasuyan River takes about 1 hour 30 minutes depending on river water level.
To monitor the bird's nest collectors, the team of management have conducted several measures such as:

1. Forming Bird's Nest stakeholder consultation commitee

Consultation with bird's nest collector and forming a committee. To date, six times of meeting and consultation with the Bird's Nest Collector were conducted. The Bird's Nest Collectors Committee was formed and produced a resolution, which was agreed between SFD (NGR SFM Project and the Teritis' of the Bird's Nest Collectors). Certain issues (i.e Ruler & Regulation, State Forest Policy, etc), without disregarding the welfare of the Teritis' of the Bird's Nest Collectors had been included in the cooperation agreement.

2. Endorsement of Certificate Of Identity (COI)

Based on directivity from Chief Conservator of Forest vide RUJ:JPHTN/PP700-1/3/21/KLT6(87) dated 02.02.2016 the nine teriti must apply the COI permit when entering the forest serve to collect the bird's nest at The VJR Bt. Timbang.
To date the Sabah Forestry Department was collected RM 130 from the COI endorse from the teriti.

3. Quarterly Monitoring at VJR Bt. Timbang

To ensure the teriti complied with the Rules & Regulation, State Forest Policy, the team of management has conducted Quaterly monitoring to VJR Bt Timbang Cave to make inspections. Due to the bad road condition going into the Birds Nest Cave, VJR Bt. Timbang, it is far and difficult to arrive at the top of VJR Bt. Timbang, and thus resulting in difficulties to organize and do a proper inspection more often.

Figure 15: Bird's Nest Stakeholder Consultation at Kinabatangan District Forestry Office

4.0 Result or Outcomes for HCV Management Prescription and Effectiveness of Monitoring and Enhancement:-

High Conservation Value (HCV)	Effectiveness of Monitoring and Enhancement
HCV 1.1 Protected Areas	Program of Patrolling such as ground patrolling, aerial surveillance, Inspection of boundaries re-brushing of NGR SFM Project and Establishment of Forest Checking Station shows that the management have manage to implement the enforcement program adequately. Nevertheless the management still must enhance the enforcement practice i.e. increase the rate of patrolling within the area and outside the project area, identify possible route of poachers coming in the area via SMART Patrolling. Furthermore the frequency of aerial surveillance must be increased and installing of proper signage along the main boundaries of NGR-SFM must be maintained. Awareness sessions (Main Stakeholder Consultations) with neighbouring logging and plantation owners should be maintained as well as the cooperation of patrolling and operation with outside agencies such as WWF, SWD, MCEE Tawau, DAMAI Team and YS.
HCV 1.2	(Flora): PSP plots re-enumeration was done in 2017 by Forest Research Center. Project Team did maintenance every year. Additional PSP plots are to be established in Northern Gn Rara Forest Reserve. The existing method used for PSP Plots establishment shall be maintained. 2nd round of Scientific Expedition recommended for the whole project area covering new Forest Reserve. Produce a stand-based mapping of vegetation types and the extent of their qualities as baseline reference by using remote sensing technique. The GIS application can be effective management and monitoring tools to examine and evaluate spatial-temporal processes of changes in forest quality and conditions. Permanent plots require ongoing maintenance and when left unattended for long periods of time, they

	become increasingly difficult to relocate, re-establish, and to undertake accurate re-measurements. The maintenance of permanent plots consists of determining the presence of center post and tree labels, including inspection of damage to the trees in the plots, and investigate its cause. (Fauna): Four initial methods were established, with another additional method were established (Opportunistic Sightings) on 2017. Camera trap to be added for continuous data of wildlife, addition of manpower for monitoring works should be progressively maintained and continued
HCV 1.3	(Flora) Endemic plots were maintained and marked. Three plots of endemic flora species were identified. The existing method used for PSP Plots establishment shall be maintained as well as maintaining the existing PSP Plots within the project area. 2nd round of Scientific Expedition recommended for the whole project area covering new Forest Reserve. Produce a stand-based mapping of vegetation types and the extent of their qualities as baseline reference by using remote sensing technique. The GIS application can be effective management and monitoring tools to examine and evaluate spatial-temporal processes of changes in forest quality and conditions. Permanent plots require ongoing maintenance and when left unattended for long periods of time, they become increasingly difficult to relocate, re-establish, and to undertake accurate re-measurements. The maintenance of permanent plots consists of determining the presence of center post and tree labels, including inspection of damage to the trees in the plots, and investigate its cause. (Fauna) Monitoring should be progressively maintained and continued.
HCV 1.4 Critical Temporal Use	Based on the Table 9 (page 29) in the year 2016 and 2018 no data were recorded. It is because, the teriti not reported of bird's nest harvesting to FCS Bt. Timbang. A meeting and consultation with the Bird's Nest Collector must be maintained and should be conducted twice a year to aware them. Based on the Bird's Nest Stakeholder Consultation that were conducted, to control the entrance of illegal individual or groups that is not from the Teriti's, a mechanism has been made to tackle the illegal entrance. The mechanism consists of (i) approval letter from Persatuan Warisan Gua Batu Timbang Kuamut, (ii) approval letter form Mahkamah Anak Negeri Kinabatangan and (iii) approval letter from Sabah Wildlife Department Kinabatangan.
HCV 2	Continuous monitoring of HCV, PSP's and Wildlife, patrolling and surveillance of protected areas were done and should be maintained. Consider using drone monitoring/ drone mapping for HCV, and establishment of SMART Monitoring also should be considered. In conjunction with the project area as the main connector of wildlife migratory pathway to other forest reserve, the FMU management should cooperate with the adjacent stakeholder that is Empayar Kejora Sdn Bhd in wildlife monitoring data sharing.
HCV 3	PSP Plot re-enumeration were done in 2017, and PSP Plots maintenance were done every year. The existing method used for PSP Plots establishment shall be maintained as well as maintaining the existing PSP Plots within the project area. Analysis of PSP data should be done to provide insight of the forest growth data in site project.
HCV 4.2	Continuous monitoring should be done progressively. Water sampling plots are to be maintained and marked. Frequency of patrolling should be increased and reported and documented.
HCV 4.3 Forest	Main Stakeholder Consultation, Fire Drill Training, aerial surveillance and

Providing Barriers to Destructive Fire	ground patrolling should be maintained and continued. To enhance Forest Fire awareness program, the management must conduct the Main Stakeholder Consultation. Apart from that, the management staff and the all stakeholder staff outside the NGR SFM project area must be involved with the Fire Drill training.
HCV 6. Cultural Identity of Local Communities	A meeting and consultation with the Bird's Nest Collector must be maintained and should be conducted twice a year to aware them. Based on the Bird's Nest Stakeholder Consultation that were conducted, to control the entrance of illegal individual or groups that is not from the Teriti's, a mechanism has been made to tackle the illegal entrance. The mechanism consists of (i) approval letter from Persatuan Warisan Gua Batu Timbang Kuamut, (ii) approval letter form Mahkamah Anak Negeri Kinabatangan and (iii) approval letter from Sabah Wildlife Department Kinabatangan