EVALUATION ON USE OF ELECTRIC FENCE TO REDUCE CONFLICT BETWEEN WILD ELEPHANT AND RURAL COMMUNITIES

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ABSTRACT: Increasement of human settlements contribute to shrinkage of wildlife habitats in the forest based developing countries. The shrinking activities are often happening along the boundary of natural forest and cultivating areas where cultivations are expending. At the same time development activities such as connecting road networks, utilities and water reservoirs are emerging to supply human needs as their development activities. Some wildlife habitats are disappeared permanently by construction of big dams as reservoirs. Satellite imagery helped to locate land changes since 1970s. The analysis of land use changes pinpointed with 35% of the habitats lost. Wild elephants from the lost habitats are distinctively search their new habitats along the boundary of the forest where healthy foods are cultivating by human communities and promoting conflict between wild elephants and human. One of programs, called grow back for posterity (GBP) program of Myanmar, doing project based on Darwin Initiative for integrating biodiversity and elephants into peace and development. United States Fish and Wildlife Service (USFWS) and Shared Earth are also supported to the activities of the project. The study area covered southern part of Bago Yoma. Human and wild elephant conflicts are reduced using electric fence to seasonal cultivated area or small village. The effectiveness of use of electric fence is evaluated by interviewing affected communities. The evaluation found the human and elephant conflict reduce to 70% together with decrease of loss of the life and injuries by attacking each other which they use electric fence to seasonal crops.

1. INTRODUCTION

1.1 Elephant in Myanmar

Wild Elephants hate being disturbed on their feeding grounds, but they don't usually stampede suddenly, like many other herds of big game. With an uncanny intelligence, they close up round one animal as though they were drilled, and their leader then decides on the best line of retreat. He leads, and they follow irresistibly, smashing though everything, like so many steam rollers. If they cannot exactly locate the danger which threatens them, they invariably retreat along the track from which they have come while grazing, with their trunks on each other's backs, but in a formation of three or four abreast. Most elephant calves are born between March and May. Maternity ward is about a square mile and the herd will remain in the neighborhood for some weeks, until the new arrival can keep up with the pace of a grazing herd. The ward may cover an area of a square mile, and during the day the herd will graze all over it, surrounding the mother and her newly born calf, and closing their ranks round her at night. The places chosen have been on low ground where a river has suddenly changed its course and taken a hair-pin bend. They are flooded during the rains, but during the hot weather (the normal calving period) they are fairly dry, with areas of dense kaing, or elephant grass, eight to twelve feet high, with an occasional wild cotton tree giving shade. Wild elephants can be found in the Rakhine Yoma, Bago Yoma and Chin Hill. Myanmar people uses elephants as live weapon in war with enemy in history and uses logistics machinery in the timber business in forest.

As part of the project supported by Smitsonian Institute, wild elephants' documentary film shoots for the awareness purposes to local communities in (2015-2016). The awareness (4) years program is implemented in 2017, 2018, 2019 and 2020. The program educated sum of (33,216) people in the local communities included (16,308) students, (15,429) villagers and (1,479) school teachers and government staff.

1.2 Development and Shrinking Habitat

Based on the global land cover data generated form satellite imagery, many development activities are appeared after (1990) in the region. The most land cover changed features are water reservoirs, increasement of cultivation land and logistics infrastructures.

1.3 Conflicts

Wild elephants lost their habitat in the deep forest such as increase of water reservoirs, connecting roads and sprawling of human communities to the forest lands. The elephants who lost their fodder grounds are track down to the foothill to fulfill their hungriness. Once they have experience cultivated crops such as sugarcane, maize and paddy, they neither return to their old habitats nor deep forest. Cultivation lands become their new habitats and conflict between human and wild elephant begin.

2. METHODOLOGY

2.1 Study Area Demarcation

Study area is defined based on the basic boundaries such as river, stream, highway, road and watershed based on the wild elephant group existence location. The area is located at the southern part of Bago Yoma and inside the Yangon and Bago Region. Geographically situated at the eastern side of Yangon-Pyay road, at the western side of Yangon-Naypyitaw road, at the eastern side of Pu Gyi and Nga Mo Yeik reservoir. Moreover, Min Hla reservoir, Ga Mon reservoir, Baw Bin reservoir and at the north-western side of the area. North Zamayi reserved forest, Kadin Bilin reserved forest, Thonze reserved forest, Okkan reserved forest, Aung Mya reserved forest, South Zamayi reserved forest, Letpan reserved forest, Kalein extension reserved forest and Pyinma extension reserved forest are inside the study area.

Total are of the study area is (5,547) square kilometers and the total circumstance parameters is (453) kilometers. The dimension of north to south is about (150) kilometers at the farthest length and west to west is about (65) kilometers at the widest width.

Selection of study area used existence of wild elephant family track by GIS coordinates. Watershed are generated from the DEM where group of elephants are habitat. After watersheds are generated, the boundary is defined limited by car accesses roads and wide streams or rivers.

2.2 Communities

The study area covered parts of Bago and Yangon Regions. Whatever the area is focus on the wild elephant habitat, (223) villages in (46) village tracts of Yangon Region and (284) villages in the (72) village tracts of Bago Region are located within the study area. Thonse and Thayawady towns from Bago Region and Okkan town from Yangon Region are also located within the study. Therefore, total of (507) villages and (3) towns are included as communities interacting with the study area. Most of the villages and towns at the boundary of the study area and total population is about 500,000 persons (Myanmar Census, 2004). The community members are cultivating several varieties of crops for their livelihood. Popular crops are rice, vegetables, pulse, onion, maize, green gram, chilli, soy bean, sesame, ginger, groundnut, sunflower, rubber, sugarcane, etc. (Myanmar Agricultural Atlas, 2000).

2.3 Habitats

The sample habitats where are selected based on the availability of tracking data of the wild elephants' feeding grounds. There are (4) selected habitats in the study area (2) are inside the deep forest and (2) other habitats are located at conflicts zone with the communities' cultivation area. Habitat areas are digitized visually based on the wild elephants GPS track data and the area shows that habitats in the conflict areas are wide than deep forest habitats. Wild elephants normally live in herds of thirty to

fifty, and during the year cover great distances, chiefly in search of fodder. During the monsoon month (from June to October) they graze on bamboo in the hilly forest, sometimes remaining on one watershed for a week or ten days, after which they suddenly move ten miles for another week's stay on another slope. After the monsoons are over, they move into the lower foothills and the swamp valleys, feeding more on grass and less on bamboo (Williams, J. H. 1943).

Table 1. Sample habitats area and parameters.

No.	Name	Area	Parameter length	Situation
1.	Sanbok habitat	1,433 acres	15 km	deep forest
2.	Dawe	3,279 acres	17 km	deep forest
3.	Taikkyi	8,541 acres	47 km	conflict zone
4.	Okekan	10,474 acres	58 km	conflict zone

2.4 Landcover

Normalized Differential Vegetation Index (NDVI) data generated by NOAA (Meier, G. A.; Brown, J. F., 2014) and MODIS (Jenkerson, C., Maiersperger, T., Schmidt, G., 2010) satellites are utilized as landcover datasets to understand the vegetation patterns in the study area. NDVI dataset are compared with 30-meter global landcover dataset with generated for 2010 by National Geomatics Center of China.

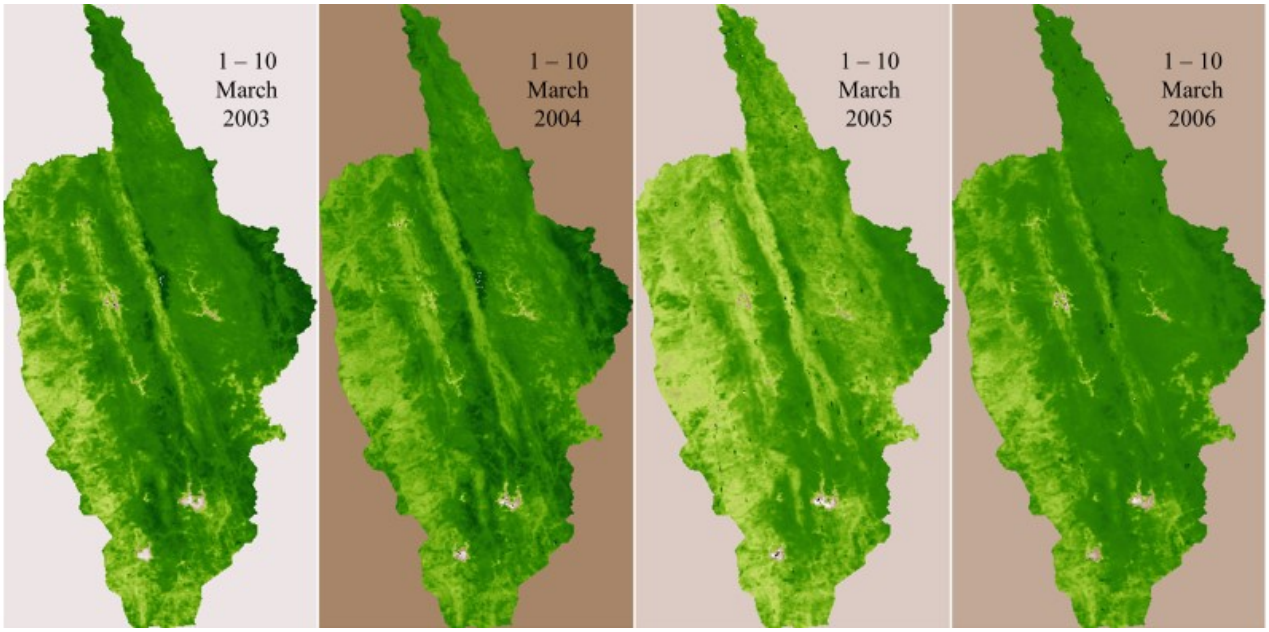

Figure 1. Comparison of MODIS's NDVI for study area from 2003 to 2006

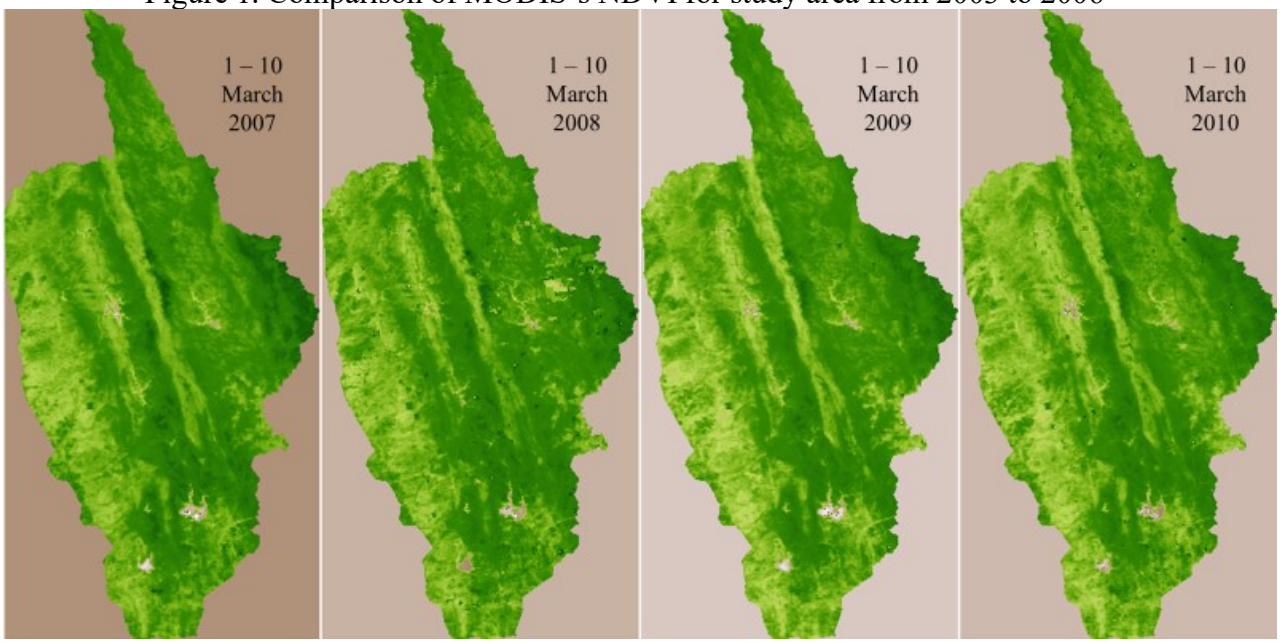

Figure 2. Comparison of MODIS's NDVI for study area from 2007 to 2010

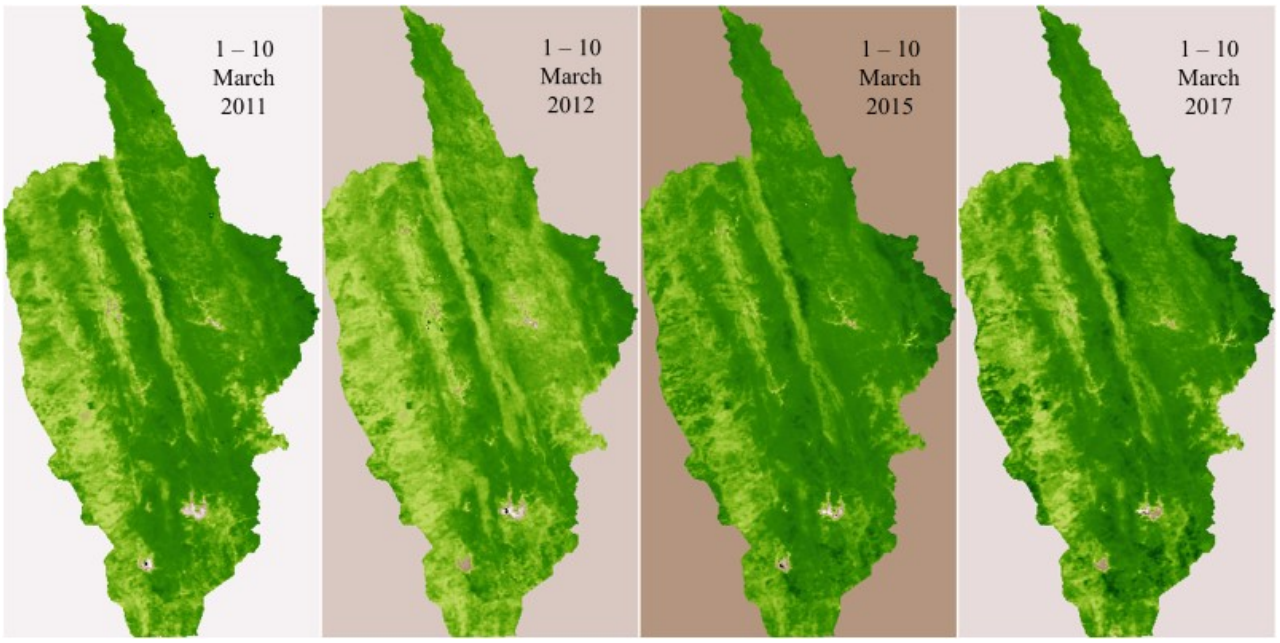

Figure 3. Comparison of MODIS's NDVI for study area from 2011 to 2017

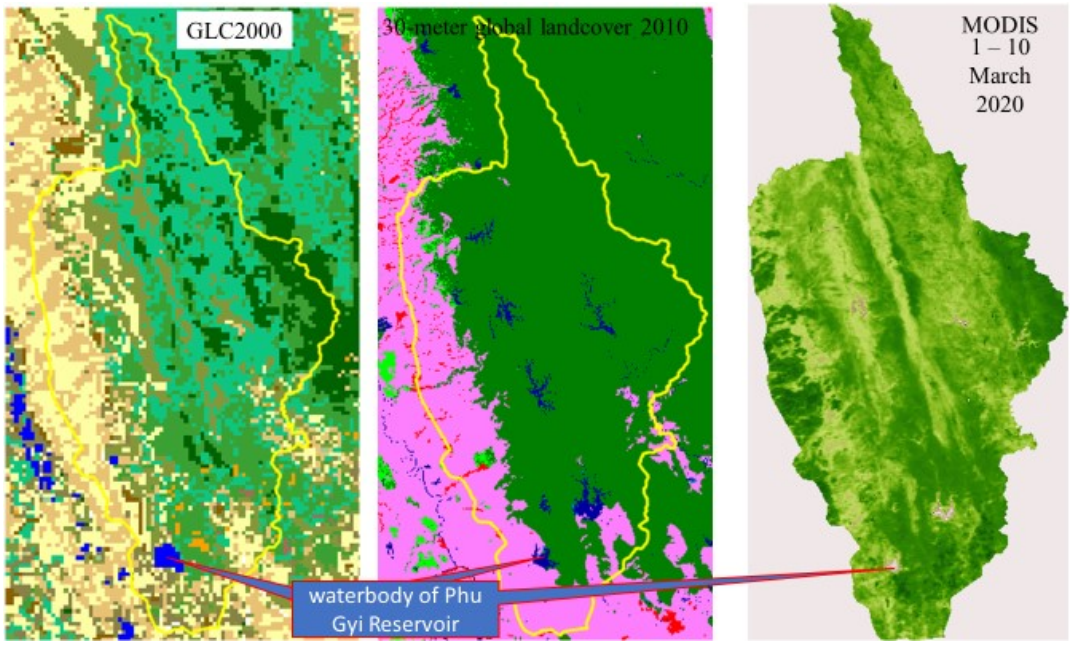

Figure 4. Comparison of Global Landcover (2000) and GlobeLand30 (2010) with MODIS NDVI (2020).

While vegetation variation of NDVI dataset representing the greenish condition of forest in the study area, the global land cover dataset (Globeland30, 2014) interpreted as isolated forest type only. Therefore, waterbodies in study area are clearly identified. Comparing with global land cover (GLC 2000) dataset, emergent of water reservoirs in the area are very high within a decade. The area occupied by water reservoirs is (0.8) percent of total study area and all reservoirs are scattering deep inside the area.

Moreover, (5) sampling locations are selected from (4) places of existing habitats. Sample (P1 & P2) are located inside the deep forest of the study area and sample (P3, P4 & P5) are selected in the conflict habitats. Those sample points are plotted the NDVI value of MODIS satellite data acquired from 2003 to 2020. The NDVI values are generated from (10) days composite of MODIS images and acquired on the days of 1st to 10th of March of all years. Therefore, NDVI values have not seasonal difference in the comparison.

Based on the NDVI, sample (P1 & P2) values are similar in year by year. Both points have high NDVI values on 2003, 2006, 2008, 2011 and 2017. Therefore, the sample points located in the deep forest has consistency for fodder.

Table 2. Sample points in habitats to identify vegetation variation based on temporal resolution.

No.	Name	Latitude	Longitude	Note
P1	Sanbok habitat	17°55'47.10"N	95°57'52.04"E	deep forest
P2	Dawe	17°45'30.73"N	96°14'16.22"E	deep forest
P3	Taikkyi	17°22'21.07"N	95°59'4.86"E	conflict zone
P4	Okekan	17°30'5.22"N	95°55'50.98"E	conflict zone
P5	Focal points include on conflict habitats	17°28'7.92"N	96° 0'3.82"E	conflict zone

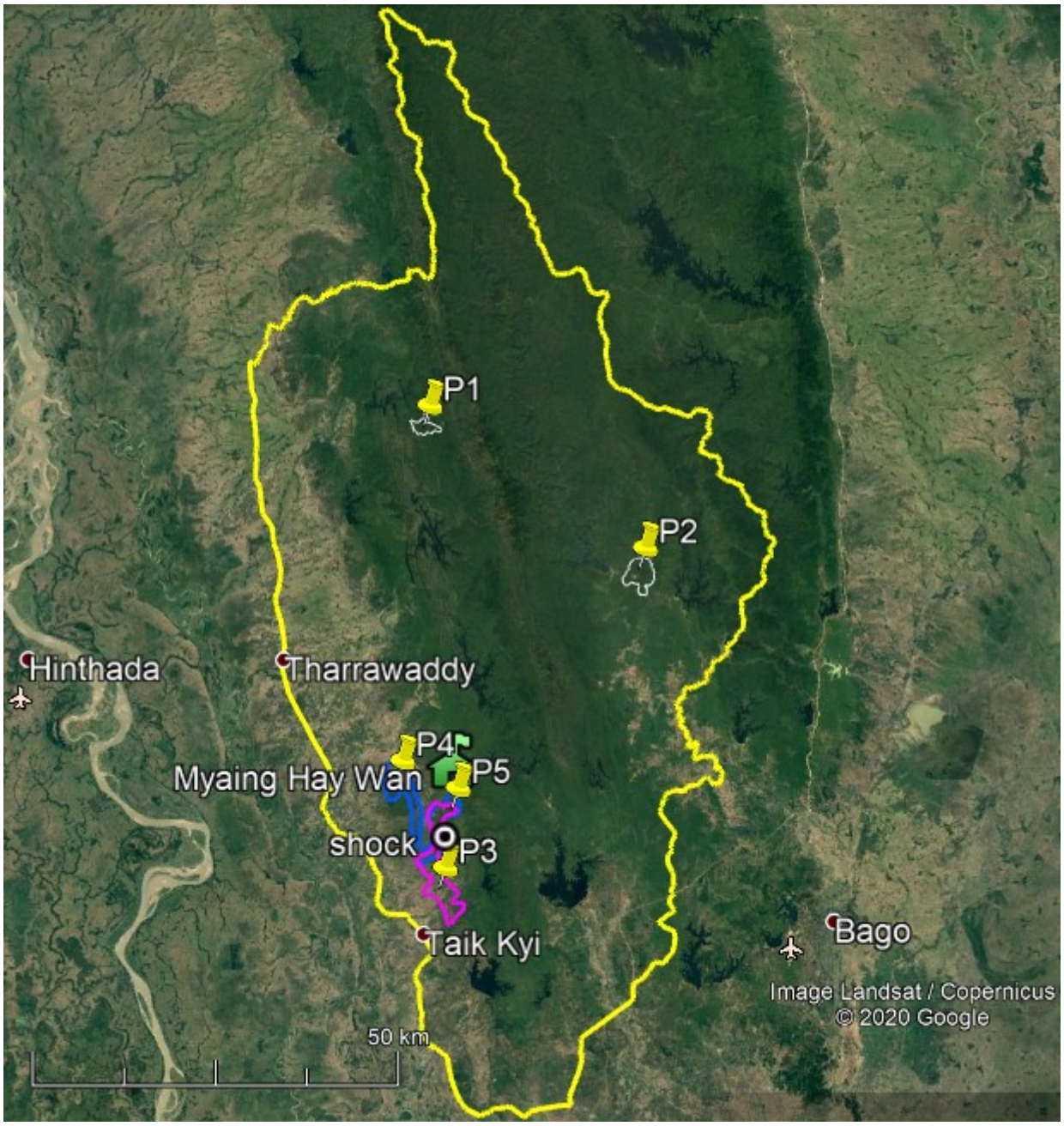

Figure 5. Location of selected sampling points for seasonal vegetation study.

The NDVI values of sample points (P3 & P5) have also same phenomena of vegetation variation while the vegetation greenness decreasing year by year in the sample point (P4). Seeing these vegetation phenomena, wild elephant habitat (P4) might not be continuing in near futures. While sample points (P3 & P4) are located in each of conflict habitat, sample (P5) is selected from overlaying area of both conflict habitats area.

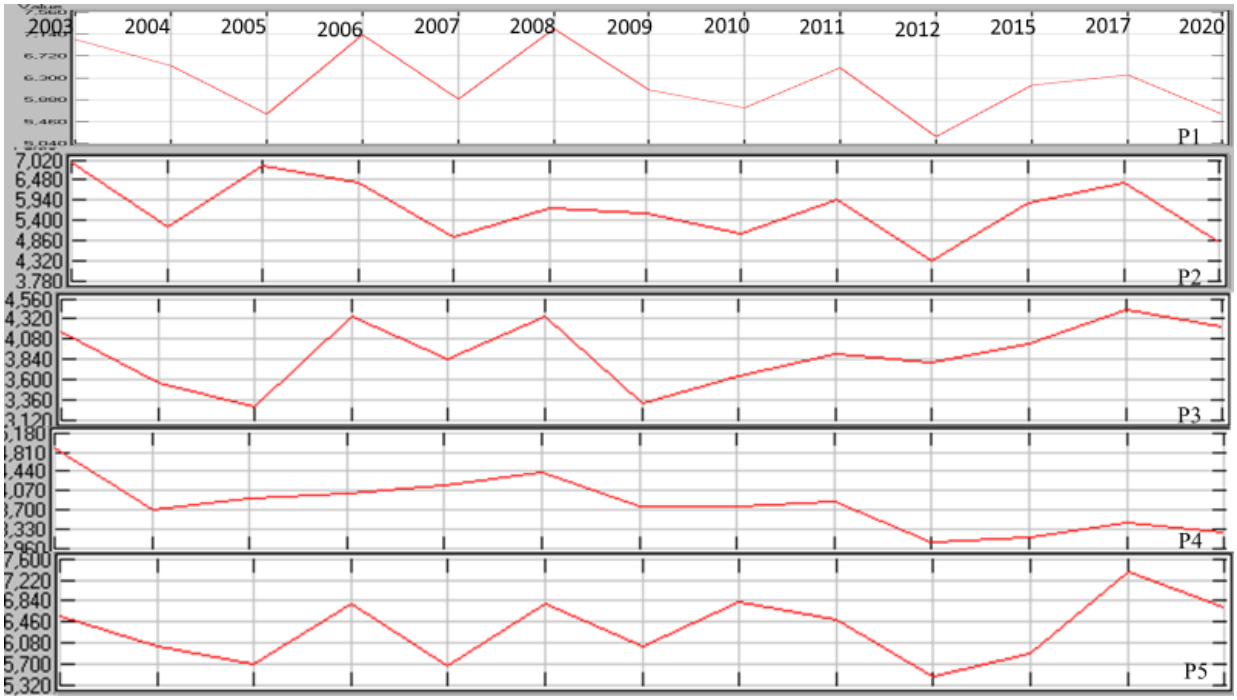

Figure 6. Comparison of NDVI value in time series MODIS data (20003-2020).

2.5 Electric Fence

Conflict reduction activity use electric fence to save human life in the communities and to save crops damages. The device use to make electric fences are energizer produce by Gallagher, New Zealand. The energizer is connecting with battery. The batteries are easily refill by solar power in the local communities. The energizer works by sending electrical pulses along the fence and these pulses give the animal a short, sharp shock. The shock is safe to both animals and people.

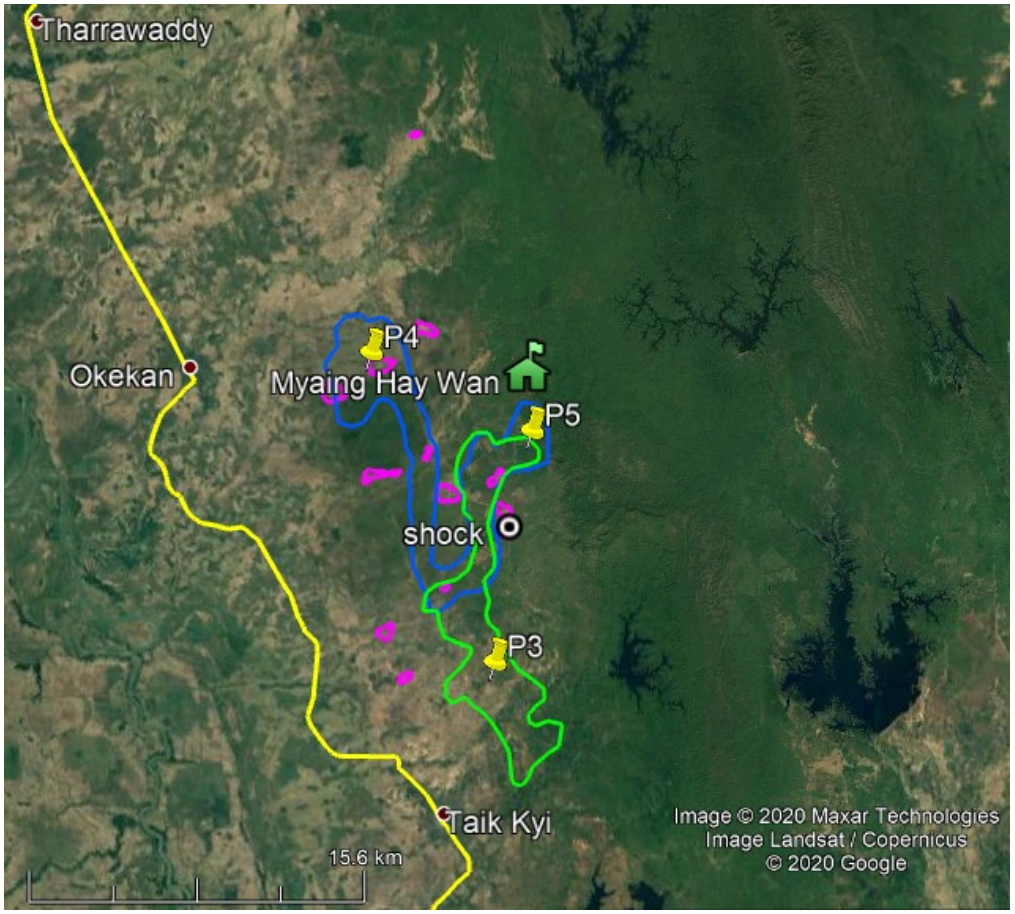

Figure 7. Location map of existing electric fences (magenta polygon) and conflict habitats (blue and green polygons).

2.6 Evaluation of Electric Fence

By using electric fences, reduce crops damages, human can stay in their house without abscond from wild elephants and no risk of life happens by drive away to wild elephant from communities thus it reduces to hade elephant and they may not inform to hunter to kill elephant. It is found out the by fencing the communities' settlements and cultivated land, killing of wild elephant is totally stop.

3. Results

Study found reduction of human and wild elephant conflict by fencing human communities including their cultivated land. Recently, fences are scattering randomly based on demand from local communities, some communities fenced their villages while some communities fenced their cultivated lands. Random fences might be promoting another issue for wild elephants since it might be blocked their seasonal fodder tracks. The issue will be solved as future work of the study.

3.1 Future Works

Scatter electric fence should be well organized to be one manageable fence facing to forest. One sided fence could be achieved to stop wild elephants fodder routes to communities' properties based on the study of elephant routes, possible new habitats in forest area and accessible path ways for elephants to be back into the forest. One sided fence will be move year by year toward to forest. Finally, the fence will be reached to the forest boundary and fencing the forest with electric fence will be future works to be the best achievement for human-elephant coexistence in the best eco system.

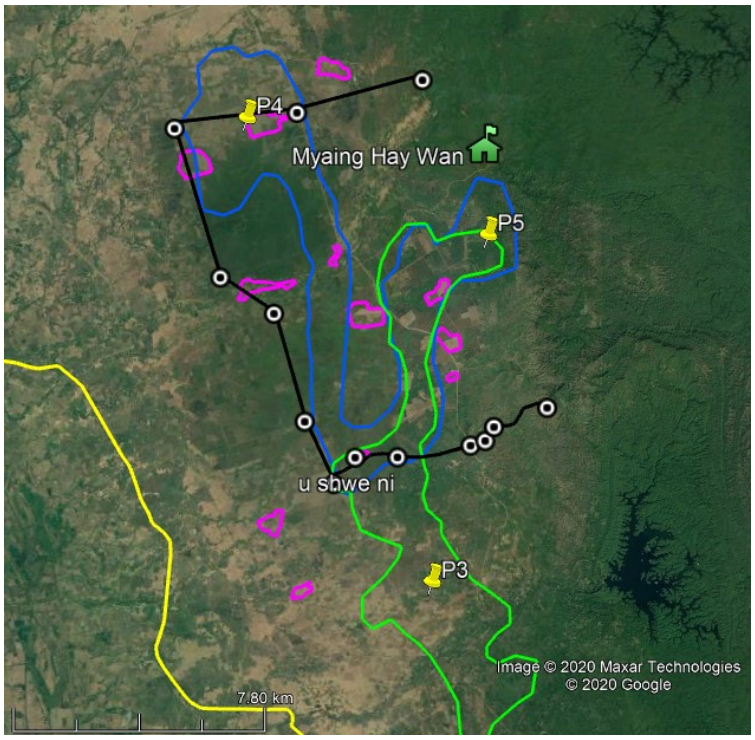

Figure 8. Proposed one sided fence to resend back wild elephants to deep forest.

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