

Oxford University
Expedition to
Usun Apau – 2019



Abstract:

In July 1955 four Oxford University exploration club members set out to explore the Sarawak region of Borneo, Malaysia, to collect a variety of data from a particular raised plateau deep within the jungle known as 'Usun Apau'. They encountered many challenges, such as the need to air drop supplies into their camp, but were also welcomed by the local tribal people with whom they worked closely. Guy Arnold, the leader of the expedition, produced a large amount of literature, photographs and video whilst travelling through the jungle, providing an insight into their work and the techniques they adopted. However, since 1955 the landscape of the area they explored has changed drastically and is now characterised by palm oil plantations, coal mines and deforested areas. The primary aim of this expedition will be to travel to the Usun Apau plateau and carry out biological surveys similar to those undertaken by the team in 1955, such as the collection of plant specimens. We will also focus on specific indicator species of environmental health to determine the impacts of surrounding deforestation to the plateau. To add greater weight to this research, we are planning on collaborating with the Institute of Biodiversity and Environmental Conservation (IBEC) in Sarawak, so we can offer biological data that is of use to their long-term conservation goals. Other objectives include rephotography of some of Guy Arnold's images to display environmental change over the last 63 years and also working with local communities around the plateau to learn about the issues and changes they have noticed to the jungle that they call home.

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1. Aims: To assess biodiversity and carry out geographical surveys on the Usun Asau Plateau, Sarawak, Malaysia.

1.1 Objectives:

Our primary objectives are focussed on the retracing of a 1955 Oxford University Exploration Club expedition, with a view to reassess some of the surveying they initially carried out. During their time on the plateau various zoological and vegetative samples were collected and sent back to the Natural History Museum and Herbarium in Oxford – we aim to view their collected specimens and thus collect some new samples during our trip. To add greater weight to this research, we are planning on collaborating with the Institute of Biodiversity and Environmental Conservation (IBEC) in Sarawak, so we can offer biological data that is of use to their long-term conservation goals. The key concerns of this institution are ‘acquisition of knowledge concerning... sustainable development of natural resources’ and the maintenance of biodiversity, following Malaysia’s signing of the Convention of Biological Diversity at the Rio Summit in 1992.



Figure 1 - Satellite images of the area just South East of the plateau showing significant deforestation and industrial activity (The deforested area shown in red next to the Usun Apau National Park)

Since then studies (many by current Oxford researchers) have been carried out in Borneo and the forested regions of Sarawak that show worrying trends of detrimental logging impacts of the species diversity (See figure 1) considering that the island itself covers less than 0.2% of global land surface, yet is home to over 4% of total plant species and 5% of birds and mammals (MacKinnon et al., 1996). It is crucial that this biodiversity is maintained and conserved to ensure the biological resilience and therefore the ecosystem services (upon which many of the island’s population depend - in terms of economic gain through ecotourism - agriculture and numerous jungle bioproducts, to name a few) are well preserved to oppose the currently increasing deforestation trends. As recent research by the University of Sarawak has shown, the formation of new wildlife corridors between national parks like that of Usun Apau and Kayan Mentarang is essential to the maintenance of wildlife persistence and diversity which in turn facilitates the protection of the forested land (Brodie, J. & Mohd-Azlan, J., 2015). If parks are further isolated by deforestation then the likelihood of species lost due to stochastic environmental or population changes significantly increases. To conserve such surrounding areas and prove the necessity of the national parks, sufficient research on the current biodiversity is needed. By comparing our results with that of the 1955 expedition and repeating some of our sampling in some of heavily logged areas of South Eastern Usun

Apau, we are hoping to prove the destructive impact of industrialisation and loss of habitat on the biodiversity of zoological and plant species. By carrying out simple biological surveys on selected indicator species (through which we can infer the ecosystem health and forest conditions) we will collect important data on the biodiversity of the plateau. Methodology for these assessments will include dung beetle pitfall and flight intercept traps, butterfly collection along transects and collection of vegetative samples in imitation of the 1955 expedition's work. To produce statistically relevant data we will be repeating the surveys at 16 randomly selected sites, within a 3-mile radius of the Plateau base camp during the 6 weeks we are there. Further surveys of the same method will be carried out in the logged region, aiming for at least 6 repeats.

1.2 Other side line objectives include:

'Retrace the 1955 Oxford University Exploration Club expedition carried out by Guy Arnold, aiming to follow some of the routes they took, recreating some of their surveying techniques and photos they took of the expedition.'

The 1995 expedition across the plateau produced a large amount of literature and specimens for us to examine and use to achieve this objective. Guy Arnold's maps in his book 'Longhouse and Jungle' provide a clear insight into the routes they took (See figure, where they camped and the difficulties they had. Our only challenge in this aspect is making sure we can translate these maps onto our own when in the field. This should be overcome through GPS systems and co-ordinates provided by previous but more recent expeditions, such as the expedition by Rory Dow et al in 2012.

'Involving the local community and university in our research through bringing two local university students on our expedition with us and communicating with locals living near to the Plateau.'

This will firstly be achieved through working with The University of Sarawak, Kuching, who we have already made an effort to contact in regard to collecting data with them. We aim to integrate two of their university members into our team and spend a significant amount of time learning from them and hopefully teaching them something as well. This will involve sharing data with them, involving them in our sampling/collecting methods and camping/living with them for a significant amount of time. We also aim to work closely with local tribes, much like Arnold did when he was in the region, in order to learn from their experiences of the changing jungle and gain insight into how they live in such a harsh ecosystem. We have anticipated the ethical implications of this and have addressed them in a separate section below.

'Create a visual report via film and photography of the expedition to show the details of expedition on return.'

Matt has significant photography experience and has taken photos all over the world, from Norway to Kashmir. We believe that documenting the film both photographically and through the creation of a short film would be beneficial for disseminating our results once we return to the UK, especially when talking to a younger audience. Furthermore, the use of a camera is essential in attempting to recreate some of Guy Arnold's original photos from the 1955 expedition. The equipment shall be provided by Matt himself and he will also aim to loan equipment from others/the university. The amount of equipment used shall be kept to the bare minimum to reduce weight/cost and filming shall be mostly done on a GoPro lightweight camera. It is also essential that this documentary does not distract from the scientific aim of the expedition and therefore shall not be prioritised.

2. Methodology:

2.1 Dung Beetles:

Why use dung beetles - Relatively quick and inexpensive taxa to sample. They are also very well studied therefore extensive information on taxonomic identification available to use, as well as many ecological studies relating to their use as indicator species. They are incredibly sensitive to environmental conditions and thus one of the most common groups of terrestrial bioindicators.

Baited pitfalls traps will be set up in the 12 randomly chosen sampling locations within the 3-mile base camp radius. To ensure trap independence, these will be at least 50m apart from each other. The trap itself is a plastic container, of 20cm width and 15cm depth, buried flush with the ground and containing a solution of water, chloral hydrate and detergent to kill the trapped insects and allow for taxonomic identification on collection. There will be a plastic lid covering the trap to prevent desiccation and avoid rainfall damage. The traps will be left for 3 days and nights. The bait will be a standardised mix of human faeces and local wildlife faeces, in a 60:40 ratio, total ~50g per trap. These sampling surveys will be carried out over the 6-week period on the plateau, with at least 6 set up in the logged areas.

2.2 Butterflies:

Why butterflies – strong links between species presence and forest health, for example indicative of logging. Relatively easy to sample and collect, well characterised taxonomically therefore easier to identify.

Butterflies will be sampled at each of the 12 randomly selected baited pitfall trap sites, from which a 100m transect will be set up, and on foot specimens will be collected using nets and subsequently identified in the field to prevent need for killing/preservation of the insects. Done in pairs, whilst one researcher sets up the pitfall trap the other will spend ~3 hours catching species and recording genus, species (if possible) date and location of capture. For those specimens that are particularly hard to identify, voucher specimens will be taken back to base camp and conserved in silica gel for identification and returning to University collections (primarily Sarawak, if unnecessary then to Oxford).

2.3 Re-photography Methodology:

This involves the comparison of one or more photographs taken at different points in time but from the exact same physical position on the planet. This has been used to study the change of glaciers, the faces of our cities and also the changes in forests. The latter applies to studying the Usun Apau plateau, as the 1955 expedition took a significant number of photographs of the area. As seen in figure one, it is likely there has been significant change to the rainforest canopy through deforestation and the planting of palm oil trees. Hence, using rephotography may allow for the display of significant change in the Usun Apau landscape.

It is essential that the historical camera location is identical but can only be based on estimations. We hope that locals familiar to the area will be able to help identify the scenes captured by the 1955 expedition. However, a method is still possible to achieve the best results. Firstly, by drawing a vertical line in the centre of the historical photograph, one can line up a feature in the foreground with one in the background. The photographer can then line these features up in real life. Then, by moving along a line

keeping and these features lined up, one can easily line up the features to the sides of the image. This takes some practice, but can achieve fairly good results. When there is no foreground in the historical image, things become harder as there is no parallax effect to guide the photographer to the true camera location. In these cases, it is up to the one's best judgement as to where the camera location could be.

3. Personnel:

3.1 Matthew Jones – Expedition Leader and photographer

Matt is a 2nd year Geography student at St Hilda's college, Oxford. He has undertaken numerous backpacking trips to remote locations, such as a solo trip to the Himalayas of Kashmir, India and the Lysefjorden region of Norway. Recently he spent two months on an internship with the NGO ADAPT in India, living in slum conditions and working with disadvantaged communities around Mumbai. His interests lie in re-wilding and conservation, which he actively promotes for the area around his home in the Lake District. Matt's passions also focus on film and photography and he has taken photos for companies such as North Face and Alpkit. He is a keen hiker/climber/mountain biker and spends a large amount of time wild camping in the Lake District. Positions of responsibility include Treasurer of the Oxford University Exploration club and St Hilda's Rugby and Rowing social secretary.

3.2 Rosalie Wright – Medical and Science Officer

Rosalie is a 2nd year Biological Sciences undergraduate at Christ Church College, Oxford. She has undertaken a 3-week internship in northern Mozambique studying nudibranch (sea slug) diversity, a 7-week internship studying the genetics of cognition in social insects and a week's ecological surveying field course in Wales. She has Advanced Open Water qualification in SCUBA diving and is a keen hiker and boulderer. Rosalie also has a deep interest in conservation ecology, climate change research and adventure so is hoping to develop these interests further in this expedition. Positions of responsibility include Speaker Secretary for the Oxford University Exploration Society, captain of the Christ Church netball team and social secretary for the college women's football team. She is also leading the Christ Church Divestment movement and is an active member of the Oxford Climate Society.

4. Background and motivation:

4.1 Background:

The existence of the Usun Apau plateau was unknown to the Western world until Tom Harrison (who also embarked on an Oxford University/RGS expedition to Sarawak in 1932) came across it in 1951 (Arnold, 1957). Guy Arnold, an alumnus of St Peter's college became interested in the plateau, in particular the Penan people that occupy its densely forested environment, when searching for an area to research at the end of his degree. Guy subsequently built a team of four Oxford students to spend six months in the area around and on top of the plateau, designing a complicated and expensive expedition that relied in airdrops (See cover photo), seventy porters and several hundred kilograms of rice (Arnold, 1957). His journey took him across the plateau and provided many samples and photos (See figure 2) that are now looked after by the Pitt rivers Museum as well as the Oxford Herbarium.

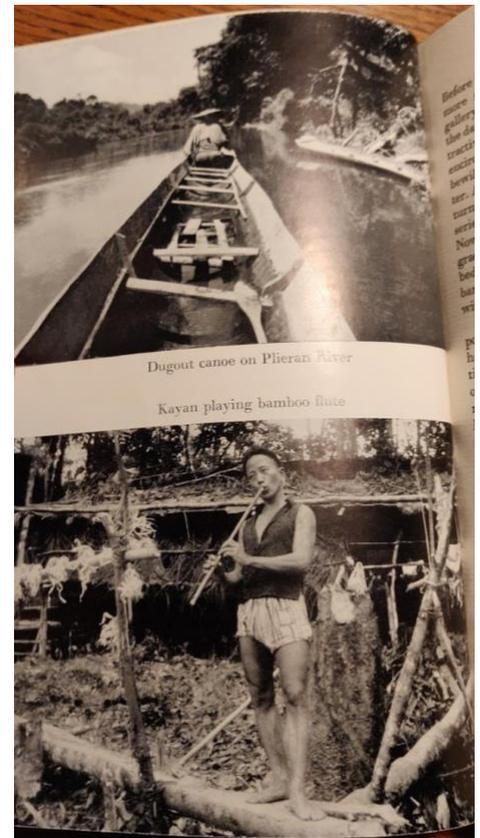


Figure 2 - Top image shows the canoes used by the 1955 expedition to reach the plateau. Bottom shows a Kayan villager, local to the region, playing the bamboo flute.

4.2 Our motivation:

Reading about Guy's experiences, trying to retrace his route using the maps provided in the literature and connecting with him through his links to the club we now both play a big role in has been inspiring. Furthermore, the expedition is deeply rooted in both of our passions, Biology and Geography, and provides a framework for us to explore some of the techniques that they used to collect data. The plateau also remains very isolated and few expeditions have ventured onto its raised canopy, providing a perfect place to challenge our abilities and test our skills within the fields we which to hope work in the future. Guy's extensively detailed writing and photography give us a clear insight into the challenges of his expedition, but they also display some practices that may not fit into contemporary exploration. Therefore, we aim to repeat elements of his expedition but through a different lens that focuses on ethics and community involvement.

5. PROVISIONAL ITINERARY:

5.1 Prior to the expedition

- Application for permits with the Sarawak Forestry Department and relevant governing bodies for Usun Apau National Park
- Grant applications
- Meetings with Colin Campbell and Gordon H. Pickle to discuss their expedition and survey techniques
- Forge links with University of Sarawak and the IBEC unit to find student team

members, and collaborate research efforts

- Contact current inhabitants of Usun Apau/nearby settlements, through the

University of Sarawak or contacts in Bario to connect with porters and local guides

- Contact with previous expedition teams and scientists in Oxford departments who have relevant experience/knowledge

- Subsequently finalise research methods and the scientific proposals of the trip

- Undertake medical training and wilderness survival courses

- Weather station/field sensor prototypes and construction

5.2 During the expedition:

London → Kuching (1st-6th of July)

We aim to tie our work closely with those working on similar projects at the University of Sarawak, based in Kuching. Therefore we will fly to Kuching and spend around four to five days working with university students there and rendezvousing with the students we hope to bring with us on the expedition.

Kuching → Miri → Long Silat (7th-9th of July)

In Miri we shall hire four wheel drive vehicles to carry on further into the jungle via the Lapok and Samling logging roads, taking us to 'Long Silat' (See figure) which has been used as a base by previous expeditions to reach the Plateau. Guy also notes passing the camp in the book he wrote on return 'Long House and Jungle' and there is a route marked on their map of the plateau passing the camp (See figure _).

Long Silat → Usun Apau first base camp (10th-11th of July)

Following this route takes us the opposite way of Guy Arnold's 1995 expedition and means we will have to trek to the other side of the plateau to reach his second base camp (See figure 5). We have chosen this route on the basis that Guy's route was extremely impractical and required airdrops for them to stay proficient in supplies. Although this may not be required anymore, the river they follow appears to have been significantly dammed since their visit and would likely take a long time for us to reach the plateau following such a route.

Usun Apau → Miri → Kuching (30th-31st of August)

We then hope to spend the next month and a half exploring the plateau and carrying out and achieving the objectives set out earlier. On return, we shall follow the same route back to Miri and then onto Kuching.

6. Geography of the Plateau:

The plateau is volcanic, with a flat area of around 600 square miles with three extinct volcanoes in the centre, named on Guy's map (See figures 3 and 4) as Selidang (1372 meters), Kenawang (1280 meters) and Mabun (1280 meters). However, we have only located Selidang properly so far, which he describes as the centre of the Plateau. The North East and Western sides of the plateau veer off into edges of sheer drops of 300 meters. The plateau is covered in a mixture of *Kerapah* or *Kerangas* forest, which is characterised by moist conditions, acidic sandy soils, permanently waterlogged ground and a low, uniform canopy (Brunei Forestry department, 2018). The forest consists of low, small trees with 'gnarled trunks' and huge roots (Arnold, 1957). All the rivers that originate on the plateau either cut very deep gorges into the edges or fall off shear drops to create huge waterfalls. The three extinct volcanoes form a triangle in the centre of the plateau causing uplift and forming clouds, as a result the main valley that runs North from Selidang receives a large amount of rainfall. The Southern edge of the plateau has fewer steep drops and instead has deep valleys with sharp ridges that contain rivers flowing into the Plieran.

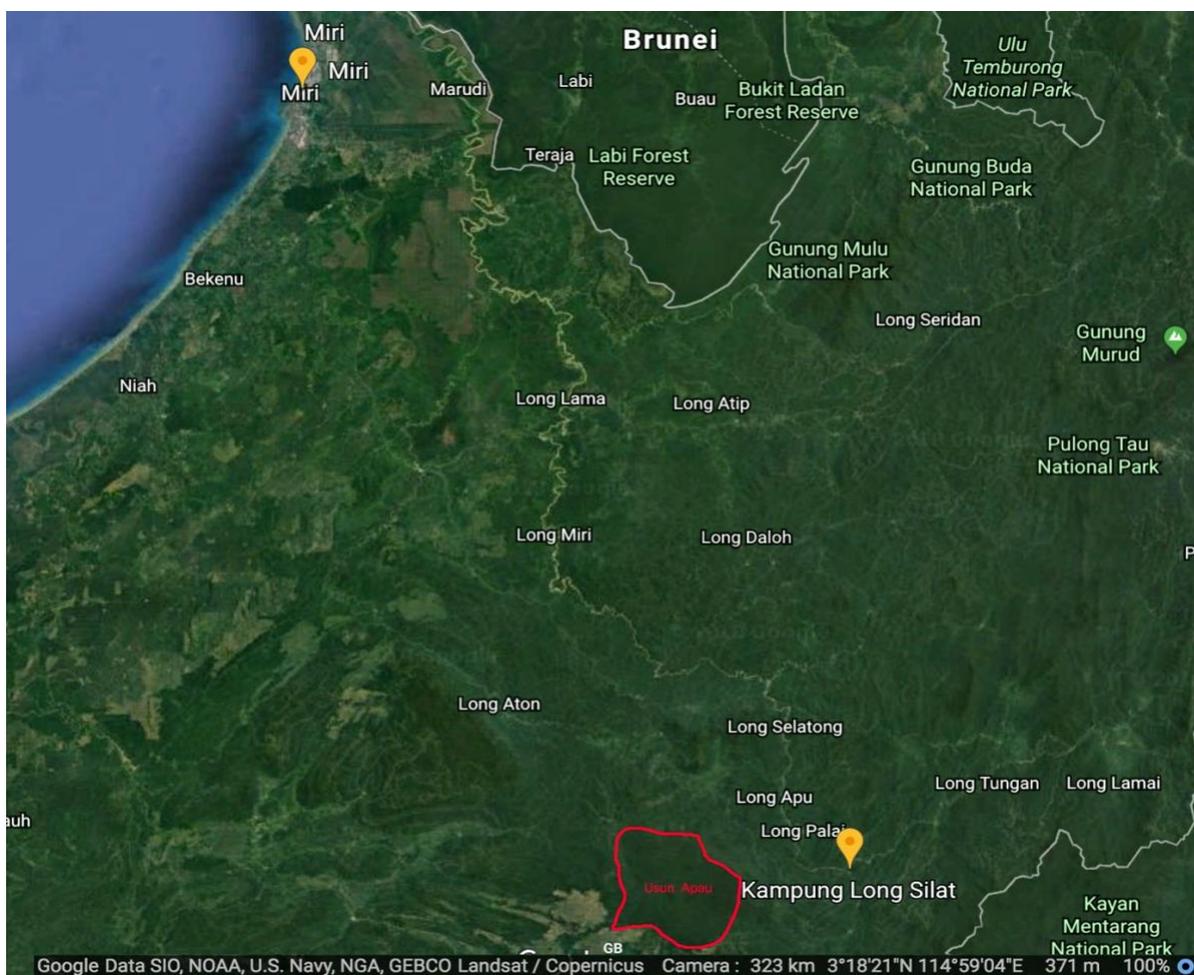


Figure 3 - Google earth view of the distance from Miri to Long Silat (both marked by golden markers) and the Usun Apau plateau surrounded in red. No clear route can be traced on Google Earth but details of the route have been obtained from previous expeditions.

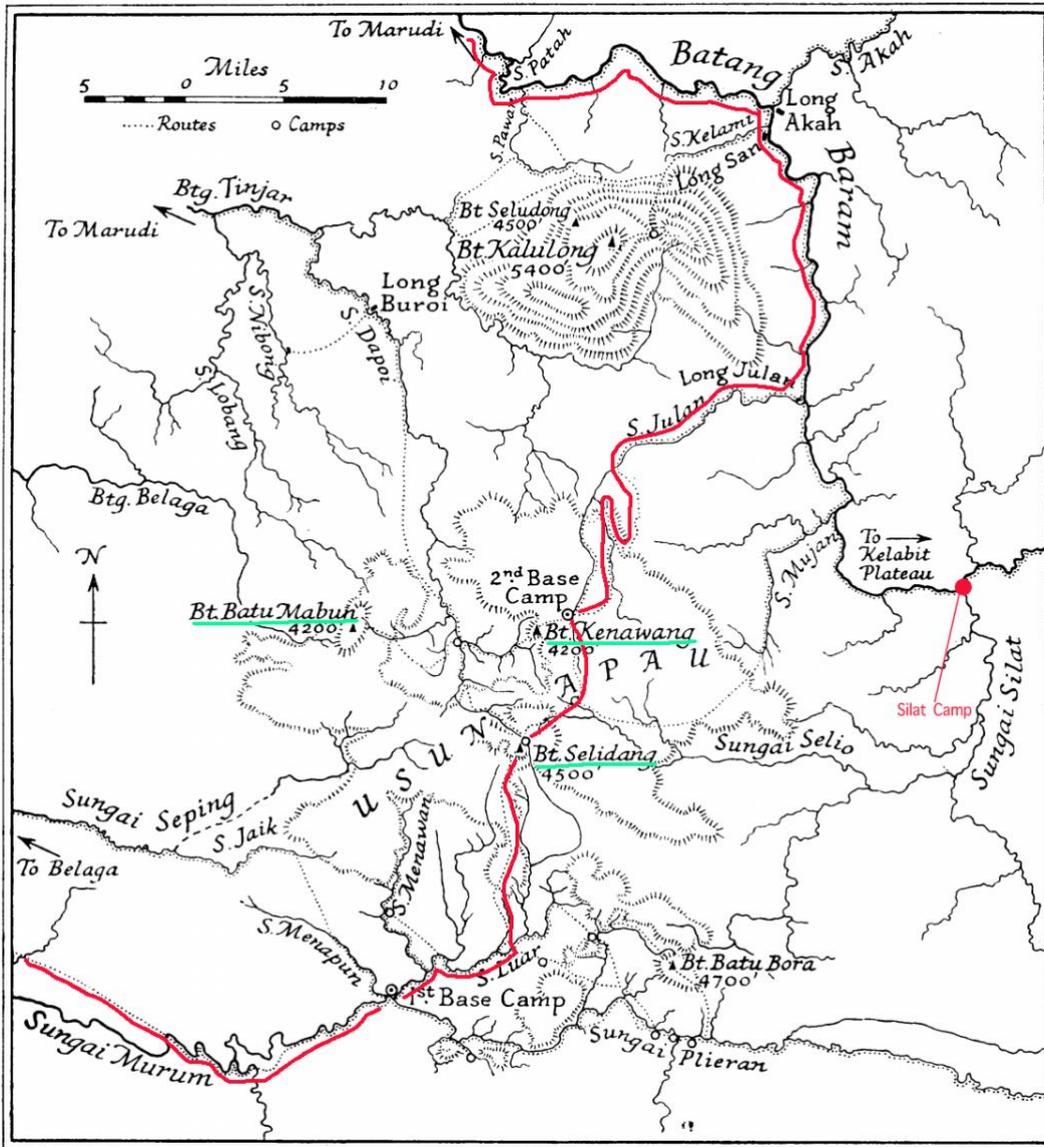


Figure 4 - Original map from the 1995 expedition. The red line shows Guy's route across the plateau, with the highest points of the plateau underlined in green. Our first base (Silat) is also shown in red.

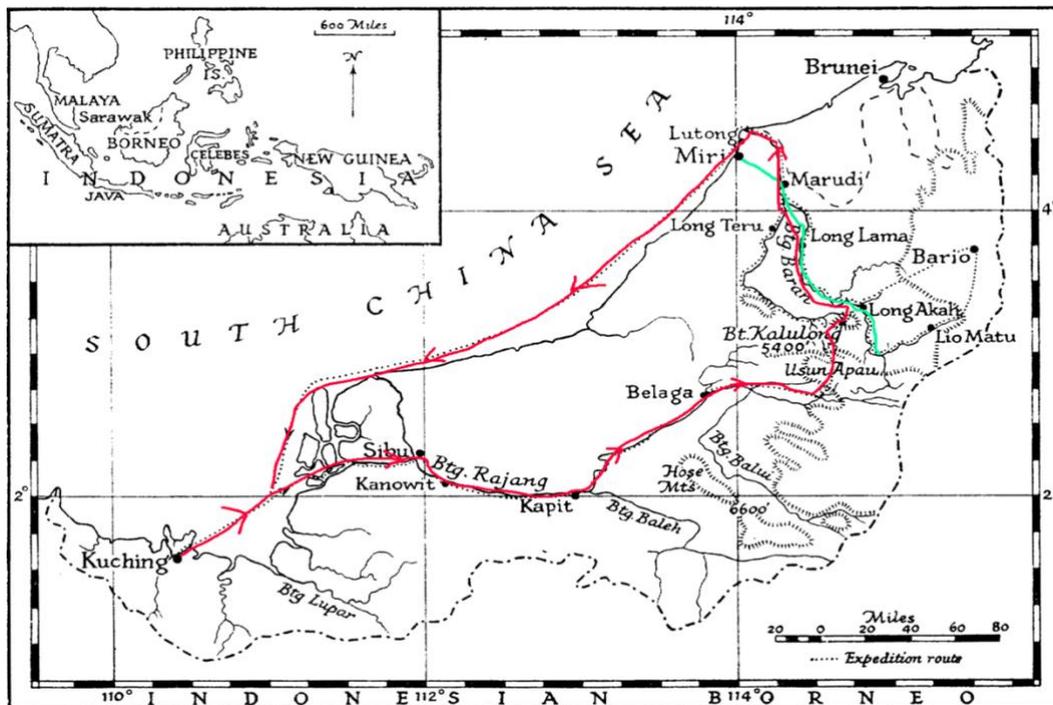


Figure 5 - Original map from the 1955 expedition. The red line shows the 1995 route from Kuching up the Rajang to Belaga and then onwards to the plateau. Our route is shown in green.

7.Ethics:

Our ethics and approach to research are central to this expedition, as we understand that we are working with people that in the past have been subjected to colonial viewpoints and have had ideology imposed upon them. Research always raises issues of accountability, morality and care and is interwoven within relations of power and politics (Bos, 2017). In order to achieve an ethical expedition, we will work closely with tutors within Oxford, such as Daniel Bos, who has experience of conducting ethical research and will help guide us when conducting our own expedition. We will also submit an application to the Oxford Research Ethics department (CUREC). Although our study does not directly focus on the people of Usun Apau and surrounding areas, we are aware (and hoping) that they may still be a big part of our expedition if we are to leave a lasting legacy that is beneficial for the community and the natural environment. We aim to achieve this through integration of locals into our project through establishing strong networks and working with local universities. Furthermore, when publishing our results we shall focus on our position when sharing knowledge we have collected in the region and aim to recognise that all knowledge is situated (Haraway, 1988) within certain contexts and therefore our own research may suffer from biases developed out of our own previous experiences.

8.Budget and Sources of finance:

Projected Expenses	Cost for two people
Flights	£1600+£200 ¹
Car Hire	£280 ²
Board and Lodging	£160
Safety Training	£520
Insurance	£300
Local cost for partners	£3000
Food	£420 – (£7/per person/per day)
Photography Equipment	£0
Jungle specific equipment	£300 ³
Hiring porters	£TBC ⁴
Field Equipment	£0 ⁵
Post fieldwork analysis and dissemination of results	£0
Training expedition	£200
Total:	£6980
Total with 10% Contingency	£7608.20

- ¹ – We will fly to Kuching first, which costs around £800 from the UK and then from Kuching to Miri which costs around £100
- ² – Hire of a four-wheel drive car is £70 per day and based on other expeditions it takes a day and a half to reach Long Silat from Miri
- ³ – Machete, clothing, medical equipment etc
- ⁴ – Unsure of the cost of this but currently in contact with previous expeditions to determine price and number of porters needed
- ⁵ – Field equipment will most be provided by ourselves and the University of Oxford

Sources of finance	Amount provided and deadline
RGS Geographical fieldwork grant	Up to £3000 (Deadline 15 Feb 2019)
Christ Church and St Hilda’s college travel grants	Up to £1400 from St Hilda’s and £2500 At Christchurch
Our own funding	£500
Oxford University expedition council	£1500 (Deadline 14 th of Nov 2018)
Neville Shulman Challenge Award	£1500 (Deadline 30 November 2018)
Nigel Winser (RGS Fellow) Awarded £250 for ‘Best expedition idea’ at the RGS Explore event 2018	£250 (Already received)

Other possible sources of funding: National geographic grants, Monica Cole Research grant, The University of Sarawak, Sources of philanthropy, Henrietta Hutton Research Grant, The Irvine fund.

9.Outcomes and legacy:

We have three key outcomes that we hope to achieve by the end of our expedition:

9.1 Scientific: A fundamental aim of this expedition is to assist in the conservation of the Usun Apau National Park, by way of biodiversity assessments and collaboration with the IBEC unit of the University of Sarawak to ensure our data collection is relevant to their research targets. By co-operating with the two university students in our expedition team we hope to connect in greater depth with the university and its scientific work, learning from their knowledge and experience of Borneo’s tropical forests. In return, we hope to provide them with useful data and simple methods of biodiversity surveying that can be taught to younger students to help them understand the need for and encourage active conservation of these forests. We are also going to construct basic weather station/field sensor systems that can be built at the university/schools with the students, using relatively simple and accessible equipment – this will enable long-term surveys and continuous data collection. By integration with locals and working with the Penan people we hope to support further conservation efforts by the current Usun Apau inhabitants, through these weather stations and facilitate interest in the research carried out by the Sarawak students.

We are also aiming to collect vegetative samples that can be directly compared to those collected by the 1955 Oxford Expedition, to assess difference in plant diversity and forest health. These can enable us to assess the effect of the logging and industrial work that has caused such dramatic landscape change over the last 63 years.

9.2 Locals: Leaving a legacy in terms of getting local students and communities involved in conservation and research around their forests. It is essential for the health of the jungle that locals understand how fragile and responsive it can be to changes. As logging continues to encroach into protected areas within

Borneo it is becoming more and more likely that the species we hope to observe may no longer be in existence within the next ten years. Co-operating with locals on our research should help to promote this message and should allow help us to take a less external approach to conducting research.

9.3 Historical: Our final outcome is to follow the activity of the 1995 Oxford University Expedition and compare some of our results to theirs. Collecting specimens, recreating photos and following the work of Guy Arnold allows us to draw comparisons between Usun Apau then and Usun Apau now, whilst also providing valuable retracing work to the Oxford University Exploration club and the Royal Geographical society. We are also in contact with the four original members (Guy Arnold, Tom Chavasse, Gordon Pickles, Colin Campbell) of the expedition who our keen to learn about our experiences and help us in any way they can.

10. Logistics:

Visa: Not needed

Passport: Every team member has a UK/Malaysian passport

Language skills: Both non-Malay speaking members are already making an effort to learn Malay and working with the Oxford language programme to find an appropriate teacher

Equipment: Equipment will be provided by ourselves and by the University of Oxford as much as possible. Technical clothing, tools and other jungle related items can be bought within our budget if needed or borrowed from contacts.

Flights: Flights will be from London to Kuala Lumpur and then from Kuala Lumpur to Kuching. We will then purchase a flight from Kuching to Miri and hire cars from then on out.

Hiring of porters: Once we have collated all the gear we need and have an idea of weight we will look into the cost of hiring porters. We have several contacts who can provide us with this information once ready.

Hiring of a car: Hiring car in Miri is relatively simple and should cost around £70 per day.

Infrastructure: The infrastructure in the Malaysian Jungle is not of a high standard and many of the roads are made of dirt. We should be able to overcome this through hiring 4-wheel drive cars but excessive rain may cause issues. If this occurs, then we would be forced to wait for the rain to subside before carrying on.

Permits: Permits can be obtained from the Forestry department of Sarawak via a printable application. After speaking to many other people who have conducted research in Borneo we are aware of the time it takes to receive a permit and are taking this into consideration by applying for the permit as soon as possible. Our permits will be around the extraction of plant specimens and also permission to enter the plateau.

11. Potential contacts (Some already contacted/met in person at RGS explore):

[REDACTED]

12. Health and Safety:

Tropical jungles are very harsh environments and there are a number of threats to human health and safety when venturing into such regions. We have both attended an RGS work shop on tropical rainforest expeditions and have been informed of the risks and necessary measures needed to deal with them. We will also be undertaking wilderness survival and medical training and a bush craft course before the trip to ensure we are as we can be prepared. We are also in touch with Scott Pallett, a British Army medical officer who has been working the jungle warfare division in Brunei, which has very similar jungle to the region we are visiting.

12.1 Contingency plan:

Medical officer will be responsible for overall incident co-ordination and leading provision of temporary immediate care; in the event of the medical officer being injured/absent, this role will be taken by the most experienced first aider, which is the Expedition Leader. Following absence of the Medical Officer and Expedition leader, this role will be taken up by the most experienced team member. Expedition leader will nominate another team member to monitor the scene safely, and coordinate communication, under the direction of the leader. If two uninjured team members are present, the most experienced first aider will be asked to provide assist in providing care.

12.2 Initial response:

Summary of procedure following a serious incident: (team will be trained in procedure beforehand)

1. Assess likelihood of further danger to group: unless low, consider moving group and casualty to safe location.
2. Locate casualty; medical officer to assist and treat
3. If no further medical treatment is required, assess causes of incident and make changes to safety plans accordingly
4. If further medical attention is judged to be necessary by medical officer/expedition leader, prepare for evacuation. Evacuation to Miri may be needed.
5. If medical assistance can be reasonably reached on foot/other (less than a two hour walk with reasonable terrain and weather conditions, with the casualty being in a suitable condition for such ravel), do so.
6. In all other cases, explore emergency evacuation options, contacting insurance/local/UK contacts and emergency services as appropriate; considerations will include the conditions of the injured (time-critically, medical requirements) and the availability of different transport methods from the incident site.
7. In the event of serious injury or death, the expedition leader/medical officer will co-ordinate assistance from the appropriate embassy, UK/local contacts, and the insurance company, with regards to contacting next of kin, repatriation, activating media plan, etc.

12.3 Contact number of emergency services and medical facilities:

Emergency number – 999

Borneo Medical Centre Miri – 085-420033

12.4 Evacuation options:

For the majority of the expedition we will be away from road networks and relatively isolated. It will be around a 2 hour walk down from the plateau to a vehicle. This is still possible and may be beneficial depending on the condition/severity of the situation.

Rescue by Helicopter is realistic but expensive and we have found little information about it apart from one company offering 'experience' in rescuing people from within Sarawak. This is something we intend to follow up and find more about within the coming weeks.

12.5 Risk Assessment:

Hazard	Risk Factor	Control measures required	Residual risk after control measures		
	Severity	Likelihood	Risk		
Navigational errors	Very Severe	Unlikely	High	All personnel have experience of navigating and will be carrying GPS equipment. We will also be hiring local guides/porters to help us with navigation.	Low
Dehydration	Severe	Unlikely	High	All personnel to maintain levels of hydration appropriate for activity levels and encourage self-monitoring by urinary output levels & quality. Peer checking to be encouraged. Maintain good supplies of drinking water	Low
Animal/Insect bites	Very Severe	Unlikely	High	The Borneo jungle is home to many poisonous species and animal bites can be potentially fatal. All UK members will be attending training courses on tropical medical procedure and will have full understanding of the species that pose a serious threat. We will also aim to avoid any	Low

				species that may want to cause us harm and be proactive in terms of checking clothing and sleeping places for animals/insects. We will also aim to carry antivenin whilst travelling in the jungle for snake bites.	
Uneven/slippery ground	Severe	Likely	High	The Usun Apau plateau is characterised by uneven and water drenched ground. All members of the expedition have experience in this sort of terrain and are aware of the limits to their ability. Caution will also be taken in this terrain to avoid injury.	Low
Mammal hazards	Severe	Unlikely	Low	Mammals such as wild boar, fruit bats, crocodiles and primates are unlikely to interact with us as they are too afraid of humans. In the likelihood that they do we shall adopt scare tactics and attempt to disperse and animal that may be position as a threat. If this fails then all team members will be carrying a machete as a form of self-defence.	Low
Vehicle break down	Severe	Likely	Low	The roads from Miri to Long Silat are mostly forestry tracks and are constructed from dirt. As a result, our vehicle may come under strain and could be damaged. We will ensure we hire a quality vehicle in Miri and make an effort to ensure our driver is safe and does not take risks whilst driving.	Low

Limited communication due to remote location	Moderate	Likely	Low	Making sure that people are aware of our route plan, time scale and locations for camp will allow a reliable person to inform others/send help if we do not make contact. Expedition leaders will have access to a variety of contact options, from satellite phones or more than one network radios. We will be carrying emergency equipment and will be fully competent in first aid.	Low
Lost communications	Severe	Unlikely	Low	We will maintain contact within the field using radios and regularly stay in contact with each other if secondary camps are implemented. If comms lost then we shall initiate our contingency plan or regroup at our original base camp.	Low
Burns/scalds/fire hazards from use of gas stoves	Very Severe	Possible	Low	All team members will be competent with a stove and fire safety regulation. Caution will be taking within the jungle to avoid burns and scalds. A fire safety kit will be carried when the use of stoves is required, and both UK team members will be 1 st aid qualified.	Low
Stomach Upsets	Very Severe	Possible	High	All participants will be aware of essential hygiene rules, especially in the jungle. Antibacterial wipes/liquid will be made available at all times. Latrines shall be established within the jungle at a suitable distance from the	Low

				campsite and at a recommended distance from running water in order to prevent contamination. Toilet paper and cleansing facilities to be provided as well as explanation of method of disposal of soiled paper. Suitable cleaning equipment to be carried in order to hygienically clean cooking utensils	
Contaminated drinking water	Severe	Unlikely	Medium	Avoid unclean water and stagnant sources and boil/filter/Steripen all drinking water. Good hygiene practice also applies	Low
Cooking	Very Severe	Unlikely	High	All cooking activity & stove usage in well ventilated mess tent. Stoves supervised at all times. Use of stoves only by experienced personnel, mindful of potential flare-ups and issues in maintenance and changing of fuel cylinders. Secure storage of fuel away from tent.	Low
Transport	Very Severe	Unlikely	High	Maintain awareness of traffic when on foot, walk facing on-coming traffic. Travel only in roadworthy vehicles.	Low
River crossings	Very Severe	Likely	High	Firstly, establish the strength of the current and decide if crossable. Local guides should be able to help with this. Also attempt to find alternative points of crossing that do not involve entering the river. Ensure that all essential supplies are waterproof	Medium

				if river crossing is essential and follow advice given within the wilderness course carried out before departure.	
Use of a machete	Very Severe	Unlikely	High	All of those with access to a machete shall be trained in its usage and significant practice of bush clearing shall be organised before departure. All UK members first aid trained if incident occurs.	Low

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