



Guyana Schools' Booklet 2020

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1. Study area and research objectives

The Amazon rainforest represents the largest rainforest on Earth, and encompasses seven million km² across nine South American countries (Brazil, Peru, Colombia, Venezuela, Ecuador, Bolivia, Guyana, Suriname and French Guiana). Amazonian biodiversity is reportedly higher than anywhere else in the world and contains approximately 2.5 million insect species, 40,000 plant species, 3,000 fish species, 1,294 bird species, 427 mammal species, and 807 species of herpetofauna (reptiles and amphibians).

The Iwokrama Forest (Figure 1 & 2) in central Guyana is 3710 km² of low-lying terra firme neotropical rainforest that is of global importance to biodiversity conservation, and carbon storage. The Forest is situated at the frontier of the Amazon and Guiana Shield eco-regions. Due to this location, the fauna of the area represents a transition point for species from both regions, and is therefore gifted with vast biodiversity. Iwokrama is home to more than 130 species of mammals, over 500 species of birds, ~150 species of reptiles and amphibians and more than 420 species of fish. The remarkably rich bat (86 species) and fish diversity, is possibly the highest for an area of its size anywhere in the world. Approximately 30% of this diversity is classified as rare and endangered. These include some of the world's largest and most majestic rainforest species, including the Arapaima (*Arapaima gigas*), Black Caiman (*Melanosuchus niger*), Giant Anteater (*Myrmecophaga tridactyla*), Giant River Otter (*Pteronura brasiliensis*), Anaconda (*Eunectes murinus*), Bush Master (*Lachesis muta*), Cabybara (*Hydrochaeris hydrochaeris*), Harpy Eagle (*Harpia harpyja*), and Jaguar (*Panthera onca*).

The Iwokrama International Centre for Rainforest Conservation and Development (IIC) forms an international partnership between Guyana and the Commonwealth, to demonstrate how tropical forests can be sustainably used in the interest of global scale climate change, local communities, and biodiversity conservation. The IIC manage the Iwokrama Forest with the mission: '*To promote the conservation and sustainable and equitable use of tropical rainforest in a manner that leads to lasting ecological, economic and social benefits to the people of Guyana and to the world in general, by undertaking research, training and development and dissemination of technologies.*' The Iwokrama Forest is divided into roughly half Sustainable Utilization Area (SUA), where sustainable use of forest resources are permitted and tested, and half Wilderness Preserve (WP), where there is no commercial extraction of forest resources.

The purpose of this monitoring is to provide long-term datasets on key biodiversity taxa, and to record trends in abundance (and to some extent diversity) of these taxa. These data may be used to understand changes in the Iwokrama and Surama forests in relation to anthropogenic impacts, climate change and climate fluctuations (in particular El Niño Southern Oscillation patterns), and also the effectiveness of management interventions. These surveys will also provide an equal coverage of the SUA and WP parts of the Iwokrama Forest, and therefore provide further understanding of sustainable use versus strictly protected parts of the Iwokrama Forest. Additionally these surveys will provide coverage of parts of this area that have not been previously surveyed, and may therefore provide additions to the species list for the area. There are now several derivatives of the UNFCCC Reducing Emissions from Deforestation and Forest Degradation (REDD+) mechanism where biodiversity criteria are included in payments derived from REDD+ funding (such as the Climate, Community & Biodiversity Alliance standards). This dataset may therefore be used for similar initiatives in Guyana.

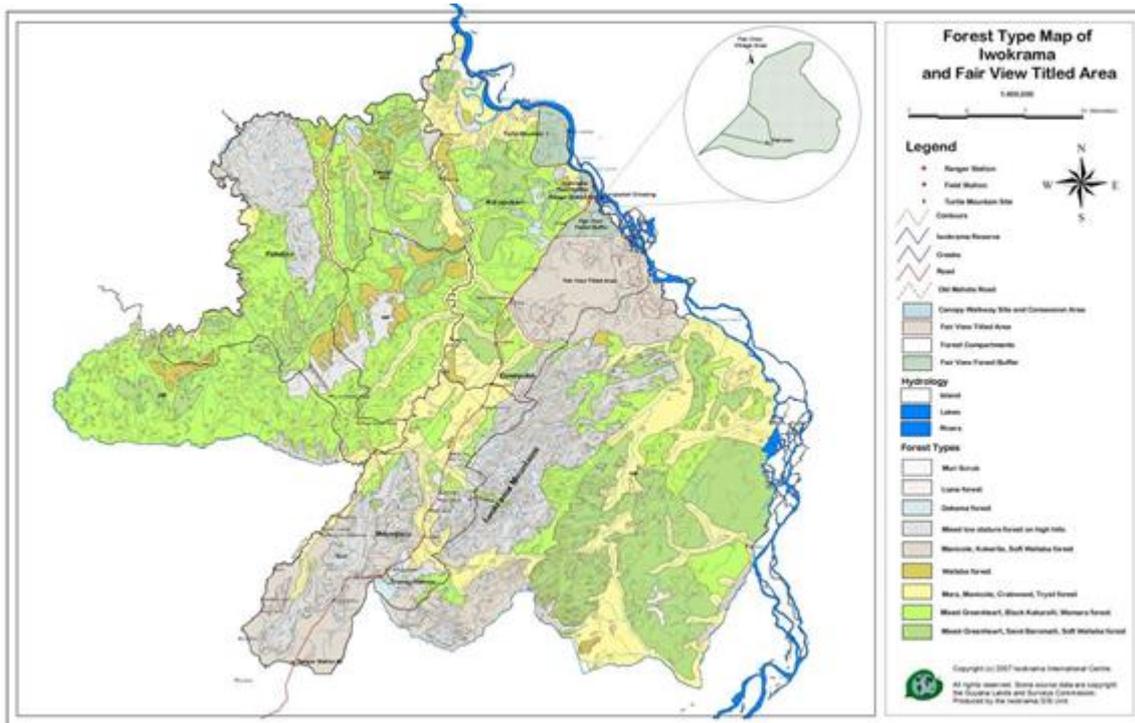


Figure 1. Habitat types in the Iwokrama Forest

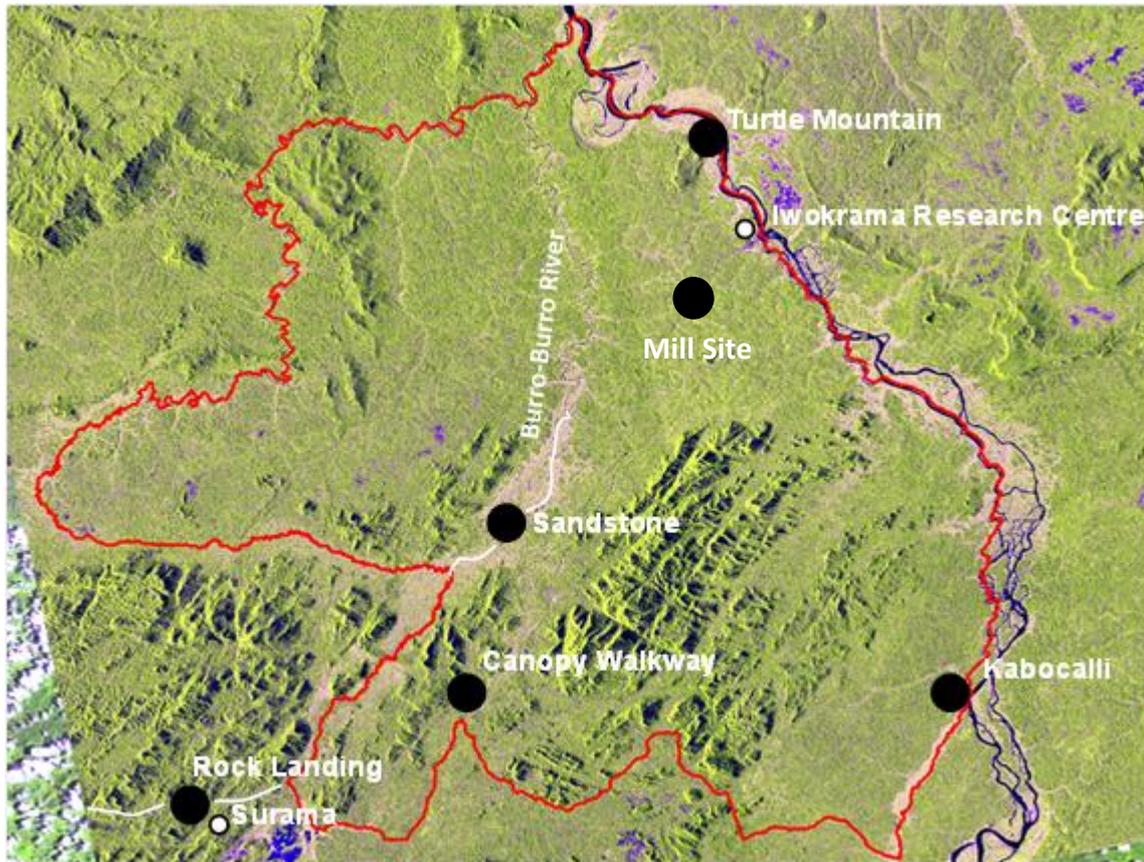


Figure 2. Survey sites (black), and other logistical sites (white). White lines indicate the two river transects along the Burro-Burro River. Red line shows the boundary of the Iwokrama Forest.

2. Itinerary

The students will spend the first few days undertaking lectures and practicals at the Iwokrama River Lodge and Research Centre (IRL) on the banks of the Essequibo River. The group will then either go on the Burro-Burro River trip, or move to one of the research camps.

Students will have the opportunity to take part in approximately five research projects over the two weeks (forest structure, transects for large mammals and game birds, bird mist netting, bat mist netting, reptile and amphibian searches, and invertebrate surveys). Students will be split into small groups and will have the opportunity to rotate around the different projects over the course of their time on site. Each student will be expected to join one of the morning and one of the afternoon activities and to participate in data entry. In addition there will be lectures with follow-up discussion topics/activities delivered during the first three days of the expedition and at times of day when there are no field practicals running.

Table 1. Indicative timetable Note there may be changes depending on the total number of students, fitness of students, weather conditions, etc. NB: Some expeditions will undertake the river trip first, so the weeks are reversed.

Time	Activity
Tues pm	Health and safety briefing
Tues pm	Presentation: What is Iwokrama?
Wed am	Lecture 1: Introduction to the Amazon and the importance of the expedition research Briefing on the forthcoming research activities, including carbon assessments for REDD+
Wed pm	Lecture 2: Survey methods
Wed pm	Practical 1: Walking in the Rainforest
Wed night	Documentary Film: 'Lost land of the Jaguar' or BBC film on rainforest.
Thursday am	Lecture 3: Taxonomy and evolution , systematics and its practical use in conservation fieldwork using Neotropical birds, reptiles and amphibians as examples.
Thursday am	Lecture 4: The Bats of Iwokrama – an extraordinary example of adaptation.
Thursday pm	Lecture 5: The large mammals of Iwokrama:
Thursday pm	Practical 2: Bird mist netting
Thursday pm	Lecture 6: Conservation Synthesis: wildlife monitoring and the conservation of Amazonia forests
Friday am	Travel to field camp
Friday pm	Set-up mist nets
Saturday	Surveys
Sunday	Surveys
Monday	Surveys
Tuesday	Surveys
Wednesday	Surveys
Thursday	Travel to Surama
Friday	Burro-Burro River – surveys
Saturday	Burro-Burro River – surveys
Sunday	Arrive back at Surama from river
Monday	Travel to Georgetown

3. Lectures and learning outcomes

Health and Safety brief: to be given to all 'new-comers' at each camp.

Lecture 1 - Introduction to Amazon and the importance of the expedition research, including carbon assessments for REDD+

An introduction to the habitats and biodiversity of the Amazon region. Students will learn about the meaning of Biodiversity and how this applies to the Guiana shield. They will also hear about the potential threats to wildlife and the aims of the scientific work they will be involved in.

- Definition of biodiversity
- Worldwide biodiversity hotspots and importance of the Guiana Shield
- Formation of the Guiana Shield

- Development in Guyana – potential threats and the need for sustainable development.
- El Niño
- Carbon assessments and the importance of REDD+ in Guyana
- Iwokrama’s approach to conservation
- Description of the work being conducted and how it contributes to the overall research programme.

Discussion/activity – Discussion on the word ‘biodiversity’.

Key words

- Biodiversity; conservation; management; sustainability; threats; ecosystems

Lecture 2 - Survey methods

An introduction into survey methods which will be followed by a number of practical sessions.

- Methods for census of animal populations
- Theory of DISTANCE sampling

Discussion/activity –In groups the students will look through a number of different ways of doing a specific survey and decide which one would be most appropriate

Key words

- Practical work; Field techniques; Ecological sampling; Random sampling; Transects; Biodiversity indexes; Data handling; Quadrats; Measuring

Lecture 3 - Taxonomy and evolution, systematics and its practical use in conservation fieldwork using Neotropical birds, reptiles and amphibians as examples.

This lecture looks at taxonomy and classification and its role in field conservation. It uses neotropical birds, amphibians and reptiles as examples of classification.

- Classification systems and why they are important
- Birds:
 - Herons, egrets, terns and ducks
 - Large game birds – tinamous, guans
 - Vultures, hawks and eagles
 - Macaws and parrots
 - Trogons and kingfishers
 - Toucans, antbirds and manakins
- Amphibians
 - Treefrogs
 - Poison dart frogs
 - Chytrid fungus
- Reptiles
 - Snakes
 - Caiman
 - Turtles

Discussion/activity – ID quiz for common species using photos.

Keywords

- Classification; Taxonomy; Binomial system; Dichotomous Keys; invasive species

Lecture 4 - The Bats of Iwokrama – an extraordinary example of adaptation.

In this lecture the bats of Iwokrama will act as an extraordinary example of adaptation. It will also focus on the classification and diversity of bat species.

- The concept of adaptation
- Phyllostomid bats
- Bat diversity in the Iwokrama Forest
- Identifying the common families and species

Discussion/activity – In groups the students will look through a number of different photographs of species found in Iwokrama and suggest how they are adapted for survival.

Keywords

- Adaptation; classification; habitat; niche

Lecture 5 - The large mammals of Iwokrama:

- Primate species
- Anteaters, sloths and armadillos
- Peccaries and deer
- Cats
- Otters

Discussion/activity – ID quiz for common species using photos.

Lecture 6 - Conservation Synthesis: wildlife monitoring and the conservation of Guiana forests:

This final lecture looks at how data collected in the Guiana Shield and Amazon can be used to see patterns and trends in biodiversity and its subsequent use in conservation management. It also considers the effects of climate change on this vulnerable ecosystem.

- The meaning of the word conservation
- How conservation works
- The importance of monitoring for conservation projects
- Human disturbance and conservation
- Community based conservation and wildlife monitoring
- Protected area conservation and wildlife monitoring
- The threat of the chytrid fungus to frogs will be briefly considered.
- Climate change and wildlife monitoring

Discussion topic/activity – Which is better: in-situ or ex-situ conservation?

Key words

- Conservation; management; human effects; climate change; invasive species

4. Biodiversity Practicals

Forest structure surveys

Assessment of habitat type provides the backbone to biodiversity monitoring programmes and assessment of ecosystem health. Assessment of a range of habitat variables and monitoring of habitat changes over time can be used to interpret variation in space and time of faunal diversity and abundance. Modelling of habitat quality and animal distribution patterns can then be used to predict changes to the ecosystem caused by a range of management plans as a means of choosing the most effective method of land management for a given area. In addition, these data are being used to calculate the carbon standing stock in the forest as a key component of the REDD+ work which is so important in Guyana.

Students will work in a group to complete surveys of habitat plots. The first task for the team at each site will be to mark out the plot. The teams are then divided into groups: growth rates and dead wood estimation, canopy openness and regeneration rates.

The growth rates team will complete dbh (diameter at breast height) measurements on all trees with dbh values $>30\text{cm}$. The canopy openness team will estimate the openness of the canopy by taking a series of readings with a canopy scope. The perspex square needs to be held 20cm from the eye and has a number of dots engraved on the square. The observer counts the number of dots that coincide with gaps in the canopy.

The regeneration rate team will count the number of woody saplings $<1.5\text{m}$ in the plot.

Large mammal and large-bird transects

Transect trails are being used to conduct terrestrial mammal surveys. Census trails between 2-5 km in length are surveyed repeatedly at each of the sites. Information registered on a census includes: day, site, species, number of individuals, and perpendicular distance from the individual to the transect line, time, and distance traveled. The method and theories behind distance sampling will be explained to students and they will be taught how to recognise different species and the main identification features will be explained. Identification sheets will be available.

Night time reptile and amphibian surveys

This practical will involve spotlight surveys along transects for and in certain habitat types for herpetofauna. Some sites also include river-based surveys after dark to locate and identify tree boas, frog species, and caiman species in order to estimate distributions.

Bird mist netting

Mist nets will be set to allow an introduction to using this method, and how to handle birds and identify them. Some biometric measurements will be taken.

Bat mist netting

Mist nets will be set to allow an introduction to using this method, and how to handle bats and identify them using the keys. Some biometric measurements will be taken.

5. Learning objectives

By the end of the expeditions the students should be competent to do the following:

- To explain why the Iwokrama Forest is so species diverse
- To describe survey methods and their disadvantages for a range of river and forest taxa
- Be able to identify 10 species of bird
- Be able to identify 10 species of reptile or amphibian
- Be able to identify 10 species of mammals found in the forests
- To describe how community based conservation can contribute to saving forests

6. Research contribution

Conservation strategies must include wildlife monitoring to determine if they actually work and are therefore key elements of any conservation work. The monitoring conducted by Operation Wallacea in the Iwokrama Forest is helping to evaluate the success of conservation strategies in an effort to promote good conservation practices throughout the world's tropical forests. The wildlife monitoring measures the success of management strategies and sustainable extraction of forest resources, as well as the effect of climate change. The impact of climate change is becoming more intense with greater flooding and more intensive droughts. The impacts of these more extreme conditions on wildlife are being monitored by the project and recommendations on how to cope with these changes are being made to the local people, the reserve management and the Guyanese government.

7. Links to A levels

The following two tables highlight how your Opwall expedition relates to the AS and A level syllabuses across all exam boards. The red blocks and blue indicates that the keywords listed are covered on our expedition (through lectures, practicals or in discussion topics) and that these keywords are also within AS or A level topics as shown.

Topic	Examining board	AQA	C	CCEA	C. int	Ed/Sal	OCR	SQA	WJEC	AQA	CCEA	Edex	OCR	WJEC											
	Subject	Biology										Geography													
	Levels: S=AS 2=A2 H=Highers	S	2	S	S	2	S	2	S	2	S	2	H	A	S	2	S	2	S	2	S	2	S	2	
Evolution, Classification and DNA	Evolution; Speciation; Species; Endemism; Gene pool; Allopatric; Sympatric; Isolation; Variation; Adaptive radiation																								
	Adaptation; Wallace; Darwin																								
	Classification; Taxonomy; Binomial system; Dichotomous Keys																								
Ecology and Ecosystems	PCR; Genome sequencing; Genetic fingerprinting; DNA profile																								
	Ecology; Habitat; Niche; Abiotic; Biotic																								
	Biome; Ecosystems; Rainforests; Deserts, Coral reefs, Mangroves, Marine; Coasts; Hot arid; Semi-arid; Woodland																								
	Bush; Tropics; Tropical																								
	Populations; Competition; Interspecific; Intraspecific; Predator Prey; density dependent; independent; Symbiosis																								
	Succession; Climax community																								
	Biodiversity																								
Agriculture, Human activities, Conservation and Sustainability	Practical work; Field techniques; Ecological sampling; Random sampling; Transects; Capture, mark, release and recapture; Biodiversity indexes; Data handling and; presentation; Quadrats; Statistical testing; Measuring; GIS; Research tools																								
	Written reports; Research project; Report; Case studies																								
	Sustainability																								
	Agriculture; Agricultural impact; Agricultural exploitation; Cultivation crops; Food production; Sustainable agriculture; Sustainability; Forestry; Timber; Deforestation; Fisheries; Over fishing; Deforestation; Human management; Human effects; Human activities																								
	Fair-Trade; Coffee; Rain Forest Alliance; Ecotourism; Tourism; Carbon trading; Greenhouse gas emission control (REDD)																								
	Indicator species; Pollution; Climate change; Global warming																								
	Carbon footprint; Fossil fuels																								
Behaviour	International conservation; Endangered species; Invasive species; Biological control; Pests; CITES; Ethical, Local; Global																								
	National Parks; Wildlife reserves																								
	Environment; Environmental monitoring; Environmental impact; SSSI																								
	Animal behaviour; Primate Social behaviour; Courtship; Territory; Co-operative hunting; Herbivores; Grazing																								

Table: Highlighted in Black are topics that you might experience at your research site. Key: C = Cambridge. Pre-U, C.int = Camb. Int. CCEA = N.Ireland; Ed/Sal = Edexcel Salters, S= SQA; Edex = EdExcel (v. 30/10/13)

Reading and research questions

Many students are now involved in producing Research 'Essays' or 'Projects' as part of their 2-year educational programme and many hope to carry this out whilst on an Opwall Expedition. If you are an IB school you will be involved in the EE or Extended Essay or if in the UK an EPQ or Extended Project Qualification. Those involved in CoPE will also have a similar project carrying out some research. There are many similar projects in most countries.

One of the key features of all of these 'Essays' or 'Projects' is that you have to choose your own research question but it is often difficult to find out exactly what is happening at each Opwall research site. To help in this, we have produced a 'Research' lookup database on the Opwall website – <http://opwall.com/epq-research-topic/> but you can also 'download' a more detailed version as an Excel Spreadsheet.

The database lets you find out what is happening at each site and there are links to pdf files and video clips. You can search the 'database' using a variety of filters such as research area and location.

Once you have decided on an area you need then to consult with your tutor and then at some stage (preferably months before you go) contact the Opwall country manager to see how appropriate your research question is for your expedition location.

The type of EPQ or EE will vary but it is less suitable for individual investigations where you collect your own primary data although in some cases you might be able to get hold of raw data and you will often have the opportunity to help collect some of the data yourself. You will certainly have the opportunity 'on-site' to meet up with the scientists involved which will allow you to get a deeper insight into your research question.

Many of you will also have seen the Wallace Resource Library (WRL) which contains many datasets based around the research being carried out and it has been prepared by the actual Opwall scientists involved. It is a very valuable source of ideas with comprehensive datasets to look at and study.

Demo version – <http://wallaceresourcelibrary.com>

Do also make use of the research library on the Opwall website - <http://www.opwall.com>

Resources

General Books for this site:

- Watkins G, Oxford P, Bish (2010) Rupununi: Rediscovering a Lost World. Earth in Focus Editions.
- Lambertini M (2000) A Naturalists Guide to the Tropics. University of Chicago Press.
- Kricher J (1997) A Neotropical Companion. Princeton University Press
- Sutherland WJ (2006) Ecological Census Techniques: A Handbook (2nd Edition). Cambridge University Press, Cambridge.

A general guide book is:

- Smock, K. (2001). Guyana. Bradt Travel guides

The best bird ID book is:

- Restell, Rodner, Lentino (2006) Birds of Northern South America: An Identification Guide. Helm Field Guides [Link](#)

Mammal books (though not very good):

- Emmons, L.H., Feer, F. (1997) Neotropical Rain Forest Mammals: A Field Guide. Chicago

Research areas and activities being carried out in Guyana:

- Conducting standardised surveys of water birds
- Mist net sampling for birds and learning how to identify birds in the hand and take morphometric measurements
- Large bird and mammal transect surveys
- Invertebrate sampling - pit fall sampling, light trapping, and scan sampling
- Scan search sampling for herpetofauna from forest transects and scan searching water bodies for amphibians
- Spotlight surveys for amphibians and reptiles to assess frog communities and opportunistically sighted reptiles
- Mist netting for bats