

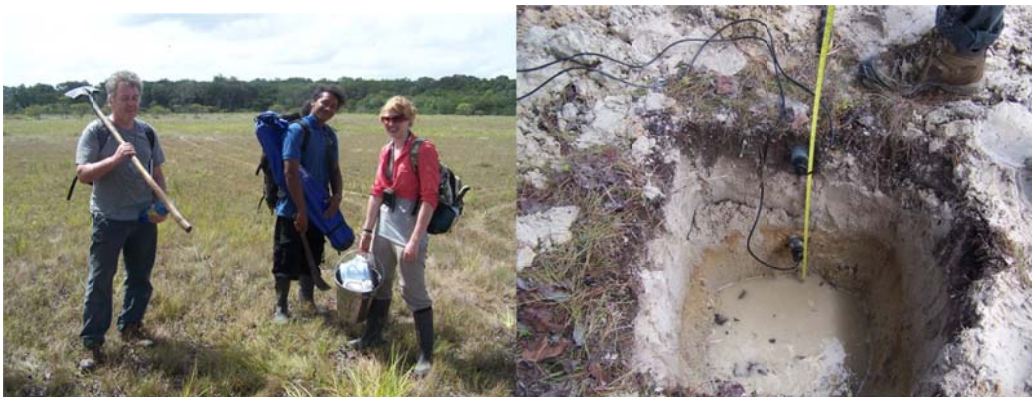
Research at Iwokrama

Research at Iwokrama is as active as always if not more so. Current research activities encompass three broad themes: hydro-climate research, biodiversity research and social research.

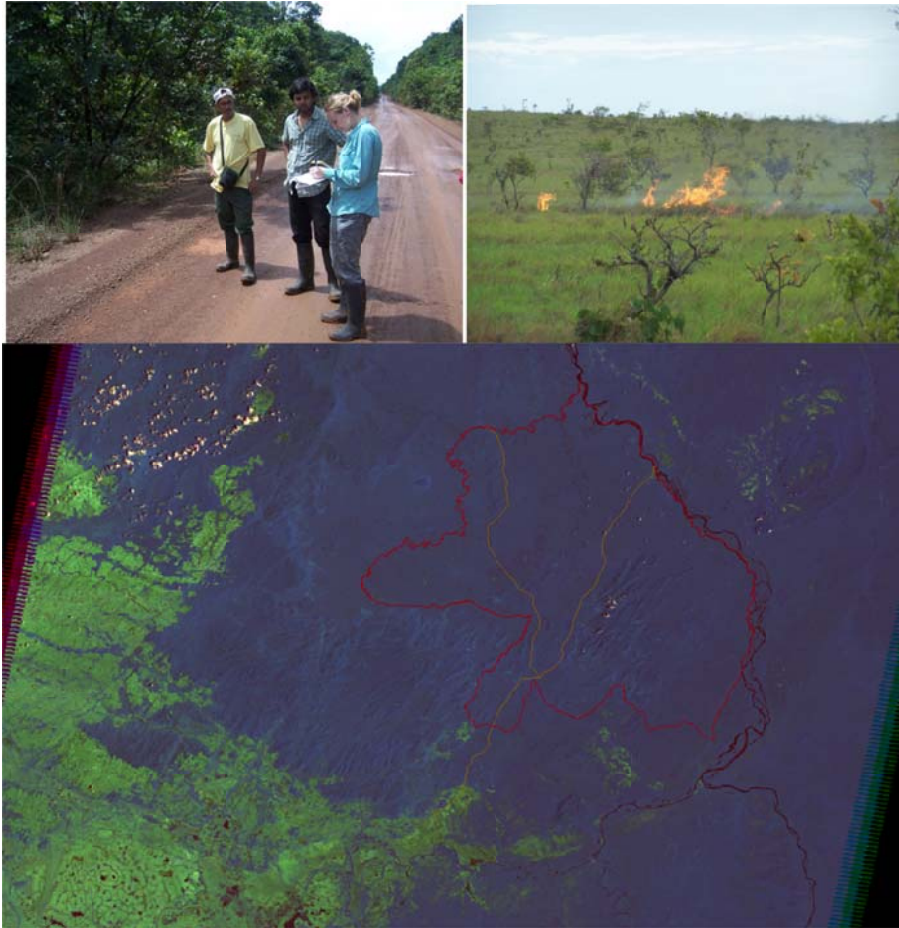
Hydro-climate research-related activities

The Iwokrama forest happens to be strategically located near the northern extent of the inter-tropical convergence zone (ITCZ) where there is a transition in the climate regime from north (coastal) to south (savannah) of two wet-seasons a year to one wet season a year. The climate transition occurs roughly where the Iwokrama forest meets the Rupununi savannah. The proximity to the savannah boundary makes Iwokrama a 'frontier forest'. Unlike the frontier forests in the Amazon where the rainforest-savannah boundary stretches over several hundred km, the rainforest-savannah boundary near the Iwokrama forest is very abrupt. We speculate that it is at this boundary that the effects of climate change will be manifested first as the boundary trees will be subject to greater climatic extremes and therefore stresses more than those protected by the dense inland forest.

How will extremes in climate affect the forest and savannah? Why is the rainforest-savannah boundary so well defined in this region? What determines the actual location of forest or savannah? How has this boundary changed over time? These are just some of the questions being asked by our doctoral researchers, Jasmine Black and Samantha Boyes (both PhD students at Newcastle University, UK). Jasmine is specifically researching the effects of climate change on soil organic matter, carbon dynamics and turnover at the molecular level in adjacent savannah and rainforest ecosystems, whilst Samantha is using satellite imagery to investigate changes in land cover over the past 25 years. Jasmine and Samantha both undertook field-work in the Iwokrama forest and Rupununi savannah between January – March 2010.



(a) Jasmine and the team ready on field work to dig soil profiles and collect soil samples at each soil-horizon along a transect from savannah to forest . (b) Measuring soil moisture.



(a) Samantha and the team on field-work to map vegetation types using GPS. (b) Savannah burning is a common type of land-management in the savannah (c) The Iwokrama forest (outlined in red) and the Rupunui savannah (green) false colour satellite image of the region.

To understand how the climate changes across the Iwokrama forest and neighbouring savannah, constant monitoring is required. Compared to the Amazon region, the climate and forests of the Guiana's has been studied very little (Bovolo et al 2011). Our hydro-climate and geochemistry monitoring program, spanning the Iwokrama forest and the Bina Hill Research Institute (Annai) in the savannahs is now in its third year of operation and is already revealing how different the climate is in the Iwokrama rainforest compared to the more studied Amazon region. For example, our new climate records show that the Iwokrama forest experienced approximately 40% less rainfall during the primary wet and dry season of 2009 (June to December) when compared to the same periods in 2010 and 2011. This is in contrast to the extreme, longer than normal rainy season recorded in the northern and north-western Amazon basin causing extreme flooding in the Amazon and attributed to the anomalously southward migration of the ITCZ during May-June 2009 (Marengo et al 2012). On the other hand, the 2010 rainy season in the Iwokrama forest began earlier than usual (in April) and ended later than usual (in August) making the wet-season particularly severe. This is in contrast to the 2010 drought identified in central Amazonia (Lewis et al., 2011), (Marengo 2011) and attributable to warming of the tropical North Atlantic, particularly during March-May which caused the ITCZ to move anomalously north by about 5°.



Monitoring river water level.

Currently, Iwokrama is only monitoring climate and river systems within the Iwokrama forest and in the savannah just to the south of the forest. To further capture the full climate signal in the savannah region, Iwokrama is considering monitoring the weather and river systems even further south in the Yupukari region. The Inter-American Development Bank funded a second field-visit to the Yupukari region in February 2012. This reconnaissance visit of the area in dry conditions was in contrast to the first reconnaissance visit carried out in wet-season in July 2011. Gaining a good understanding of the river system in wet and dry conditions is essential for the purchase and installation of suitable instrumentation and a good data set from the savannah will make it easier to understand the linkages between forest and savannah. For the visit, Iwokrama worked in collaboration with Dr. Geoff Parkin (Senior Lecturer in water resources, Newcastle University) who is a collaborator in Iwokrama's hydro-climate monitoring program, along with Prof. Thomas Wagner (Professor of Earth system science, Newcastle University).



(a) Surveying the Yupukari savannah area. (b) The high water mark is clearly seen on this tree.

The effects of seasonal climate events and reduced impact logging (RIL) on the hydrology and riverine carbon cycling from meso- and micro-scale river catchments in Iwokrama have been studied by Ryan Pereira (PhD student Newcastle University, UK). Paired rainfall and river records for 2009 and 2010 combined with river water isotopic signatures and dissolved organic carbon concentrations (DOC) show that whilst RIL had no measurable impact, the extended drought in 2009 changed DOC

cycling by reducing the ability of the rainforest to flush organic carbon from the litter layer into the river (Pereira et al, *In preparation*).



Ryan Pereira monitoring dissolved organic carbon in a small stream in the Iwokrama forest.

Biodiversity Monitoring

The Iwokrama forest and neighbouring Rupununi savannahs are incredibly diverse, however much is yet to be learned about forests and wildlife and linkages with the ecosystem in general, including the impact of Iwokrama activities on the forest.

Jake Bicknell (PhD student, Kent University, UK) is studying how reduced-impact logging (RIL) techniques affect wildlife including bats, under story birds and mammals. Data is collected through Iwokrama's long-term Forest Impact Monitoring Program (currently in progress) and assistance is also given through Operation Wallacea wildlife monitoring activities which began in summer 2011.

Skye Rivett (Master's student, Kent University, UK) has just arrived to Iwokrama to start work on how RIL affects the small mammals of the Iwokrama forest.

Zelda van der Waal (PhD Student, Newcastle University, UK) is using Iwokrama's river monitoring data (including caiman data from Caiman House, Yupukari and otter data from Karanambu Ranch) to model habitat and demography of selected water mammals and water fowls along rivers.



Zelda assisting in weighing a spectacled caiman with the Caiman research team at Yupukari on a recent field visit in February 2012.

Monique Hoelting (Senckenberg Natural History Museum, Germany) is looking at the impact of reduced-impact logging techniques on frogs whilst the RAINFOR Program (Leeds University, UK) works with Iwokrama and monitors forest biomass and dynamics related to climate across the whole Amazon Region.

Social Research Activities

On the communities' front, Iwokrama is always very active. Several projects are currently in progress, including the EU ENCOMPASS project (lead by Newcastle University, UK) dealing with grass-roots initiatives identify and safeguard threatened heritage resources in Guyana, China, England and Kenya; the NORAD Community Monitoring for REDD project (lead by Global Canopy, UK) integrating with the national measuring, reporting and verification mechanisms for dealing with REDD+ payments and building capacity in the communities to maintain and use local forest knowledge; the EC Community Owned Best Practice for Sustainable Resource Adaptive management in the Guiana Shield (COBRA) project (lead by Royal Holloway University, UK) to help communities respond more effectively to environmental, economic and political pressures (using participatory video techniques); the EU Chainsaw Milling Program developing alternatives for illegal chainsaw lumbering through multi-stakeholder dialogue in Ghana and Guyana; the Moore Foundation Capacity Building to support national initiatives project and the EU FORENET project improving capacity and facilitating links between forest research organisations in Central Africa, the Caribbean and the Pacific. The FORNET project also includes five research projects (inclusive of two PhD programs).

Jared Bowers (PhD student from Newcastle University) is also studying how ecomuseology could be used in developing sustainable tourism in the Rupununi. Ecomuseology is an approach to natural and cultural heritage conservation that is focused around community participation. Jared carried out field work in the Iwokrama and savannah area in January 2012 to assist his research.

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